An Evaluation of the Impact of Computational Interventions (Scratch) on the Learning of ESOL Students

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DECLARATION

I certify that this work has not been accepted in substance for any degree, and is not concurrently being submitted for any degree other than that of Doctor of Philosophy being studied at the University of Greenwich. I also declare that this work is the result of my own investigations except where otherwise identified by references and that I have not plagiarised the work of others.

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Praise be to God, the Lord of Creations, and Peace and blessings be upon the Prophet Muhammad, the faithful and the honest. Oh God, we know nothing but what You teach us. You are the All- Knower, the Wise. Oh God, teach us what is useful for us, and let us make use of what Thou hast taught us; show us the righteousness as right as it is, and bless us with following it; make us amongst those who listen to the Word and follow the best meaning of it, and admit us, by Thy Grace, to the ranks of Thy righteous Servants. O God, lead us out from the depths of darkness and illusion, unto the lights of erudition and knowledge, and from the muddy shallows of lusts unto the heavens of Thy Vicinity.

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ABSTRACT

This thesis presents the findings of a case study research that investigated the impact of a computational and constructionist intervention on young adult ESOL literacy learners in a Sixth Form College in London. The research represents an interdisciplinary project that signifies a synergy between constructionist learning theory and the sociocultural approach to multimodal literacy and new literacy studies. The study used Scratch as an illustration of a constructionist tool and explored an innovative approach to improving ESOL teaching and learning.

The case study in this project shows that Scratch supports the acquisition of language elements and that it can be used as a complementary teaching and learning strategy for ESOL learners and tutors. The utilisation of Scratch provided the ESOL learners with an additional learning platform for meaningful self-expression which relates to their ESOL curriculum. In a fieldwork stretching over 23 weeks, the study tracked the enhancement of the English language skills and learning practices of the ESOL learners by complementing their classes with computational interventions.

The research seeks to develop fresh understandings of the pedagogical perspectives of emerging computational environments. It demonstrates the impact of Scratch on the promotion and facilitation of literacy learning in a multimodal context. This approach shows how contextualised, personalised and meaningful computational practices can contribute to improving learning and can benefit ESOL learners in their development of higher levels of multiliteracies.

Finally, the thesis provides perspectives to the multiliteracies framework in practice by illustrating the possible applications of computational environments in ESOL literacy programmes. In this context, this project concludes that the utilisation of computational tools and applications should be extended beyond technical and computing frameworks. Therefore, it draws attention to a broader consideration of computational applications in literacy teaching and learning.

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Chapter 1: Introduction

In 2001, I had the opportunity to donate refurbished computers to a local UNRWA school in my North-East Jerusalem neighbourhood. At that time, I had a small business, refurbishing computers. A suite of 12 old-fashioned desktop computers was set up in a boys' school, and another in the adjacent girls' school, with help and support from the local community and the schools' administrations. Consequently, primary school students had the opportunity to be introduced to computers and computing in a classroom setting.

The refurbished computers at both the boys' and girls' schools were ASUS 486 DX4 equipped with 100 MHz processors and Packard Pell Pentium1 powered by 133 MHz processors, all with 14-inch VGA monitors. These machines were capable of operating Microsoft Windows 95 and running Microsoft Office 97 in addition to other essential Windows programmes, such as Microsoft Painter. As a result, technology and maths teachers in the schools had the opportunity to teach students basic Windows skills, such as creating folders, saving files, and copy and paste functions, while the focus on computer programmes was on Microsoft Office applications, mainly Word and PowerPoint.

Later, in 2005, new buildings were constructed at both schools and two state-of-the-art computer laboratories were installed. Each laboratory had new Pentium 4 computers connected to a computer network and a heavy-duty server. As a result of this upgrade, students were taught Microsoft Office 2002 instead of Microsoft Office 97, while continuing to use Microsoft Word, PowerPoint and Painter as their main tools to create projects. Although there had been an upgrade, there were no changes in the teaching strategies employed; the same way of teaching and learning continued in spite of the underlying computing power and the infrastructure provided by the upgrade.

I came to this conclusion mainly on the basis of observations in my capacity, back then, as coordinator of the Ramallah Intel Computer Clubhouse programme – an after-school learning centre that provides cutting-edge technologies for young people from low-income communities (Resnick and Rusk, 2010). I had the opportunity to coordinate the activities of this learning centre with the local communities and schools, and to mentor a few hundred members from early 2003 to the summer of 2006 with the help and support of adult volunteer mentors. Most of the members of the Computer Clubhouse were students at the nearby UNRWA schools, so I had been in frequent communication with the schools' teachers and students.

During an exhibition for UNRWA schools, hosted at the boys and girls schools mentioned earlier in 2005, in which students presented their best projects to the community, it was observed that the projects from almost all the schools in the region had the same theme, that of animation using Microsoft PowerPoint. One exception was the Scratch projects that had been brought to the exhibition from the nearby Computer Clubhouse learning centre – Scratch is an open source computer programming and authoring environment. The students were very enthusiastic about presenting their Scratch projects at this technology exhibition in their school. These projects were unique and attracted the attention of both visitors and educators. This experience of working with students on Scratch projects in and out of school marks the inception of my interest in using constructionist tools in learning, as I observed the impact of these tools on the students.

The development of the Scratch constructionist tool was based on constructionist learning theory (Papert, 1980, 1993), which embraces learning practices through the construction of meaningful designs as well as physical and digital artefacts within social settings. Papert (1993) firmly believed that the best learning occurs “when the learner takes charge” (p214). Constructionism, therefore, focuses on learning through constructing meaningful designs (Resnick and Silverman, 2005) in which higher attention is given to the transformation of learners’ ideas when experimenting with diverse media and within various contexts (Ackermann, 2004).

In the summer of 2005, I was fortunate both to be awarded a research fellowship at the MIT Media Lab and to work with the Scratch team in the Life Long Kindergarten research group there. This enabled me not only to contribute to the development of Scratch and benefit of testing it in various settings before it was released in the spring of 2007 but also to embark on research and discovery as a constructionist learner and to develop scholarship in this field.

This PhD project stemmed from these earlier empirical experiences that illustrate the constructionist and technological non-determinist approaches I have adopted in this study. Technology by itself is not the primary driver, and not enough to enhance learning. Therefore, equipping a classroom or a computer laboratory in a school with recent technology may not necessarily generate better learning outcomes. In my previous role, which included working at after-school learning centres and using constructionist tools such as Scratch, I embarked, a decade ago, on a journey as a constructionist learner. I consider this thesis an important chapter of my journey as a constructionist learner, through which I seek to develop scholarship on new literacy studies with the use of the constructionist approach.

1.1 Research Background

The constant growth of Information and Communication Technologies (ICT) is a relatively new phenomenon. The impact of these technologies is shaping various aspects of learning for individuals, societies and nations (Jain, 2013). While ICT may not be the sole driver of development, these technologies have profound effects on various social and cultural dimensions in societies. Consequently, it is inevitable that ICT will play a significant role in shaping learning nowadays and in the future.

There is a consensus that the 21st century has brought with it various and rapidly changing demands and challenges and, also, uncertainties (Castells, 2010). The progression from industrial and information economies to knowledge societies and economies, the increasingly globalised world and networked societies are all elements of the 21st century (Castells, 2010; Wells and Claxton, 2008; Cope and Kalantzis, 2009). On the one hand, the globalised and networked societies of today are characterised by vast and fast communication technologies as well as by multicultural and multilinguistic diversity (Cope and Kalantzis, 2009), while on the other, "many [of these] societies today are characterised more by confusion and fragmentation" (Wells and Claxton, 2002, p1), and are maintaining ever more complex social and cultural structures than was the case in the "traditional" societies of a few decades ago.

Accordingly, the rhythm of the changes in rapidly growing ICT fields and their effect on learning are becoming increasingly influential. In this respect, along with the eruption of innovation in ICT, new scholarships are evolving to provide understandings and descriptions of contemporary societies and culture as they are shaped by new media and computational layers driven by ICT. These include contemporary emerging networked and Information Societies (Castells, 2010), Knowledge Societies (UNESCO, 2005), Post Knowledge and Creative Societies (Resnick, 2007), Computing Culture (Papert, 1993, 1980) and computational thinking (Brennan and Resnick, 2012). Consequently, these emerging trends in using ICT and digital media in learning can be seen as fashioning new realities and social platforms that raise the alarm for a need for a broader understanding and definitions of what constitutes literacy and literacy learning. As such, new terminologies and literacy frameworks are emerging. In this context, this study seeks to set out emerging computational learning practices and frameworks while focusing on literacy programmes for people whose first spoken language is not English.

1.2 Research Approach and Design

This study adopts a mixed methods research model that employs a case study approach. Its aim was to investigate the impact of constructionist and computational interventions, exemplified by the Scratch programming language, on the achievement of English for Speakers of Other Languages (ESOL) learners in the post-16 learning sector. The core research participants are the case study students and their ESOL tutor. The students were individual ESOL students aged 16-19 years old, in two ESOL classes in a sixth form college in North London, who had arrived in the UK in the previous two to three years.

The study also targeted groups of non-core research participants in order to provide insights into the context of the study as well as to triangulate the findings that emerged from the core research participants. These groups of non-core research participants were ESOL students at the research site who did not take part more fully in the study, ESOL tutors in various ESOL centres in London who did not commit to participating more fully in the study, and Scratch tutors in the UK who provided their views on the impact of Scratch on improving the skills of their students and enhancing their achievements.

As such, the project was designed to track the enhancement of the English language skills and learning practices of the ESOL learners by complementing their classes with Scratch computational interventions. The goal was to further the understanding of how emerging computational environments can help to improve and enhance learning practices within complex and diverse ESOL literacy programmes. This includes the enhancement of the English language skills of ESOL students, increased classroom interaction, and the development of positive attitudes towards learning English as a second language in and outside of the classroom. In particular, the study aimed to answer the following research question:

To what extent can constructionist interventions such as Scratch contribute to the achievement of higher levels of literacies among young adult ESOL learners?

The purpose of the research, therefore, is to examine the extent to which Scratch promotes innovative learning practices for ESOL learners. The general aims are:

1. To incorporate constructionist new media interventions, using the Scratch tool, into lifelong sociocultural practices.
2. To explore the pedagogical relevance of the constructionist tool of Scratch for ESOL students and tutors as well as for practitioners in the further education context.
3. To utilise, evaluate and refine computational learning practices for ESOL literacy learners.

In more specific terms, the aims of the research are:

1. To explore and develop insights into the use of the constructionist and technological tool of Scratch in the context of the classroom with young adult ESOL literacy learners.
2. To investigate the effectiveness of the Scratch computational environment in terms of its pedagogical contribution to helping young adult ESOL learners to improve their English language skills.

In this context, I hypothesise that utilising dimensions of the Scratch programming environment as complementary components in literacy classes has the potential to enable literacy learners, especially ESOL learners, to construct personal and meaningful computational learning environments. I also hypothesise that it has the potential to provide additional pedagogical and social dimensions to the learning activities, thereby complementing these activities. In effect, the construction of new Scratch artefacts or the customisation and remixing of already shared Scratch projects has the potential to bring about not just certain computational or coding skills but also personalised learning activities beneficial to ESOL literacy learning. Validating these propositions and hypotheses is the ultimate goal of this research project.

This study is aligned with the non-technologically-determinist approach to rethinking learning through constructionist and computational media interventions that aim to reform instructional and didactic educational schema. The research is inspired by interdisciplinary perspectives, including the social-cultural approach to learning (Wells and Claxton, 2008), and rethinking media and Information and Communication Technology (ICT) literacies (Luke, 2002). This, in effect, makes this a multi-disciplinary study, which draws on a number of areas for its review of literature and its analysis.

The theoretical and epistemological foundations of this research draw on the constructionist approach (Papert, 1980, 1993) to learning and pedagogy as well as the notion of epistemological knowledge as a social construct (Luke, 2002; Cushman et al., 2001; Gee, 2000). In line with new sociocultural literacy research (Gee, 2012; Cope and Kalantzis, 2009; Street, 1995) and the pedagogy of multiliteracies (Cazden et al., 1996), this study has multi-disciplinary dimensions and is built on previous work on the development of constructionist media interventions using the Scratch programming environment (e.g. Resnick et al., 2009; Maloney et al., 2008; Peppler and Kafai, 2007). In this context, I endeavoured to contribute to the development of higher levels of literacies among young adult ESOL learners within the lifelong learning context.

In the context of learning trends being increasingly contextualised at the personal, cultural and professional levels (Freitas and Yapp, 2010; Sampson and Karagiannidis, 2010), this research aimed to provide ESOL learner groups with a context-specific learning environment through the customisation and personalisation of their learning setting using computational frameworks and the Scratch programming environment. Such environments are helpful in tackling the diversity and complexity in the literacy and lifelong learning domains. From another perspective, this research was designed and conducted to demonstrate insights regarding bridging the gap between research and practice in the midst of emerging computational learning trends (Brennan and Resnick, 2012) and a mixture of literacy studies mainly dominated by sociocultural research (Gee, 2012; Cope and Kalantzis, 2009; Street, 1995). Finally, this study endeavours to enhance the use of new media computational practices in achieving higher levels of literacies, while showcasing evidence of new abilities which contributed to creating positive learning attitudes, self-confidence and self-esteem among groups of literacy learners.

1.3 Chapter Organisation and Thesis Outline

This thesis consists of nine chapters:

- Chapter One, this introduction, describes the motivation for the study, sets out the research aims and outlines the content of the chapters in this study.
- Chapter Two discusses relevant contexts of literacy learning programmes. It provides a review of the literacy learning context in the UK and reflects on significant literacy policies. Next, the chapter discusses related computing and ICT trends across literacy learning practices to establish the case for the computational and constructionist reviews in the following chapter. The Scratch programming environment is introduced as the constructionist tool in this research. This chapter also provides the rationale for the selection of ESOL programmes as the targeted population in this study.
- Chapter Three contains the literature review. It is divided into four parts. The first part discusses constructionist learning theory while reflecting on related learning theories and concepts. The second reviews the literature on the sociocultural approach to literacy, including new literacy studies and the pedagogy of multiliteracies. The third part discusses computational thinking and the fourth considers relevant and empirical computing and computational learning practices.
- Chapter Four discusses the study's research methodology: mixed methods research using a case study approach. The chapter also presents the research population and the project sample.
- Chapter Five presents the context of the case study, including the communications undertaken during the piloting and planning phases in order to secure the research site and recruit the participants. The chapter discusses the findings from the three surveys, which targeted both core participant and non-core participant students and tutors who were not able to take part more fully in the study.
- Chapter Six discusses the case study in this project, which consists of multiple case studies of the core participant ESOL students. The case studies provide the empirical evidence and demonstrate perspectives on the linguistic, computational and attitudinal improvements achieved as a result of the constructionist and computational intervention.

- Chapter Seven is one of discussion and reflection. It synthesises the outcomes of the case studies and provides reflections on the computational and participation concepts.
- Chapter Eight presents and discusses the responses to and the findings of the survey of Scratch tutors in the UK, which investigated the impact of Scratch on students' achievements and skills. The chapter serves to provide additional information on the research question and triangulates the findings that emerged from the case study.
- Chapter Nine is the conclusions and recommendations.

CHAPTER 2: SETTING THE CONTEXTS

This chapter presents relevant contexts of literacy learning and discusses the learning context of English for Speakers of Other Languages (ESOL). Aspects of Information and Communication Technologies (ICT) and computing are discussed in relation to the literacy context in the UK. Also, the Scratch programming and authoring environment is introduced in this chapter, which is the constructionist tool utilised in this research. The importance and relevance of this research are discussed at the end of this chapter.

2.1 AN OVERVIEW OF LITERACY LEARNING

There is a recognition and consensus among most of the sociocultural literacy researchers and theorists that conceptualization of literacy goes beyond the traditional definition of literacy focused on basic reading, writing, and numeracy skills (Cope and Kalantzis, 2009; Street 1995). The traditional definitions of literacy have been under scrutiny during the past few decades, mainly within sociocultural approaches. Contemporary views of literacy, however, have taken on many more strands since the eruption of digital communication technologies (Lankshear and Knobel, 2006; Wells and Claxton, 2002; Cazden et al., 1996) as well as emerging computational practices and culture.

The National Institute of Adult Continuing Education (NIACE, 2003) defines basic skills as "[t]he ability to read write and speak English and to use mathematics at a level necessary to function at work and in society in general" (p1). However, this can be contrasted with the sociocultural view of literacy (Gee, 1990; Street, 1995) that embraces literacy as social practices and discourses; a view that stands in opposition to the traditional, or autonomous (Street, 1995), models of literacy that view literacy as a set of skills. Therefore, the call to return to "basic skills" through the national basic skills strategy (DfEE, 2001) sparks debate about the directions of literacy learning as manifested through sociocultural views of literacy.

Equally important, given the tremendous shifts triggered by ICT and the fast pace of today's societies (Castells, 2010), it is inevitable that technological advancement will impact on current innovations including areas that are central to this research. Many literacy studies have highlighted problematic areas in contemporary policies where such an approach would be helpful. Such areas include: moving beyond the basic skills and "three Rs" when tackling disengaged young learners (Luke 2002, p142); rethinking literacy learning using new digital media and computational environments (Resnick et al., 2009); and developing a meaningful application and curriculum for literacy learners (Simpson and Gresswell, 2012). Overall, therefore, the foci of this research become relevant for these contemporary issues which are discussed in more detail in Chapter 3.

An overview of the literature on literacy learning shows that literacy programmes target learners with low levels of numeracy and language skills, generally through lifelong learning contexts. These literacy programmes usually target students for whom English is Not the First Spoken Language (ENFL) through literacy language programmes that include: English for Speakers of Other Languages (ESOL), English as an Additional Language (EAL), Not in Education Employment or Training (NEET), or English as a Foreign Language (EFL). This study, however, is focused on post-16 learning environments, and therefore, targets learners on ESOL programmes. While the following section provides insights into ESOL programmes and students within these programmes, this chapter provides the context and rationale for the selection of this research population.

2.2 English for Speakers of Other Languages (ESOL)

English for Speakers of Other Languages (ESOL) refers to learners for whom English is not their first language. Different English speaking countries have different terminologies to describe English learning to students whose first language is not English. This distinction may reflect variations in labelling schemas, technical definitions, or accents of "Englishes" (Pitt, 2005). Also, while aspects of literacy and ESOL learning can be understood within recent globalisation and migration trends, this perspective triggers ideological differences among societies and nations. In the UK, ESOL provision targets learners among both international and European migrants to develop their English and literacy skills in order to enhance their economic opportunities and social integration in the country. Therefore, ESOL programmes constitute essential elements in settlement plans in the UK for family reunification, or for seeking refuge or asylum. The ESOL learning sector has been increasing consistently as reported by Paget and Stevenson (2014):

> "ESOL began as a grassroots movement providing courses for migrants, and is now a professional industry, with standards overseen by government and a specialised method of teaching and learning, backed by research, funding and various professional bodies" (p9).

In the UK, as in other English speaking countries, literacy in general and ESOL programmes in particular, are believed to be influential for social cohesion, economic growth among migrant communities and individuals. Research confirms that the acquisition of English language skills is requisite not only for employability, economic and sustainable growth but also for a broader social cohesion and integration in the UK (Skills Funding Agency, 2014; Paget and Stevenson, 2014). Therefore,

> "Learners who do not use English as their first language are expected to undertake ESOL learning which improves their prospects of getting a job and enables them to progress to a GCSE grade A* to C in English language" (Skills Funding Agency, 2014, p28).

English for Speakers of Other Languages (ESOL) is administered by the Skills Funding Agency and Young People's Learning Agency. ESOL provision is mainly delivered in the further education sector, third sector organisations, and private training providers. It is placed within the remit of post 16 learning in England that is shared between the Department for Education (DfE) and the Department for Business, Innovation and Skills (BIS) (2014). ESOL learning is offered at different levels of skills: Entry 1, Entry 2, Entry 3, Level 1 and Level 2, in which Level 2 is virtually equivalent to GCSE.

The provision of ESOL learning is highly complex and heterogeneous. While ESOL learners may have one attribute in common, that is, they do not speak English as their first language, they usually uphold disparate levels in the remaining attributes. Additional complexity applies nowadays amidst globalised societies. For example, Cope and Kalantzis (2000) conclude that English is becoming "multiple and increasingly differentiated Englishes" (p6), a description that is highly relevant in cosmopolitan cities, such as London. In addition, among migrants' families, English may not always be the first language spoken at home. Children, therefore, may develop bilingual abilities in terms of accent and speaking skills, but they may still lack other English skills, such as reading, writing or attaining a proper range of vocabulary.

To illustrate, while discussing the diversity and English language abilities of students in an ESOL class at the research site, the ESOL tutor pointed out that although there might be learners who may consider English as their mother tongue, and they can speak English without a foreign accent; they may still lack certain English vocabularies. He added that this observation of some ESOL learners at the research site can be clarified by not having English as the first spoken language in their homes; or possibly because they received a partial education in the UK.

One explanation for the complexity of ESOL programmes is the diversity of ESOL learning contexts. Therefore, this may clarify why it is not feasible to provide a unified curriculum for ESOL learners, even if they were within the same institution or possibly in the same class. For example, consider a class that has a dozen ESOL students who may maintain different levels of English language skills, different cultures, and speak different languages as their first spoken language. In this context, a centralised or unified curriculum may not serve all students in this class.

In summary, the lifelong learning sector, including ESOL programmes, has become increasingly more diverse and complex. It is difficult, if not almost impossible, to mark boundaries between various literacy and lifelong learning parameters including: applied linguistics, economic drivers, policy directions, ideological frameworks, personal identities, and social contexts. In this regard, ESOL learners are "in themselves small multilingual worlds bringing together speakers of many different languages" (Pitt, 2005, p84). Therefore, ESOL learning programmes constitute a dynamic, heterogeneous, and complex environment that requires dynamic interventions, similar to the computational interventions proposed in this thesis.

2.3 Literacy Language Learning: The Context of the UK

The context of policies of literacy interventions in England has taken several turns in the past two decades. These turns illustrate the timeline of developments in adult literacy and numeracy interventions. I choose three of these developments to provide insights into the policy perspectives and interventions into literacy learning during the past twenty years. The three developments are: first, the Moser report (1999); second, the 2003/2011 Skills for Life Survey: A Survey of Literacy, Numeracy, and ICT Levels in England (BIS, 2012); and third, the Organisation for Economic Co-operation and Development (OECD) survey (2013).

First, the report of the Working Group chaired by Sir Claus Moser entitled, "A Fresh Start: Improving literacy and numeracy", widely known as the Moser report (1999), marks a turn in rethinking literacy interventions and policies in the UK in recent decades. The surprising figures in the report reveal that 20 percent of adults, about 7 million people, lack basic literacy skills and about 40 percent of adults have some numeracy problems (Moser report, 1999). These alarming findings triggered various policies, initiatives, and programmes in the UK. The report lists 22 recommendations to remedy these striking results. At the top of these recommendations was the establishment of the Skills for Life - National Basic Skills Strategy (Moser report, 1999). The Skills for Life Strategy, implemented by the Learning and Skills Council, aimed to set a national target to reduce functional illiteracy and innumeracy by half by 2010 through targeting people over the age of 16 and up to literacy Level 2 within formal or informal learning (Moser report, 1999). The Learning and Skills Council completed its commission and closed on March 2010 and was then replaced by both the Skills Funding Agency and Young People's Learning Agency (The National Information Infrastructure [NII], 2015).

Of particular relevance is the fact that ESOL is significantly represented among the 20 percent of adults who lack basic literacy and numeracy skills (Moser report, 1999). Consequently, a working group of experts and practitioners in the ESOL sector was set up and published a report entitled, "Breaking the language barriers", almost a year after the publication of the Moser report (Grover, 2000). The ESOL working group had several recommendations to improve the ESOL learners' skills, which are summarised below (Grover, 2000, p4-5):

- ESOL must be addressed as a unique and distinct programme in the national adult basic skills developments.

- National and local baselines for literacy and numeracy should be established for ESOL needs in order to set participation and achievement targets and allocate funding.

- The Learning and Skills Council (LSC) should set local and national targets for ESOL that uphold quality and effectiveness of provision.

- The Department for Education and Employment (DfEE) is to investigate expansion of ESOL provision through colleges and third sector organisation, and commission production and supporting materials packs for ESOL tutors and learners.

- Standardisation of a distinct ESOL curriculum framework up to Level 2 with adequate and independent evaluation schema with qualifications should be mapped against the national standards to allow flexibility in delivery and a separate assessment of the four skills (listening, speaking, reading and writing).

- Develop teaching standards and training for teachers as well as qualification frameworks for ESOL learners along with coherent and consistent inspection process for ESOL provision.

The findings and the recommendations of the Moser report may also be controversial as argued by Ade-Ojo (2011) who pointed out that the committee upheld a "pre-determined agenda…aligned significantly to the themes of employability and economics" (p153). He notes that there were members of the committee who were not fully aware of the details and accuracy of the data, and only three of them acknowledged the existence of limited data. Although there are critiques to the methodologies and therefore to the findings and recommendations of the report (Hamilton et al., 2001), it is an important turning point in adult literacy policies and interventions in the UK. These policies and interventions are, therefore, underpinned by economically-driven agendas, the market, and employers' needs, which is a new mainstream policy for the Department for Business, Innovation and Skills (BIS) as well as for the Department for Education (DfE). This debate raises ideological questions about the purpose of education, the policy context (Hamilton et al., 2001) as well as the role of government, market, and the third sector in setting out visions and planning strategies for literacy and education.

The findings on adult literacy and numeracy skills in the Moser report were followed by two milestones of conducting two comparable national surveys, the first carried out in 2003 and the second in 2011, that aimed to measure literacy, numeracy, and ICT levels in England (Department for Business, Innovation and Skills, 2012). The review of these two surveys will provide more insight on the progress of recommendations of the Moser report and recent interventions, particularly on its national target to reduce illiteracy and innumeracy.

The second development originates from the Skills for life Survey: A Survey of Literacy, Numeracy, and ICT Levels in England (BIS, 2012) conducted in 2003 and 2011. The two national surveys captured progress during the eight-year gap and aimed to contribute to shaping the direction of literacy, numeracy and ICT interventions in England. The findings of the latter survey (BIS, 2012) replicate the earlier survey (BIS, 2003) which allows comparison between the two surveys. The report of the Skills for Life Survey (BIS, 2012) reveals significant improvement in the literacy skills within Level 2 and above since the recommendations of the Moser Committee (1999). Also, the report reveals a shortfall of improvement in literacy and numeracy in the lower literacy skills levels (BIS, 2012).

Eventually, the low-level literacy and numeracy are the literacy levels of the majority of ESOL learners (within or below literacy Level 2). Moreover, the findings show a significant increase in demand for ESOL programmes (BIS, 2012).

The findings on numeracy and ICT skills are more encouraging than those of literacy figures. Numeracy figures are found to be less promising in London as “London was the only region to see a sizeable decline in numeracy performance since 2003” (BIS, 2012, p4). Consequently, because of the over-representation of ESOL learners, London becomes particularly significant in the context of tackling overall literacy problems in England.

Furthermore, the findings concerning the demographic figures reveal that ESOL learners are located in the context of a dynamic sector that upholds different parameters including migration, short and long settlement in the UK, and sociocultural contexts. Each of these parameters emphasises the fact that static interventions may not be enough in tackling such a dynamic sector. For instance, the findings show that during the eight-year gap, the proportion of people whose first language is not English increased from seven per cent in 2003 to eleven percent in 2011, while Black and Minority ethnic groups increased from nine per cent in 2003 to fourteen per cent in 2011 (BIS, 2012).

Moreover, the findings of the survey (BIS, 2012) show that lower literacy and numeracy levels are correlated with increasing populations that describe themselves as Black and Minority Ethnic (BME) groups, particularly in London where the majority of immigrants are located, and where more than 50 percent of the entire ESOL provision in England is located (Greater London Authority, 2012).

The conclusions of the findings show that although “[l]ittle change in the literacy performance of each of the age groups is evident since 2003…[the] youngest age group in 2011 have far poorer numeracy skills than their equivalent counterparts in 2003” (BIS, 2012, p5). These findings suggest that ESOL programmes show no progress or remain unchanged at the best possible scenario. Therefore, these findings suggest a need to rethink literacy interventions under Level 2 including ESOL programmes, and it provides a rationale for conducting further research to enhance ESOL interventions. Finally, these conclusions are supported by findings from the survey of the Organisation for Economic Co-operation and Development (OECD) (BIS, 2012) discussed in the next section.

The third development originates from the International Survey of Adult Skills (BIS, 2013), known as the Organisation for Economic Co-operation and Development (OECD) Survey. The OECD conducted an international survey and assessed literacy, numeracy and ICT skills in 24 countries (BIS, 2013). In England and Northern Ireland, the survey was conducted by the Programme for the International Assessment of Adult Competencies (PIAAC) supervised by the OECD (BIS, 2013). The survey found that 16 to 24 year-olds have "literacy and numeracy levels no better than those of their grandparents' generation" (Ramesh, 2013). The findings show that the oldest age group in England had higher levels of literacy than those of the youngest adults aged 16 to 24, and that England's overall literacy scores were around the average scores (BIS, 2013). In addition, the findings concerning the numeracy skills were "unusual" and significantly below the average of the OECD as "almost a quarter (24 percent) of adults in England scored Level 1 or below" in numeracy (BIS, 2013, p58), and "a quarter of adults in England have the maths skills of a 10-year-old" (Ramesh, 2013).

The debates on these findings were not far from the political lounges. A parliamentary article, in response to the OECD survey in England, reports that the Business, Innovation and Skills (BIS) Select Committee is seeking to launch a campaign to tackle the striking findings in literacy and numeracy in England (Parliament. House of Commons, 2014). There is no doubt that the reactions and responses to the ever-changing literacy landscape are almost indefinite. The three contemporary developments discussed earlier aimed to provide insight into the timeline of the development of literacy and ESOL programmes as well as the recent figures and directions of literacy and numeracy learning policy in England.

Finally, a recent report shows that migration figures to the UK are estimated to be more than two hundred thousand a year (Paget and Stevenson, 2014), and the report summarises the current ESOL situation as follows:

> "Our ESOL system is under strain because of significant demographic, political and funding pressures… The 2011 Census revealed that close to 1 million people speak either poor English or none at all. There is thus a blockage of skills and language potential, which require English to be "unlocked' " (p19).

On the basis of this, it can be concluded that the ESOL learning system is increasingly of significant importance due to the recent migration trends in the UK and the European Economic Area. Although ESOL can be seen as a part of wider literacy interventions, it is still under-researched, and further research is suggested to explore the effectiveness and relevance of ESOL provision (BIS, 2012); particularly in the context of effective strategic interventions that could support ESOL learning. The numbers of the ESOL students are projected to continue increasing. There is no evidence that they are developing literacy skills at the desired level. In this context, it is important to consider innovative strategies for promoting ESOL and literacy learning, which is what this study aims to do.

2.4 Computing, ICT, and Literacies

Information and Communication Technologies (ICT) have been of increasing interest in learning domains as technological innovations continue rapidly. Plenty of studies promote the employment of technology in learning and report positive outcomes from this employment (Sutherland et al., 2009). This is manifested in various terms which describe using ICT in education, such as educational technologies or technology in education. A snapshot of the different spheres of development shows the progress made through different approaches that include: (1) the digitalisation process of books and learning materials, for example, on computer storage disks or compact disks; (2) e-learning approaches that utilise the Internet to deliver courses; (3) blended learning approaches; and (4) most recently, adaptive learning approaches (Gartner 2014). These different elements of educational technologies utilise various types of technological tools in order to assist learning. The use of educational technologies may reflect either isolated and decontextualized drills and practices approach, or the use of online social platforms that initiate more interactive learning approaches. This description of the educational technologies can be viewed similar to the approaches to literacy that range from the static and decontextualized interventions to the literacy approaches that embrace social practices and discourses (Gee, 2012; Cope and Kalantzis, 2009).

In the UK, ICT were highlighted in almost all educational reports, surveys, and policy research papers in the past two decades. For example, the findings from the recent national survey (BIS, 2013) in England identify ICT skills as a core set of skills besides literacy and numeracy skills. In this context, there have been many profound manifestations of the embodiments of ICT and computing in learning and educational settings in the UK and other developed countries. The BIS (2012, 2013) and the OECD (2013) surveys exemplify aspects of these manifestations. The review of recent policies in the UK, and globally, show shifts from ICT to Computing in using technology in the core subjects in mainstream education. While many of these shifts are taking place at the time of writing this thesis, the Department for Education (2014), not surprisingly, announced new statutory computing programmes of study in the national curriculum in England. A daily report describes this process as:

> "England will become the first country in the world to mandate computer programming in primary and secondary schools. Children will start learning to write code when they enter school the age of five, and will not stop until at least 16, when they finish their GCSEs" (Curtis, 2013).

In addition, the Department for Education (DfE) has proposed the replacement of the old computer literacy and ICT programme of study with a new national curriculum in computing education, commencing with Key Stage 1 to 4. According to the DfE, the new programme is designed to help pupils to:

> "use computational thinking and creativity to understand and change the world...[for] teaching children how to code, create programmes and understand how [the] computer works" (Department for Education [Statutory guidance], 2013).

Therefore, the school year 2014-2015 was earmarked as "the year of coding" with the Chancellor of the Exchequer and Education Secretary making half a million pounds available to support training teachers in coding and computing skills (HM Treasury and the Department for Education [News story], 2014). This development has been followed by campaigns, such as the "Year of coding" (2014), aimed at encouraging learners in the UK to get started with coding. These developments took place amidst increasing national and international interest in computing and coding through formal and informal learning initiatives. In effect, the movement towards developing coding skills appears to be gaining ground and attracting interest from different sectors of the UK educational system.

In this context, it is important to highlight selected initiatives that are taking place in formal and informal learning contexts, as these initiatives constitute trends useful for increasing the understanding of the inclusion of computing and computational practices into mainstream education. These initiatives serve as a proxy in uplifting computing and computational thinking into mainstream education. These initiatives include after-school learning centres and dozens of other grass-root, not-for-profit and profit initiatives. To illustrate, I select the following two examples of the Code Club and Computing at Schools (CAS).

2.4.1 The Code Club Example

Code Club was founded in 2012 and is considered a growing and successful initiative of national and international networks of volunteer-led after-school coding clubs aimed at helping school children to get started with coding (Code Club, 2014). In these clubs, learners use the Scratch programming environment in the first and second terms, and then enrich their coding skills using more advanced web programming tools in the third and fourth terms. This initiative is implemented in primary schools in the UK in afterschool learning contexts and aims to "put a Code Club in every single primary school in the country" (Code Club, 2014). Upon the establishment of the Code Club in 2012, the BBC reported that Code Club aims "to have 25% of the UK's primary schools running a Code Club by 2014" (BBC, 2014). Currently, Code Club has 2,771 clubs (an after-school coding clubs or at non-school venues) registered in the UK since 2012, teaching more than 30,000 pupils (Code Club, 2014).

2.4.2 Computing at Schools (CAS) Example

Computing at Schools (CAS) supports computing education in schools through the CAS hubs which include school teachers, university partners, and computer science and programming professionals from profit and not-for-profit sectors (Computing at Schools, 2014). Computing at Schools is dedicated to training teachers in coding skills and preparing them for using these skills with their schools' pupils. Recently, Computing at Schools, in partnership with "The Chartered Society for IT", started offering new certificates for teachers in computer science teaching. This demonstrates the relevance that computing is beginning to have in the teaching profession and the education process.

In the UK's mainstream education, the interest in Information and Communication Technologies is not new. For instance, the Moser report (1999) made a recommendation to the trilogy of literacy, numeracy and ICT skills. The interest in ICT fields in the Moser report (1999) was more focused on access, facilities and infrastructure rather than content and curriculum as reflected in the Chairman's Foreword to the report:

> "We have made proposals about the use of Information and Communication Technology (ICT) in helping basic skill programmes, a vital priority for the future. But we have not addressed the teaching of ICT skills as such. This issue - the future of ICT as a basic skill in itself - is of utmost importance, and is being considered by the National Skills Task Force" (Moser, 1999, p4).

In conclusion, while computing and coding are increasingly gaining attention and becoming compulsory in mainstream education in the UK, it is important to consider interventions that utilise forms of dynamic computational practices to enhance ESOL literacy learning. These computational interventions are not limited to the traditional views to support ESOL learning using ICT equipment similar to the views in the late 1990s, and they are not merely focused on the technical aspects of computing and coding. However, these computational interventions transcend these traditional views into more meaningful computational practices that this research is aiming to investigate.

2.5 Scratch Computational Environment

I start this section with the story of Zeina who is a member of the Scratch online community, and who created and shared various projects with Scratch online forums. Zeina is a Spanish member at Scratch online community who speaks English. Her story exemplifies promoting second language learning using the Scratch online community. She creates Scratch projects useful to teaching the Spanish language to English speakers.

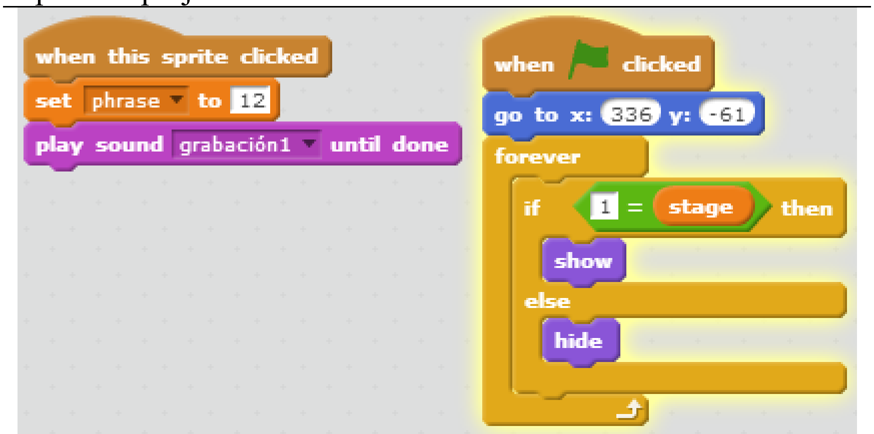
One of the projects that Zeina created and shared with the Scratch online community is a Spanish learning project entitled, "Words in Spanish", which aimed at teaching Spanish vocabulary. The project demonstrates her personalised ways of teaching and learning the Spanish language by showing the English spellings of sets of colours, seasons of the year, days of the week, and months. This Spanish language learning project enables scratchers, members of the Scratch online community, to learn Spanish words and show the spelling when clicking on words or pictures provided in her project. For example, as illustrated in Figure 2.1, by clicking on the yellow square on the screen of colours, the word "Amarillo", the Spanish translation of the colour yellow, will show beneath the set of the colour screen in her project.

Figure 2.1: a set of colours screen in Scratch project entitled "Words in Spanish".

This interactive Scratch project is an example of a personalised language-learning activity shared and remixed within the Scratch online community - Remixing is a functionality that enables online users to import a project from another member in the Scratch online community, building upon or customising others' Scratch projects and sharing them again through the Scratch online community while keeping the credits of the original author or authors. Further analysis of this personalised Spanish learning project shows that three other users within the Scratch online community have remixed it. Each new remix demonstrates further personalised and customised learning activities of users who are interested in learning the Spanish language. For example, Maria, a Spanish native speaker and a member of the Scratch online community, remixed Zeina's "words in Spanish" project by adding a recorded voice to each of the Spanish words in the project. Consequently, she, or any user may try her remixed project, can listen to the Spanish pronunciation while checking the Spanish spelling of any word or shape clicked. In other words, Maria added new personalised learning functions to the original Scratch project that was created and shared by Zeina.

In this example of the "words in Spanish" Scratch project, Maria most likely tried the original Scratch project, looked inside the project page to see the code inside this project, and decided to remix this project by recording her own voice to the Spanish words as seen in the purple colour code block of "play sound [grabacion1] until done" in Figure 2.2. Maria, similar to any other "remixers", only needed to "read" or understand the blocks of codes to identify where she can drag and drop the "play sound" code block within the code blocks of the project she virtually "borrowed" from Zeina.

Figure 2.2: a snapshot of a code block of the remixed "Words in Spanish" projects.

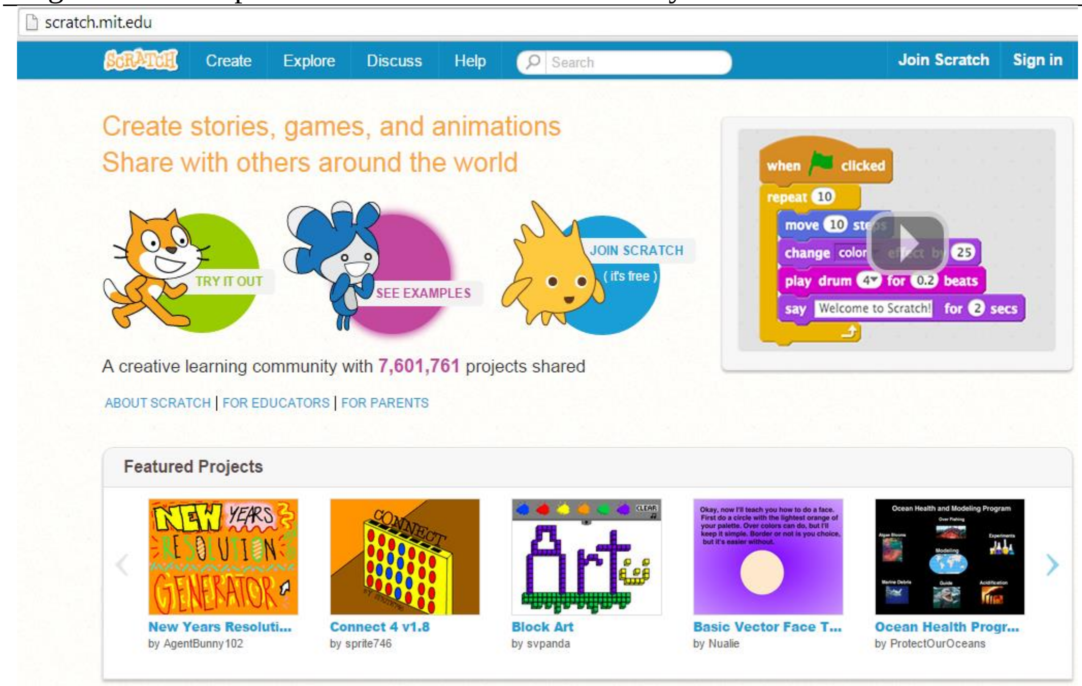


The remixing functionality of Scratch has been carefully designed so a member can easily remix other members' projects by clicking on the "remix" button and the entire project will be accessible to the scratcher to adjust as she or he wants.

This project exemplifies how Scratch can be used to facilitate the learning of a second language, such as English for ESOL learners. This environment provides an opportunity for investigating and designing ways through which second language learners can create, customise, or remix interactive learning tools and projects through the facility available in the Scratch online community (Brennan et al., 2010)

Scratch is a new open source computer programming and authoring environment, which was released in spring 2007 by the MIT Media Lab. It enables learners to construct computational code blocks and experiment with computational thinking through creating meaningful artefacts and creative expressions including digital storytelling, games, interactive art and animation. As it has been called "the YouTube of interactive media" (Resnick et al., 2009), Scratch maintains growing online communities that enable members to share their projects, learn from each other and remix others projects through friendly and multilingual programming environment. Figure 2.3 shows a snapshot of the Scratch online community.

Figure 2.3: a snapshot of Scratch online community



Scratch is an illustration of constructionist computational tools which this study seeks to validate for its effectiveness on ESOL learners. Existing studies involving the use of Scratch in various contexts conclude that it helps learners to move beyond what they are learning to how they are learning through being engaged in computation practices (Brennan and Resnick, 2012). Central to this is the fact that it is seen as capable of providing learners with a computational thinking environment (Brennan and Resnick, 2012) that is useful for creating personalised learning spaces and meaningful artefacts while customising and remixing projects in the Scratch online community.

Developing from this, the research aims to investigate ways this tool is supportive to young and adult learners, such as ESOL or NEET learners, in acquiring higher levels of literacies as they experiment with creative expression using constructionist and computational thinking frameworks through constructing personalised learning projects from their curriculum.

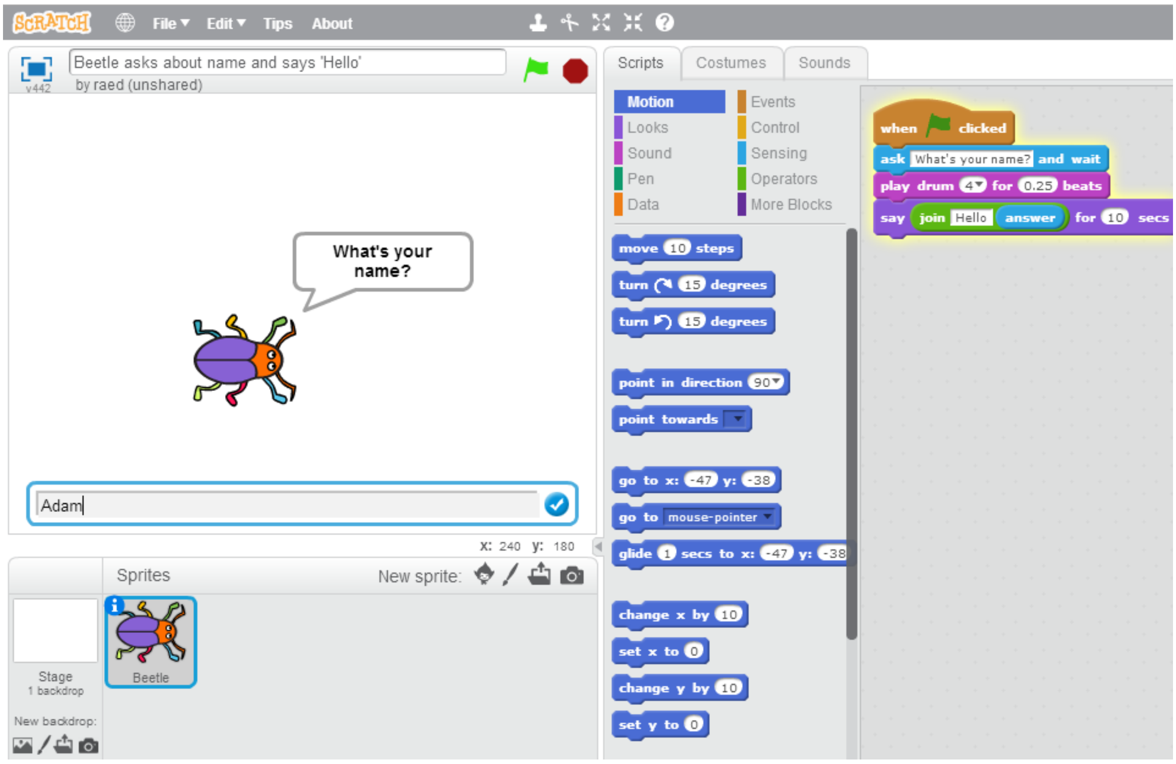
Three factors inform the decision to utilise Scratch in this study. First, as demonstrated in Yacoub (2010), it can be used in both formal and informal educational settings and, therefore, aligns closely with the concept of new literacy studies, which is itself not exclusively school-bound. Second, because it is a free open source software, it has a significant global presence, as it is used in more than 150 countries, available in more than forty languages and has multi-disciplinary applications (Scratch, 2015). This obviously has implications for the applicability of the findings of this study. Third, the growing and safe online community of Scratch that maintains millions of shared projects and hundreds of thousands of members, educators, and researchers. This makes the online community of Scratch a vibrant environment, useful for experimenting with innovative computational thinking and learning frameworks which can be utilised by literacy ESOL learners.

2.5.1 Main Functions and Screens of Scratch

This section explains how Scratch programming visual scripts and blocks work through a demonstration for a Scratch project which is an illustration of the greetings and salutation Scratch project. The turtle, or the beetle in Figure 2.4a, which is a sprite or an object in Scratch programming environment, asks for the name of the user in order to demonstrate greetings for the user as illustrated in Figure 2.4a. The snapshot shows the script for a sprite (the Beetle) that asks for the name of the user in this demonstration. Once a user enters a name, "Adam" in this example, then, the Beetle will say "Hello" to the user.

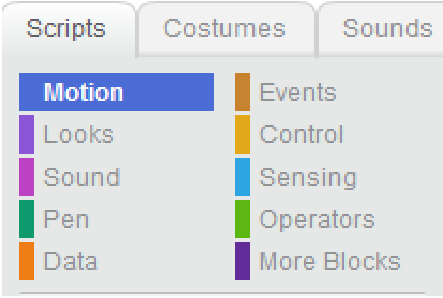
In this project, a click on the green flag is an event that will start the programme and the sequence of the visual scripts (or code). The sequence of the visual blocks of script (Figure 2.4c) shows a logical sequence for this script: (1) ask for a name and wait; (2) when a name entered, then store the name in the "answer" block; then (3) play the drum sound; then (4) say "Hello", to the name entered in step 2, by displaying the name stored in the "answer block". See Figure 2.4c for an explanation of the visual script and blocks in this demonstration.

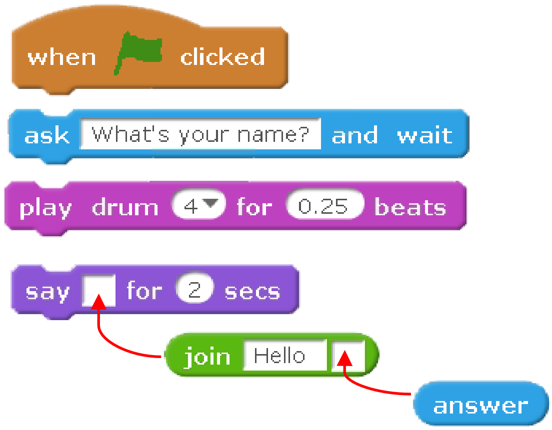
Figure 2.4a: a snapshot of a scratch project that shows the stage, the script sections, and the project script created by the researcher



The example in Figure 2.4a is an illustration of Scratch project that demonstrates various screens and functions available at the Scratch editor. A Scratcher can access the editor when she clicks on the "Create" button at the Scratch online or offline editors.

Figure 2.4b: a snapshot of script sections that contain commands and function blocks that we use in programming a sprite	Figure 2.4c: breakdowns for blocks of the Scratch visual script





There are several sections in the Scratch editor; the following are the main sections:

1- The Stage: which is the screen that shows the results and the output of a Scratch script or a project.

2- The Sprites: which are the characters or objects that we can give commands using the scripts. It is the Beetle in the illustration in Figure 2.4a.

3- The Scripts section: which contains all of the commands and function blocks that we use in programming a sprite. The script section (Figure 2.4b) consists of subsections that each has its distinct colour. These sections are: “Motion”, “Events”, “Looks”, “Control”, “Sound”, “Sensing”, “Pen”, “Operators”, and Data. Blocks can be joined in puzzle-like shapes to create code in Scratch (Figure 2.4c).

4- The script area: is the area on the right panel of the Scratch programme, where different scripts, and blocks of scripts, can be dragged and dropped. Each sprite may have its particular script. For an example of a script in a Scratch project, see the joined blocks of scripts in Figure 2.4a. For illustration, Figure 2.4c shows the breakdown of these blocks of scripts.

Therefore, an essential element in visual programming is to use visual scripts and blocks to create a project; in which blocks can be dragged and dropped in the script editor to create a Scratch project. Blocks of scripts in a Scratch project can be remixed by re-using shared projects available through the Scratch online forum. Using scripts or projects from other users is licenced under “a Creative Commons Share Alike license” (Scratch, 2015).

2.6 IMPORTANCE AND RELEVANCE OF THE RESEARCH

This research is set up to explore the impact that technology can have on the promotion and understanding of literacy in general and ESOL learning in particular. Having established the importance of ICT and computational practices for literacy learners and the context of the literacy sector in England, my contention is that constructionist and computational media interventions have the potential to open up new learning and teaching practices for literacy ESOL programmes.

London hosts the largest segment of immigrations and literacy interventions. The Greater London Authority (2013) statistics reveal that London hosts more than 50 percent of ESOL literacy provision in England. Therefore, this cosmopolitan city is the home of the largest communities for whom English is not the first spoken language. Furthermore, London appears to have its own disproportional figures regarding demographic, sociocultural, and English language skills. The BIS survey (2012) shows that the capital accommodates Black and Minority Ethnic populations almost three times the average with “40 percent compared with an average of 14 percent nationwide” (p25). This cosmopolitan capital is “disproportionately more likely than people from other regions not to have English as their first language” (p25).

These records resonate proportionally with around four per cent growth (10.7% in 2011 compared to 6.7% in 2003 (BIS, 2012, p31) of the overall population of people for whom English is not the First Spoken Language (ENFL). These figures reflect the significant importance of conducting the research in London. This very city exemplifies almost all innovative socio-cultural-political and technological practices helpful to scaling the experience and the findings of this study, and useful to harvest diverse skills and potentials among communities of immigrants in the area.

Computing practices are increasingly being incorporated into mainstream education, as is the case in the introduction of the new national computing curriculum in the mainstream education in the UK (Department for Education [Statutory guidance], 2013). These emerging practices are increasingly affecting teaching and learning in all subjects including literacy and ESOL subjects. The argument is that forms of computational practices are increasingly being utilised as core pedagogical frameworks in mainstream education. This, however, does not solely mean learning to code in a sense that learners are being introduced to certain conceptual and technical coding skills, but extends to how computing and computation can be utilised in constructing innovative learning environments useful to tackle high levels of complexities in contemporary education in general and ESOL literacy programmes in particular.

To demonstrate, I draw on Resnick's (2013) illustration to highlight the importance of computing in the context of computational learning frameworks, as he draws an analogy between writing and coding. He suggests that everyone should learn to code, not because everybody should develop a career in computer programming and computing, but because he considers coding a skill for life that extends technical computing skills. In the same sense, writing is a skill for life and not a monopoly of journalists or professional writers. Consequently, developing from the fact that educational trends nowadays are incorporating computing and computational practices, it is important to consider forms of computational-led learning frameworks in learning settings including literacy programmes. This view illustrates employing technology and its applications in a way that transcends static technical concepts of coding into abstract notions of computational frameworks.

Based on the above and the findings from the discussed surveys (BIS, 2003, 2012; OECD, 2013), literacy statistics and interventions constitute a pressing issue in the UK. Apparently, these alarming literacy figures are not going to be resolved soon; and this has various economic and social implications. Therefore, there is a need for creative literacy interventions and it is essential to explore innovative interventions in the context of growing computing and computational practices, especially as the gap of access to technology and computing is narrowing. For example, the Skills for Life survey (BIS, 2012) reveals a change in access to computers and the Internet from 71 percent in 2003 to 93 percent in 2011, with a total of 90 percent of respondents having access to the Internet in their homes (BIS, 2012, p184). These statistics illustrate a digital infrastructure capable of hosting increasing shifts towards computational learning frameworks that transcend access and deployment of static technical concepts.

In addition, the innovation trends in the technological cycles are dynamic, not linear, and usually not predictable. As evidence of these developments, Gartner Hype Cycles (2014), which is a leading technology and advisory company, identifies several growing technology trends, such as the "Internet of Things" and "Big Data" as well as related educational trends such as "Mashware" or "Adaptive Learning". Therefore, I argue that these emerging technologies manifest the foundation for an emerging computational practices in education.

In this context, this study has identified an important area of research which investigates the impact of computational interventions on the achievement of ESOL literacy learners. My contention is that ESOL learners can improve their language skills through the personalisation and remixing of constructionist interactive media projects, and this demands comprehension and conception of elements of computational frameworks, not static, decontextualized, and esoteric syntax of computer programming languages. Therefore, it is not the case that ESOL learners need to learn how to code first in order to be able to enhance their English language skills.

In fact, the results of the Skills for Life survey (BIS, 2012) show that performance in literacy and numeracy is positively correlated with performance with ICT skills:

> "By contrast, respondents who lacked ready access to a computer in their home or workplace or who did not have internet access in their home tended to perform poorly, not only in the ICT assessments but also in the literacy and numeracy assessments" (p7).

As such, it is important to differentiate between the use of ICT as a set of skills, which is eventually useful for ICT learners to learn various ICT skills, and the utilisation of computational frameworks as a learning medium in a particular learning environment, such as ESOL learning settings. The two concepts are correlated but distinct. That is, ICT is a term often used in the 1990s, whereas computing areas incorporate a higher abstraction of ICT applications and programming concepts. Computation is, however, an emerging field that incorporates an abstraction of ICT and computing and usually focused on concepts and expressions. These concepts are discussed in more detail in chapter four.

From another perspective, given the fact that ESOL learners constitute heterogeneous groups of learners (Pitt, 2005), the computing and computational environments offer prospects for forms of customisable and personalised learning mediums which has the potentials to benefit individual learners through serving their needs and contexts. These environments and opportunities offered through computational tools, such as Scratch. In other words, customisable and personalised learning, through computational environments, have the potential to benefit ESOL students.

2.7 Chapter Summary

This chapter has presented relevant contexts for the major policy, learning, and interventions of recent literacy developments. Three significant developments in adult literacy and numeracy intervention have been discussed in the context of the UK and England: the Moser report (1999), the 2003/2011 Skills for Life survey in England, and the survey of the Organisation for Economic Co-operation and Development (OECD) (2013). The context of English for Speakers of Other Language (ESOL) programmes, the targeted population in this study, has been presented. Computing and coding have been discussed along with other relevant ICT aspects in relation to literacy learning. These topics included the Scratch programming environment, the constructionist tool utilised in this study, and other examples of computing-focused initiatives in the UK. Finally, the importance of this study within the provided context has been discussed.

CHAPTER 3: LITERATURE REVIEW

3.1 PERSPECTIVES ON LEARNING THEORIES

Theories about learning, and epistemology in general, are often classified into two categories, positivist and constructivist (Edwards, 2012). The positivist notion of learning is underpinned by the behaviourist learning theories, which view learning as conditioned responses (Cohen et al., 2011) and knowledge as a "commodity" that can be "packaged and transmitted" (Edwards, 2012, p82). In contrast, the constructivists argue that reality "is a construct that cannot be determined independently of the observer" (Jefferies et al., 2007, p113) and, therefore, perceive knowledge as a social construct, as proposed by theorists such as Vygotsky (Cole et al., 1980).

In practice, these views of learning are manifested in pedagogical practices, underpinned by the constructivist and constructionist approaches to teaching and learning. Edwards (2012) suggests that positivism is in line with the teacher-centred and didactic approach to learning, in which teachers are described as "fact-givers" and students are described as "listeners and recipients", with an instructional approach tailored towards memorising facts (p83). In contrast, constructivism is in line with the student-centred approach, in which teachers have a collaborative role with an instructional approach that value relationships, inquiry and invention (Cohen et al., 2011; Suter, 2005).

Skinner's experimental approach (1993) typifies the behaviourist theory of learning. It views learning as a passive process, essentially focused on responding to external stimuli through positive and negative reinforcement (Murphy et al., 2009). In contrast, constructivism describes different theories of learning, including cognitivism (Davies and Arthur, 2009) and constructionism (Papert, 1980, 1993). Therefore, constructivist, cognitivist and constructionist learning theories suggest an active role for the individual learner. Among these theories, one common feature is that they uphold distinct levels of focus on the personal and internal dimension of learning (Davies and Arthur, 2009). The assumption that learning is a cognitive or brain-based process aligns more with the Piagetian view of constructivism as a cognitive learning theory (Murphy et al., 2009). Vygotsky, on the other hand, sees learning as socially constructed (Wadsworth, 1996), which sets him in opposition to the behaviourist approach.

In this context, we can draw out two important features of the changes and shifts in learning approaches. The first illustrates a shift from behaviourism and positivism toward a constructivist approach to learning. This shift appears to have resulted in the emergence of notions and concepts such as the information society (Tinio, 2003), the creative society (Resnick, 2007) and networked and information societies (Castells, 2010).

The second feature is the increasing interest in lifelong learning. Murphy et al. (2009) argue that "education is no longer seen as just an early preparation for life" (p90). Furthermore, learning has multidimensional boundaries that cut across different domains including the sociocultural, the sociological, the psychological, the philosophical and the political. These illustrations uphold learning as practices that are not limited by the time or space of educational establishments.

A key question now is: how are these learning approaches related to digital technologies? We can argue indeed that digital technologies can be employed in either constructivist or positivist approaches. Therefore, new technologies, including online and virtual learning platforms, can be perceived as tools that can be used, either in didactic learning practices underpinned by the positivist approach, or in fostering collaboration and the social construction of knowledge, which are in line with the constructivist approach to learning (Jefferies et al., 2007).

In this context, this study falls within the framework of the social constructivist approach, which can be contrasted with the technological determinist approach regarding the role of technology in education. The constructivist theories become relevant for this study, which focuses on a constructionist and sociocultural approach to literacy. For example, the social constructivist approach allows for the inclusion of social and cultural elements in the employment of digital technology in the ESOL classroom, and it stands in opposition to the view that technology is a self-regulated and independent phenomenon (Edwards, 2012). As such, the social and cultural dimensions are essential determinants of the outcomes of this employment, and the outcomes cannot be understood in the separation of the social and cultural context of the ESOL teachers and learners, as demonstrated in the case study in this thesis. In the subsequent sections, I present and discuss essential constructionist perspectives and their implications for digital technologies and literacy teaching and learning.

3.2 THE CONSTRUCTIONIST LEARNING THEORY

Education reform and rethinking learning have, in contemporary times, displayed a pattern that "shifts from traditional literacy…into media-based knowledge acquisition" (Papert 1993, p12). Constructionism is Papert's (1980, 1993) re-construction of constructivism. It is "both a theory of learning and a strategy for education" and has a wide-ranging impact on learning theories and methods in education (Resnick and Kafai, 1996, p1). This learning theory provides not only an epistemological and theoretical framework with which to understand the construction of knowledge, but also suggests that the constructionist approaches and learning apparatus are helpful in acquiring meaningful designs using new digital media and art (Resnick, 2007; Kafai and Resnick, 1996; Papert, 1993).

Three key features distinguish constructionism from other learning theories. First, it is aligned with a sociocultural approach to learning, and, therefore, it can be seen as standing in opposition to didactic and instructional education. Although constructionism is based on the constructivist theories of Piaget et al. (1952, 1967), it can be seen as more aligned with sociocultural domains than with the Piagetian cognitive and psychological learning framework. For example, constructionism gives importance to constructing and creating meaningful artefacts in social and cultural contexts (Ackermann, 2004).

Constructionism, therefore, suggests that people learn more effectively when they are actively engaged in creating physical or virtual computational models, such as meaningful artefacts or projects based on their interests. Furthermore, constructionism suggests that knowledge is being constructed actively rather than being passively transmitted and received. This assertion is supported by Papert (1993) and Resnick (2007) who note that constructionism advocates an approach that addresses meaningful creative expression using technology and new digital media in context.

However, in the context of literacy teaching and learning, despite a plethora of literature advocating that literacy be viewed as a social practice (e.g. Street, 1995; Gee, 2001), the sociocultural view of learning is currently more contested than ever before, particularly because of the emergence of new digital technologies that add additional arguments to the already contested domain of literacy. This imposes a limitation on the extent to which constructionism can be employed in practice within literacy education. In the midst of this seeming lack of clarity, this study is an attempt at locating an approach to constructionist literacy practices that embraces the context and social environment of ESOL literacy learners.

Second, constructionism promotes the employment and construction of artefacts and computational objects in teaching and learning, and therefore, it is closely positioned towards the utilisation of computational practices and computational environment. As such, we can argue that the creative computational expressions using new digital media (Resnick and Silverman, 2005) are a cornerstone of the constructionist learning approach. In other words, the use of computers and technological tools as objects “to learn with” (Falbel, 1991, p30) is pivotal in constructionist learning theory.

A brief background to constructionism and the impact of the early LOGO computer programming language can provide an insight into this feature. The construction of virtual and physical computational artefacts in the LOGO system was a central focus of Papert’s constructionist approach to learning. For example, in exploring the potential of physical computational artefacts and their relevance to learning, he drew on mathematical constructs in developing the LOGO computation system (Papert, 1993). The main programmable (or computational) object in the LOGO system is the Turtle, which can be controlled through a set of instructions entered into the computer. Also, Papert (1993) distinguishes between virtual and physical types of Turtles, with the former being abstract and living on the computer’s screen, such as in computer games and animations, and the latter being tangible and physical, like the “floor Turtle” (p11). He explains that the principal role of the Turtle, which exemplifies computational “object-to-think-with”, is to “serve as a model for other objects, yet to be invented” (Papert, 1993, p11). The constructionist model of LOGO and the computational object of the Turtle inspired the innovation of several projects, including the constructionist Scratch tool utilised in this research project.

However, it can be argued that the roles of computational and programmable objects are overemphasised in the constructionist’s view of innovation in education. The constructionists’ approach to innovation and reform in education can sometimes be seen as being more aligned with radical innovations in education than with incremental innovations (Molnar, 1997). For example, Papert (1993) proposes a constructionist framework that is acquired through “the construction of educationally powerful computational environments that will provide alternatives to traditional classrooms and traditional instruction” (p182). This led to some scepticism about the constructionist tools. Also, Papert’s (1987) LOGO was initially criticised for promising more than it delivered regarding the role of computers in education (Edwards, 2012). Therefore, although computational objects can be quite beneficial to learners in, for example, computing classrooms, the adaptation of these constructionist tools and objects can be problematic in other mainstream education subjects such as literacy.

The third feature of constructionism is that it is underpinned by informal learning principles. An examination of the environment in which the constructionist tools, including Scratch, were developed reveals that most of these tools originated within informal learning settings and principles that embraced an open-ended pedagogy. Cunningham and Allen (2010) support this view and note that the constructionist epistemology is seen as one that "favours more open-ended pedagogical approaches…which embrace pluralistic outcomes" (p487). Also, this view constitutes a shift "from general laws of development to individuals' conversation with their own representations, artifacts, or objects-to-think-with" (Ackermann, 2004, pp5-6).

This open-ended pedagogy can be understood from the perspective of Papert's (1993) radical approach to innovation in education in which successful innovation in education privileges "the surrounding culture and the use of dynamic cultural trends as a medium to carry out…educational interventions" (p181). Pursuing the same argument, Resnick (2006) asserts, while comparing computer, television, and paint brush, that:

> "computers will not live up to their potential until we start to think of them less like televisions and more like paint brushes. That is, we need to start seeing computers not simply as information machines, but also as a new medium for creative design and expression" (p192).

Although the constructionist's open-ended pedagogy can be easily adopted within informal learning settings, the utilisation of this pedagogy in mainstream education is an arduous task. The Scratch tool, for example, was developed and tested through working with educators and young people in after-school learning centres. As such, Scratch has remained a constructionist tool that promotes "objects-to-think-with" (Ackermann, 2004, pp5-6) within informal learning environments until it was picked up recently by governments, educators and policy makers as a tool for computing and programming in mainstream education. In effect, Scratch was utilised as a programming and computing tool within an instructional environment that did not necessarily serve the original principles of constructionism. Incorporating constructionist tool kits and principles into mainstream education, therefore, is still a challenge, a challenge that this study, which offers a complementary constructionist approach within mainstream literacy teaching and learning, aims to offer an approach for tackling.

The debate about what constitutes constructionist and instructionist learning is usually played out within the theoretical realms. Nonetheless, learning can, in reality, adopt a mixture of approaches and theories, not just a single one. We may, therefore, draw the conclusion that there is no such thing as a native constructionist, constructivist or instructionist tutor, but rather learning activities that are underpinned by different learning theories and approaches.

In order to show the relevance of these constructionist features and developments to literacy teaching and learning, it is beneficial to locate the ways in which they are used in the context of constructionist learning approach as well as other learning theories. This in effect will inform the introduction of Scratch into the ESOL classroom, and examine the impact this tool may have on the achievement of the targeted ESOL students and their classroom interaction (Cazden, 1988), discourses (Gee, 2001) and social interaction within classroom language learning (Hellermann, 2008).

In the subsequent sections, I discuss theoretical concepts related to constructionism, and I reflect on the cognitive development theory of Constructivism (Piaget, 1952, 1967) as well as on Vygotsky's Zone of Proximal Development (ZPD) (Cole et al., 1980).

3.3 Reflections on Constructionism and Relevant Learning Theories

In relation to constructionism, this section discusses aspects of Piaget's (1967) constructivist theory of cognition and of Vygotsky's learning theories including the Zone of Proximal Development (ZPD), and it highlights Bandura's (1977) social learning theory.

Several learning theories adapt to the view of the construction of knowledge. These include: constructivism (Piaget, 1967), Vygotsky's (Cole et al., 1980) learning concepts and notions, constructionism (Papert, 1980) and social learning theory (Bandura, 1977). Both Piaget and Vygotsky see knowledge as "a construct" (Wadsworth, 1996, p10), and they both "identified a clear role for social exchange in intellectual development" (Smith et al., 1997, p12). However, according to Wadsworth (1996), they hold different views about the process of construction and its effects on the intellectual development of learners.

For Vygotsky (Cole et al., 1980), the social environment plays a major role in intellectual development. He distinguishes between the "social process" in learning and "programmed and frequently mechanized instruction" (p131). He conceptualises learning as "a profoundly social process", and "emphasizes dialogue and the varied roles that language plays in instruction and mediated cognitive growth" (p131). Piaget, on the other hand, recognises the role of social context and interactions in intellectual development and, therefore, in intelligence. However, Piaget views the social context and interactions as "a source of cognitive conflict, thus disequilibration, and thus development" (Wadsworth, 1996, p11). These views about social context have different implications for what constitutes learning and the process of intellectual development. For Piaget, biological development is "the driving force" of intellectual development and therefore of learning, whereas for Vygotsky learning stimulates the internal and intellectual development through interaction and cooperation within a social environment (Cole et al., 1980).

In this context, there are two relevant views to be drawn from the work of Piaget and Vygotsky regarding learning and intellectual development. The first shows the contradictory positions of the two theories (Kozulin, 2003). Unlike Piaget's constructivism, Vygotsky's learning theory embraces an essential role for social context in learning, as suggested in his three learning models: (1) a multiculturalist learning model that embraces literacies and cultural diversity within "multicultural classrooms" (Kozulin, 2003, p15), something that is currently palpable more than ever before, particularly among new literacy studies; (2) a mediation learning model, human and symbolic, which, unlike traditional approaches, portrays the child as an active participant and is also unlike the "Piagetian [views] and the proponents of discovery learning [who] expected children to be independent agents of acquisition" (Kozulin, 2003, p16); and (3) the Zone of Proximal Development (ZPD), which conceptualises spaces that are supportive of the maximising of learning potential and other implications for assessment and intelligence (Kozulin, 2003).

Also, in line with cognitive and psychological learning arguments, and according to Kozulin (2003), Piaget attaches little importance to sociocultural factors in the construction of internal mental processes. This constitutes a major criticism of Piaget's theory of cognitive development, which stands in contradistinction to Vygotsky's learning theory. However, in my view, the growth and expansion of sociocultural domains validate the importance of the social and cultural realms in cognitive development and learning. This is supported by the plethora of literature developed in the last few decades (e.g. Street, 1995; Bandura, 1977; Gee, 2012; Castells, 2010; Cazden et al., 1996).

The second view shows that "there is some significant overlap between Vygotsky's and Piaget's ideas" because the perception of knowledge development as inside/out versus outside/in does not reflect the essence of these learning theories (Tryphon and Voneche, 1996, p8). This view suggests that the two theories represent a "necessary marriage for effective educational interventions" (Shayer, 1997, p36). Piaget (1967) gives significant importance to individual cognitive learning through the internalisation of self-experiences and sets out four stages of cognitive development that constitute the fundamental part of constructivist learning theories. The four stages are, in order: (1) sensorimotor, (2) preoperational, (3) concrete operational and (4) formal operational. The key idea is that knowledge and cognition are developed in each of these stages, thereby reflecting the sequential process of mental and biological development from infancy to maturity. Piaget describes internal mental processes, which he calls "schemas", as a way to architect mental and internal thinking processes.

In this regard, I support the notion that the two theories are complementary and should be viewed in a balanced way. I argue that this can be beneficial in establishing a comprehensive understanding of learning and development. It is feasible, therefore, to see an alignment between constructionism and this balanced view even though constructionism has its origin in the constructivist epistemology. The rationale for that perceived alignment is discussed in the following paragraphs.

Constructionism embraces the construction of knowledge amidst social and surrounding environments, as demonstrated in (1) experimenting with a computational "object[s]-to-think-with" (Papert, 1993, p11), which includes tangible objects such as a tangible Turtle, or abstract ones such as computational experimentations that use new digital media and art, and (2) the importance of an emerging computational culture (Brennan and Resnick, 2012; Papert, 1993, 1980) that constitutes fertile soil for constructionism to grow and flourish in. Therefore, for Papert, the inside/out view of knowledge construction is tangible, experiential, personalised, dynamic and social (Ackermann, 2004). Consequently, the role of technology and, therefore, computational practices, within social contexts, can be seen as a catalyst for learning because "[l]earning and technology are viewed as part of a rich fabric of relationships between people, technology, institutions, tools and practices of all kinds" (Sutherland et al., 2009, p49).

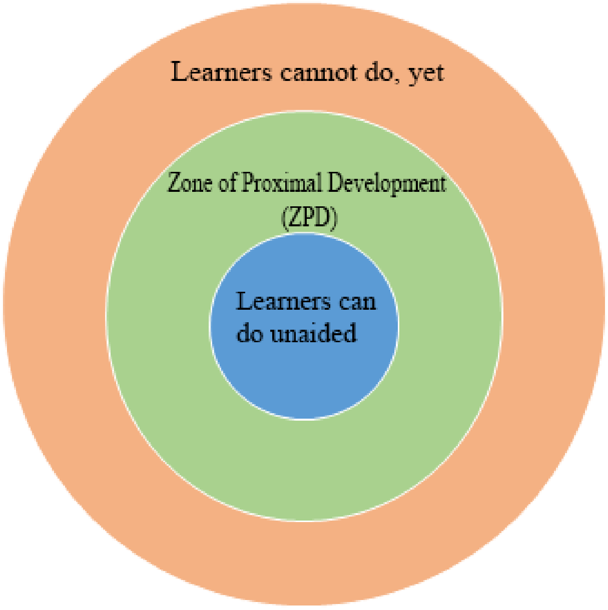
This distinction is also manifested in the relationship between Piaget's theory and constructionism. While Piaget (1967) distinguishes between the four stages of cognitive development, including "concrete thinking" and "formal thinking", constructionism argues that, through computational culture, computational thinking can "concretize" and "personalize" formal thinking and, therefore, "[k]nowledge that was accessible only through formal processes can now be approached concretely" (Papert, 1993, p21). In other words, computational culture provides an agency for shifting the boundaries between formal (or conceptual) and concrete thinking. This illustrates how concrete thinking can be manifested socially in a number of ways. Constructionism, therefore, is aligned with pragmatic views, and is more situated than Piaget's constructivism (Ackermann, 2004).

Issues of diversity and multiculturalism are another important aspect of Vygotsky's learning theory (Kozulin, 2003); something that is currently more evident than ever before. Vygotsky's learning theory has implications for literacy and learning, including new literacy studies (Gee, 2000). This echoes the position of constructionism, which emphasises the social environment and cultural context in learning (Ackermann, 2004). In this sense, it is logical to think that constructionism may have more in common with the development and learning theory of Vygotsky than with that of Piagetian and discovery learning theories. This may sound like a contradiction, because Papert's (1993) constructionism was built upon constructivism and originally inspired by the work of Piaget (1967). However, one possible explanation for this is that both Papert and Vygotsky see learning as primarily situated in external contexts rather than being more independent and internalised. As for Vygotsky (Cole et al., 1980), the external context is conceptualised around a sociocultural context characterised by mediation and elements of ZPD, which includes assessing and maximising learning potential. Similarly, the focus in constructionism on externalisation can be conceptualised around computational culture and models, including artefacts and "object[s]-to-think-with" (Papert, 1993, p11). These models, artefacts and objects uphold recognition of the sociocultural contexts.

Vygotsky's notion of the Zone of Proximal Development (ZPD) provides insights that help to expand the understanding of cognitive development and literacies practices within computational frameworks. Vygotsky (Cole et al., 1980) defines the ZPD as:

> "It is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p86).

Figure 3.1: an illustration of the Zone of Proximal Development. The figure is based on an illustration of ZPD available at http://www.innovativelearning.com/



In other words, this potential development area represents an area that has the potential to be extended and expanded with the help of other learners or tutors. ZPD provides a conceptualisation of the process of learning taking place in three different zones. The first zone represents what learners can do unaided; the second represents the zone where the learning process takes place with assistance, or what learners can do with guidance and assistance; while the third represents what learners cannot do, yet. Therefore, the middle zone represents the area in which learning takes place and for which the term ZPD is used, as shown in Figure 3.1. In particular, Vygotsky (Cole et al., 1980) proposes that:

> "an essential feature of learning is that it creates a zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers" (p90).

The social context in learning is stressed in social cognitive theory, which suggests "learning through modelling" (Bandura, 1977, p22) as an alternative to the enforcements learning model. Social cognitive learning theory synthesises behavioural and cognitive dimensions in the learning processes. Therefore, it perceives learners as active participants, not as passive recipients of information, and shows that the learning process requires attention, remembering and motivation.

Constructionism, on the other hand, provides additional perspectives to the process of learning through modelling (Bandura, 1977). As constructionism recognises the importance of computational artefacts in learning, these artefacts and their computational and social environments support the observation and remembering of the observation. In other words, constructionist computational interventions have the potential to model the observations digitally and allow different modes of social interaction with these artefacts.

In this framework, the sociocultural context constitutes one important element of constructionism. An illustration of this is the constructionist creativity spiral (Resnick, 2007), which shows the important social role of creative learning. Resnick (2007) proposes new frameworks of creative learning and suggests that "knowledge alone is not enough" and that success is based on how "creatively" learners can think and utilise their knowledge in the "creative society" (p1). In addition, constructionism suggests that learning is more effective when it involves the creation of meaningful artefacts that are related to the interests of learners (Resnick, 2007). Therefore, I suggest that computational culture induces shifts that maximise the ZPD and learning potential, as learners are able to acquire information and knowledge via continually growing online and digital mediums.

The role of collaboration and social context is fundamental in constructivist learning theories including constructionism. However, drawing on the work of Resnick (2014, 2007), there are three features that distinguish constructionism from other learning theories: (1) the focus on the personal/individual and social elements of the learning process; (2) the attention to the computational environments, objects and practices (Brennan and Resnick, 2012); and (3) the constructionist view of creativity, which suggests a framework for creativity in the context of post-information and post-knowledge Societies (Resnick, 2007).

Therefore, the Scratch tool can be seen as a relevant environment for stimulating the achievement of multiliteracies among young adult ESOL learners, particularly because this offers an approach that utilises constructionist and sociocultural practices within mainstream literacy teaching and learning. This in effect underpinned the research question in this study that seeks to evaluate the impact of constructionist and computational interventions on ESOL learners.

3.4 NEW LITERACY STUDIES

There is an ongoing debate about what constitutes literacy in contemporary societies, as literacy is increasingly becoming a crucial topic in educational policies and practices (Lankshear and Knobel, 2006) and definitions of the qualities required to be literate are always shifting (Crowther et al., 2001). Literacy research is currently "in a state of flux" (Merchant et al., 2013, p1), and it cuts across various disciplines and maintains multiple evolving parameters as profound changes and shifts continue to occur in different societal, cultural and technological domains.

In the last few decades, literacy research has been dominated by the sociocultural perception that was arguably initiated by Street's classification of the autonomous and ideological perceptions of literacy (Street, 1984, 1993 and 1995). The sociocultural view of literacy has demonstrated new ways of conceptualising literacy as social and contextual practices and discourses (Street, 1995; Gee, 2001). Literacy, therefore, is seen as a social practice that "is always embedded in socially constructed epistemological principles" and is not simply a technical skill (Street, 2003, p77). Gee (2012) notes that this paradigm "arose in the 1980s and 1990s to replace the traditional notion of literacy with a sociocultural approach" (p63). Since then, an increasingly vast range of knowledge, learning and educational practices are recognised as literacy practices (Lankshear and Knobel, 2006).

The sociocultural view of literacy is usually seen as critical, progressive or transformative and it recognises multiple literacies in the context of social and cultural practices (Gee, 1990; Street, 1995), with notions of multimodalities amidst contemporary globalised societies (Cazden et al., 1996). These sociocultural views of literacy can be contrasted with the autonomous model (Street, 1995) or the conventional approach to literacy, which is usually static and state-led, and focused on the basic skills of reading, writing and arithmetic (Lankshear and Knobel, 2006). Generally, the theoretical directions in sociocultural research call for shifts beyond "word" literacy and basic numeracy skills into contextualised and multifaceted literacy definitions and environments, including literacy as social practice (Street, 1985; Gee, 1990), new literacy studies (Gee 1990; Street, 1995), social practice and Discourse (Gee, 2001), pedagogy of multiliteracies (Cazden et al., 1996), literacy for specific purposes (Ade-Ojo, 2015), social patterns (Claxton, 2008), social turn (Gee, 2000), new literacies (Knobel and Lankshear, 2006), information age (Castells, 2010) and "digital turn" (Mills, 2010).

These emerging views and traditions embrace literacy as a social practice (Street, 1985), unlike dominant approaches to literacy that prioritise an understanding of literacy as a set of skills to be acquired (Street, 2003). Therefore, these contextualised views embody an understanding of literacy in its plural form, which is based on culture, language and ideology (Cope and Kalantzis, 2009; Street, 2003). In this context, this section anchors the review of the literature to two fundamental theories in the sociocultural domain of literacy: the new literacy studies (Street, 1995, Gee, 1990) and the pedagogy of multiliteracies (Cazden et al., 1996). While the former aims to provide a necessary conceptualisation of and theoretical background to literacy, the latter provides an approach to literacy practices.

The review of new literacy studies shows a consensus that social context and practices are multiple and that there are many literacies that can be acquired within these contexts. For example, literacy experience, practices and meaning-making, are always contextual and cannot be understood or assembled without their wider social context (Lankshear and Knobel, 2006). Gee (2001) asserts that "the focus of literacy studies or applied linguistics should not be language, or literacy, but social practices" (p525). This sociocultural perspective demonstrates that literacy is embedded within social contexts. Furthermore, Gee (2001) argues that literacy practices, including reading and writing, are embedded in social practices and discourses. Therefore, he notes that de-contextualised reading and writing skills do not reflect discourses, and that "you cannot teach anyone to write or read outside any Discourse…unless it is called 'moving a pen'" (p530).

In this context, although the views that are promoted by new literacy can be beneficial to literacy learners, they are not without their own limitations, as manifested in their boundary definition, implementation and assessment, as well as in their progress measurement. A precise definition of social practices that are multiple and contextualised can be problematic and a unified understanding can be hard to achieve. Also, these multiple and contextualised social practices can, in effect, compromise the accurate assessment and progress measurement of literacy education in which the overall new multimodal literacy model becomes infeasible. This is because an understanding of the sociocultural view of literacy can arguably vary across individuals, communities, institutions and countries. As such, unified policy and secure funding become a challenge.

These limitations and problems can be overcome. For example, the concept of English for Specific Purposes (Hutchinson and Waters, 1987) offers a learners-centred model that focuses on the learners' purpose in learning English. Also, Ade-Ojo (2015) offers the concept of "literacy for specific purposes" as a literacy curriculum that is fashioned to meet the learners' needs (p15). In line with the arguments of the two studies above, this study aims to overcome these limitations within ESOL literacy programmes by drawing on the existing ESOL curriculum in the design of complementary constructionist learning activities that are implemented using Scratch, as discussed in Chapter 4, entitled "Research Methodology".

One significant development in the sociocultural view of literacy in the 1990s, and therefore in the views of new literacy studies, is the pedagogy of multiliteracies, that is, "a new approach to literacy pedagogy", coined by the New London Group (Cazden et al., 1996, p60). The pedagogy of multiliteracies represents an international project that aims to "develop an educational[ly] accessible functional grammar" using a metalanguage that promotes meaning-making in various realms, including textual, visual and multimodal patterns of representation and meaning-making (Cope and Kalantzis, 2000, p24). Therefore, it is in this context that the pedagogy of multiliteracies proposes "a metalanguage of multiliteracies" based on the concept of "design" (Cazden et al., 1996, p73).

The pedagogy of multiliteracies proposes three elements of design (or semiotic activities): "Available Design", "Designing" and "The Redesigned" (Cope and Kalantzis, 2000, p20). These elements reiterate the fact, which is central to the sociocultural view of literacy, that "meaning-making, and therefore, learning, is an active process, and not something governed by static rules" (Cope and Kalantzis, 2000, p20). This perspective, significantly, converges with the constructionist learning approach, which also sees learning as an active process and underscores the argument that the two theoretical positions can work together. Similar to the new literacy studies, the pedagogy of multiliteracies offers an understanding of literacy as something social, situated and contextual. It suggests that the process of development of knowledge "is embedded in sociocultural and material contexts" (Cazden et al., 1996, p82).

A significant contribution of the pedagogy of multiliteracies is its view of literacies as multimodal, with contextualised, spatial and diverse modes of representation and meaning-making (Cazden et al., 1996; Cope and Kalantzis, 2009; Kress, 2000). While this important ideological movement in literacy research originally aimed to represent "programmatic" and conceptual frameworks (Cope and Kalantzis, 2009) of multiliteracies, the work of the New London Group in the last two decades has developed in parallel with the growth and expansion of communication and information technologies and networked societies (Castells, 2010). These developments, unsurprisingly, were sparked at a time in the early 1990s when the number of Internet users and its usage started to expand exponentially (Huberman and Adamic, 1999).

In this context, the pedagogy of multiliteracies emphasises development through meaning-making and representation within increasingly multilingual and multimodal societies. As a result, digitised and networked societies progressively blurred the boundaries of traditional societies, as the more societies are networked and globalised, the more multilingual diversity is developed (Cazden et al., 1996). Hence, English is becoming "Englishes" – in a globalised sense of diversity (Cope and Kalantzis, 2009) or, as Gee (2012) coined it, English, along with other major languages, has evolved into a "social language" (p90). It is from these valuable contributions that an outline of the pedagogy of multiliteracies appears to have emerged.

In line with the established views of new literacy studies (Gee, 1990; Street, 1995; Hamilton and Barton, 2000) and literacy as social practice (Street, 1985), the pedagogy of multiliteracies proposes that "curriculum is a design for social futures" and suggests that this approach supplements the traditional phonetic, textual and alphabetical approach to literacy (Cazden et al., 1996, p73). Therefore, meaning-making is outlined within the pedagogy of multiliteracies as an active process of "Design" within a social context and framework (Cope and Kalantzis, 2009). In particular, this approach describes modes of meaning-making as multimodal and multilinguistic modes that are "becoming increasingly integrated into everyday media and cultural practices" (Cope and Kalantzis, 2009, p. 166).

Furthermore, based on Cope and Kalantzis (2000, pp33-6), the pedagogy of multiliteracies provides an approach to literacy practices and suggests a complex integration of four dimensions: (a) "situated practices", which emphasise the notion that human knowledge is situated in highly contextualised sociocultural settings, in which the role of a community of learners is significant (p31); (b) "overt instruction", which focuses on scaffolding learning activities, rather than on having a passive transmission of information from teacher to students, in which students construct their own metalanguage of design (p33); (c) "critical framing" of meaning based on learners' purposes, social context and practices (p34); and (d) "transformed practices", which involve transferring the practice of meaning-making (the redesigned) into other contexts (p35). This shows that the pedagogy of multiliteracies is in line with the views of new literacy studies that criticise the traditional approaches to literacy as a de-contextualised set of skills transmitted instructionally and passively.

In order to minimise the limitations of the traditional model of literacy, which is characterised by over-instruction and progressivism, the pedagogy of multiliteracies proposes the utilisation of modes of meaning-making and representation, including situated practices, critical framing and transformed practices in the traditional model of literacy (Cope and Kalantzis, 2009). Following the same line of reasoning, Gee (2001) shows scepticism about learning languages only through "overt instruction" and suggests "enculturation" within social practices and discourse (p527).

This also indicates a convergence between notions of the pedagogy of multiliteracies and constructionist learning theory (Papert, 1980). This convergence can be captured on several levels, including focusing on design-based activities, following learners' own interests, and sharing and reflecting on the learning process and the developed artefacts within a community of learners. It is within this framework that constructionism embraces learning activities as a reflective dynamic process, rather than as a static passive transmission of information (Resnick, 2007).

On the basis of this, practices and meaning-making constitute the essence of the sociocultural approach to literacy. For instance, Knobel and Lankshear (2007) argue that "[t]here is no practice without meaning, just as there is no meaning outside of practice" (p2), as the literacy practices are situated within a social context, rather than being a product of it. Similarly, Street (2003) asserts that literacy practices are "particular ways of thinking about and doing reading and writing in cultural contexts" (p79). In other words, "children do not learn language incidentally, separate from the practicalities of life" (Mercer, 2000, p11). Therefore, being literate involves much more than linguistic skills and modes (Lankshear and Knobel, 2006, p17).

The pedagogy of multiliteracies also comes with weaknesses. First, the reality is that while these notions of literacy are usually incorporated into research discourses, they are scarcely manifested in practice and in policy discourses. As such, "very little has been offered towards reversing the dominance of the so-called cognitive model in policy making and practice" (Ade-Ojo, 2015, p1). Literacy is, therefore, "loaded with ideological and policy presuppositions" (Street, 2003, p78). Perhaps one good illustration of this reality is captured by the notion of learning within "affinity spaces" (Gee, 2004), which is unlike learning within mainstream education or traditional schooling that are dominated by human resources development discourses "with managerial, technicist and corporate notions" (Hamilton and Barton, 2000, p31).

Similarly, although there has been a plethora of literature and research on new literacy in the past few decades (e.g. Street 1985; 1995; Gee, 1990), the approaches offered in these studies have essentially remained in the theoretical realm (Ollofsson and Lindberg, 2014). Consequently, we argue that researching ESOL literacy development in practice can contribute to bridging the gap between the ongoing theoretical debate and the practitioner experience in the field, particularly in relation to the role of digital technology in learning and literacy development.

The second possible weakness of the pedagogy of multiliteracies is that it arguably uses the terminologies of new digital technologies to perpetuate the old ongoing debate between the autonomous and ideological models and perceptions of literacy (Street, 1984, 1993 and 1995). This criticism can be viewed in light of the "old wine in new bottles" paradigm (Lankshear and Knobel, 2006, p54), in which research is labelled with digital terminologies and presented as a new domain, when the fact is that there is nothing significantly new as a result of the digitisation of certain learning practices.

This study, therefore, takes into consideration limitations of new literacy studies and the pedagogy of multiliteracies that is underpinned by the eruption of digital technologies over the past few decades. Also, it offers a view of new literacy in practice, employing new and arguably significant socially-constructed computational practices using the Scratch constructionist tool.

3.4.1 WHAT IS NEW IN NEW LITERACIES?

If literacies are always socially situated, as described above, what is new about having "new" literacies? If technology in general and the fast-growing and expanding Information and Communication Technologies (ICT) are just more tools within the sociocultural paradigm, what makes these tools significant enough to play a central role in shaping learning these days, and in sparking new domains of literacies? I address these questions from three perspectives.

First, according to Lankshear and Knobel (2006), what may count as "new" in new literacies is not the "contingency" of certain literacy practices, but an "approach to thinking about literacy as a social phenomenon" (p24). In other words, it is important to distinguish between types of literacies and literacy practices. In essence, labelling each new literacy practice as a "new" literacy may not be useful, as it means that there will be an infinite list of "new" literacies. For example, a quick Internet search for the keyword "literacy" shows that "literacy" is being conflated with literacy practices and is being used to describe a broad range of learning practices. Also, Lankshear and Knobel (2006) note that "new" literacies are conceptually drawn from an "emerging and evolving mindset…of an unfolding 'literacy dialectic'" (p29) in which literacies can be conceived as "new ontologically" (p25).

In this regard, one important theme about what is entitled to be labelled "new" in literacies is currently associated with the new digital and social media such as "Web 2.0" technologies (O'Reilly, 2007) that prioritise attributes such as participation and collaboration over centralisation and control (Lankshear and Knobel, 2006; Kress, 2005). It is in this context that the present study is relevant, and the exploration into Scratch is seen as "new" in the context of literacy and language development, because it is based on collaborative and socially constructed pedagogy, not on a prescribed model in which the tutor delivers de-contextualised content.

Nevertheless, it is difficult to establish a clear-cut distinction between contingent literacy practices and ontologically new literacies. The state of contingency can be essential in the literacy definition itself, as it evolves around the social and technological developments. For example, consider computer literacy and information literacy (e.g. Horton, 1983), which were more present, and perhaps more relevant, in the literature of the 1980s and 1990s than in the literacy debate of recent years. In the same sense, Internet literacy (Eagleton et al., 2003) evolved during the 1990s and beyond, alongside the eruption of multimodal and computing notions of literacy.

Second, multimodal representation and communication (Jewitt, 2013; Kress, 2000; 2005) provide a necessary understanding of new forms of text and knowledge. Lankshear and Knobel (2006) label texts within multimodality as "post-typographic" (p25), which has implications for literacy and learning (Davies and Merchant, 2007; Stone, 2007; Kress, 2005). Based on this multimodal approach, Kress (2005) argues that modes of representation and communication are always multimodal and culturally situated. He notes that these modes are continuously realigned "in culturally valued modes" (p5). He also proposes that new modes of representation and communication, such as images or visual modes, are coalescing along linguistic modes (speech and writing, as in the "book" medium) that represent the dominant and "culturally most valued forms of representation" (p5).

In addition, in line with the pedagogy of multiliteracies approach, Kress (2005) notes that representations have to be seen in "the wider framework of economic, political, social, cultural and technological changes" (p6). He discusses emerging modes in the landscape of multimodal representation and communication, using a historical review based on a social semiotic approach. Drawing on this discussion, he concludes that emerging semiotic changes entail a revolution in the modes of representation on two levels: the significant increase in the incorporation of "image", which increasingly shifts the "centrality of writing" (p6); and the changes in media dissemination, which are characterised by a medium shift "from the centrality of the medium of the book to the medium of the screen" (p6). Within this framework, he distinguishes between the term "mode", as "the culturally and socially produced resources for presentation" (p6), and the term "medium", as the "culturally produced means for distribution of these representations-as-meanings" (pp6-7). This study, therefore, is drawing on the twin concepts of "mode" and "medium" to create an element of novelty that employs constructionist perspectives in sociocultural literacy and language development.

Third, the role of technology, signified in ICT and computational tools and artefacts, constitutes integrated elements of human cognitive architecture and practices (cultural and societal practice). As such, we cannot be understood in separation from the mental and physical tools we use (Wells and Claxton, 2002). These "meaning-making tools" include physical, technological and psychological tools crucial for mediating the communicative and reflective process of human actions and practices (Wells and Claxton, 2002, p4). Accordingly, these tools and artefacts are an integral part of social practice and meaning-making and without them no practices are made and no meaning-making is accomplished (Wells and Claxton, 2002).

In this context, digital technologies are relatively new inventions and innovations. They are relevant to literacy and the daily life of meaning-making because their contemporary digitalised communications are different from previous innovations in the sense that they produce a cultural medium capable of being integrated into and interchanged within the sociocultural atmosphere, social groups and individuals.

Furthermore, cultural historical activity theory (CHAT) (Wells and Claxton, 2002) provides an understanding of the demands of the modes of representation and meaning-making within emerging networked and creative societies. Based on Wells and Claxton (2002), this theory of human development perceives “human societies and their individual members as mutually constitutive” (p3). Therefore, CHAT suggests that it may not be possible to understand human cultural practices in the abstraction from the tools used or artefacts produced.

From a related perspective, Kozulin (2003) analyses Vygotsky’s conceptual apparatus of using “psychological tools” in cognitive development and learning. He notes that the “formation of different literacies is intimately related to the appropriation of different psychological tools” (p16). This notion of tools can be relevant to the concept of mediation, particularly when considering Scratch as a tool for mediating learning activities through digital artefacts. Therefore, this study utilises aspects of the Scratch programming environment as the primary tool for mediating the learning practices necessary for meaning-making and for constructing meaningful artefacts within the Scratch online community. Also, given this essential role of artefacts in human social practices and, therefore, in literacy development, this research discusses perspectives on the Scratch digital artefacts developed and remixed by ESOL learners using Scratch. These digital artefacts, I argue, have the potential to provide fresh perspectives into multimodal literacies in the targeted ESOL programme.

3.5 Technology-Enhanced Teaching and Learning

Digital technology in education is an emerging discipline of research, and it is characterised by continuous change (Bates, 2000). There is a growing body of literature that investigates the relationship between digital technology and education. This investigation requires multidisciplinary perspectives, including those of history, philosophy, psychology and sociology, all to play a role in developing understandings of this relationship, especially because “what has emerged is that notions of technology have changed over time and that technology is a particularly difficult concept to grapple with” (Edwards, 2012, p13).

In this context, there are often two main standpoints regarding the impact of digital technology on education. The first standpoint displays a conviction that digital technology is useful for all learning practices in the 21st century. This view has been adopted by policy makers and technological determinists as interest in using digital technology in education has been increasing significantly, as depicted in the amount of investment in it by governments and institutions worldwide (Kennewell, 2003).

The second standpoint displays a level of ambiguity about the distinct role of new digital technology in teaching and learning, as well as uncertainty about the effectiveness of these emerging digital technologies on learners. (e.g. Locke and Andrew, 2004; Torgerson and Zhu, 2003). Many studies and reviews suggest that there is little evidence of the effectiveness of digital technology in schools and post-compulsory institutions (e.g. IEA studies 1993 and 2014).

According to a study conducted in about two dozen developed countries by the International Association for the Evaluation of Educational Achievement (IEA) between 1987 and 1993 (Plomp et al., 1996), the fast pace at which computers were being introduced into schools was accompanied by uncertainty and the expectations that were largely not reached (Plomp et al., 1996). Furthermore, a recent study for the IEA (Fraillon et al., 2014) indicates that although many governments have made substantial investments in equipping schools with ICT resources, little evidence is provided regarding the effectiveness of these in improving teaching and learning.

Kennewell (2003) comes to a similar conclusion and argues that despite a few decades of investment and interest in using ICTs in an educational context, there are no clear gains from providing more technology for schools and colleges. He notes that the increase in funds for the expansion of digital technologies in education is driven by “a political conviction that ICT is beneficial for all aspect of life in the 21st century” (Kennewell, 2003, p247).

In my view, although both of these standpoints are logical and viable, they present a critical problem that we must not ignore. The determinist view, such as that of policy makers, promotes a positive role of digital technology without raising enough concern about the affordance of new technologies. This problem draws attention to how new technologies can be incorporated into existing classrooms and meet the learners’ needs as well as the tutors’ capacity to adopt new technologies. Furthermore, the sceptical view of a distinct positive role for digital technologies seems to overlook the diversity of learning environments driven by multiple social practices in which a distinct role for digital technology is not feasible in practice. While this line of argument will be further developed in the following sections on digital literacy and multimodality, I argue that, a balanced view is needed that recognises elements of each of these standpoints, discussed earlier in this section, and which provides a new perspective.

Also, I argue that some major digital and technological innovations and trends, which have been occurring rapidly over the past few decades, can radically influence educational practices. Indeed, some of these innovations have radically changed our perceptions about the use of technology in education and throughout our everyday life. These innovations include the uptake of personal computers, the eruption of the Internet and the World Wide Web (WWW), web 2.0 technologies and social media platforms and, most recently, the emerging computing and computational technologies. Yet these technologies add more questions than answers to the very nature of the relationship between digital technology and education. For example, in which ways can the emerging computational trend and culture shape education and how is this different from previously identified innovations such as web 2.0 and WWW technologies? In an attempt at addressing some of these questions, this study aims at exploring the role of digital media and technology in literacy and language development using computational interventions. It could arguably contribute to providing answers about the role of digital media and technology in literacy teaching and learning using forms of emerging computational practices. As such, a key point here is the conceptualisation of the landscape of technological innovations, more as a dynamic computational environment that is shaped through various sociocultural elements, and less as a fixed prescribed set of digital skills.

In this regard, there is now a diffusion of digital technology and innovations (Timucin, 2009) and the role of digital technology in education is a central issue for educators and policy makers (Luppicini, 2005, Edwards, 2012), and it constitutes a necessary dimension in educational reform in developed countries (Tinio, 2003). However, the more innovations in digital technologies that can be employed in educational contexts, the more the debate is extended concerning the effectiveness of these digital technologies in teaching and learning.

Therefore, there is a need for a new approach to understanding the incorporation of new digital technologies into classrooms. This new approach can contribute to the development of a framework through which digital and computational technologies can be conceptualised and utilised in the classroom. In support for this view, Roth (2009), for example, suggests that traditional approaches to learning and teaching are “quickly losing their ability to challenge, motivate, and engage students in ways that are compatible with their digital lives in a techno-centric society" (p125).

On the other hand, the introduction of new technology into the classroom is not a straightforward process; it involves various social, cultural and political elements (Edwards, 2012). For example, according to Merchant (2009), innovative digital literacy practices including virtual world game play, can easily alter and disrupt daily classroom routines. He suggests, therefore, that a holistic approach that questions the tutor-pupil relationship in a classroom is a necessity in incorporating such practices.

In conclusion, these views suggest that new approaches to investigating new digital technology in education and literacy development should be sought. As such, this provides a rationale for investigating the impact of digital computational technologies on literacy teaching and English language development. In this regard, this study is designed to extend the understanding of the use of emerging forms of digital computational practices in teaching and learning within ESOL literacy programmes. Therefore, this study is in line with the social constructivist learning approach, which underpins the constructivist and constructionist learning theories, in order to provide a fresh approach to emerging computational practices as a medium that transcends the traditional understanding of ICT and the technical concepts of computing inside and outside the classroom.

3.6 Multimodalities and Encoded Texts

Multimodality can be seen as an overarching principle of literacy studies because multimodal representation and meaning making can be manifested in digital and non-digital forms. The literature on multimodality can be classified into three themes that discuss the process, the outcomes and the role of artefacts as described in the subsequent sections.

The first theme presents and discusses multimodal digital literacy as a process. For example, Britsch (2009) draws on the new literacy studies framework of multimodality and the representation of encoded text and "visual thinking", and examines the primary role of visual literacy and thinking in language learning and in the professional development of ESOL courses (p716). She found that "visual imagery with oral language resulted in products that were semiotically richer than the written word alone" (p712) and suggests that the "aim is not simply to merge visual learning with the verbal curriculum but to reify a multimodal view of identity and its role in learning" (p718). In addition, she investigates aspects of visual thinking in the development of an ESOL professional course project for educators by setting up a graduate course for learners from several cultural backgrounds. She provides insights into engagement via "means of exploring communication through modes other than language… and [through] notions of narratives from a multimodal point of view" (p714).

She concludes that: (1) the fact that visual thinking, learning and expression "created communicative comfort zones that gave course participants a 'sense of freedom', in their words, not typically experienced in university courses" (p716) and, therefore, personal and community visual narratives for creative and communicative expression were helpful in language learning; (2) "ESOL teacher education needs to include the development of visual literacy" (p718), because visual language is a catalyst for both expression and understanding and, therefore, helpful in maximising meaning-representation through visual and verbally rich experiences; (3) inspired by Jewitt (2008), that the curriculum for English language learning needs "classroom discourses that blend semiotics, digital and non-digital image creation, multimodal communication, and visual literacy to shape the curriculum and to mediate classroom language learning"; and (4) visual thinking is "central to the language and content learning of English language learners" (p719). Therefore, visual literacy and visual thinking frameworks are catalysts for the learning of a second language, especially when elements of storytelling are employed in the learning practices (e.g. Ohler, 2007; Parkinson, 2011). Consequently, there is a need for the development of the "technological tools" necessary to support and facilitate visual literacy learning approaches (Britsch, 2009, pp718-19).

Clearly, these examples illustrate the process of incorporating multimodal practices into a learning and teaching environment. In my view, however, missing from this process are the learner perspectives and preferences. As such, an important question at this point is: what happens if the learners have different ways of learning? Will the process remain the same? Also, will the prescribed process work in the same way? This constitutes a gap that has not being addressed. Therefore, it is important to include the learners' perspective in this research.

The second theme highlights the role of artefacts in multimodal digital practices. For example, in a study that examines aspects of collaboration in creative learning and writing through the use of “diverse cultural artefacts” in producing multimedia texts and stories, Rojas-Drummond et al. (2008) employ sociocultural perspectives in describing oral literacy through digital media and writing. The authors utilise a micro-genetic methodology to examine the interaction between children (aged 9-10) mediated through digital and cultural artefacts. They conclude that the learners appropriated the social construction of knowledge approach using mediated artefacts through collaboration, co-production and construction of stories using digital artefacts. They highlight roles of “construction”, “intertextuality” and “intercontextuality” by using ICT to initiate creative “development of dialogical and text production strategies and appropriation of diverse cultural artefacts for knowledge construction” (p1).

The third theme focuses on the outcomes of multimodal and digital practices. For example, Ajayi (2009) locates his multimodal perspective on the pedagogy of multiliteracies for school students in California, where there are more than 1.5 million for whom English is not the first spoken language. Drawing from the new literacy studies framework, he builds upon Dyson’s (2003) notion that distinguishes between the theories of multimodalities and practical pedagogy in classroom settings, and Jewitt’s (2005) assertion that school curricula offer “a linguistic view of literacy and a linear view of reading” (Jewitt, 2005, p330, cited in Ajayi, 2009, p586). In this context, and through the use of advertising images on a cell phone, Ajayi (2009) demonstrates that using multimodal activities and resources has “the potential to enhance language and literacy learning” (p594). He concludes that (1) students’ situated meaning of the advertisement text and image reveals new meanings reflected in contexts and sociocultural-specific views and experiences; (2) multimodal resources have the potential to transform and enhance second language acquisition and literacy learning; (3) multimodality and multiliteracies provide ESL students with spaces to “enter into text composition from different paths”; and (4) multimodality and multiliteracies provide ESL students with “opportunities to create new identities and challenge discursive practices that marginalize them” (p594).

A second example is by Kajee (2011) who explores students’ multimodal representation in an English as an additional language class in Johannesburg, South Africa. She concludes that multimodality enables greater meaning-making among learners whose first language is not English. Elements of identity and recognition of the learners’ local social context are evident this study. Consequently, this is considered to be influential in the reconstruction of the identities of the learners as South Africans.

Although the studies presented under this theme have focused on the outcomes of multimodal processes and activities, not enough attention has been given to the specific educational outcomes. In my view, this constitutes a shortcoming of these studies. For example, although studies under this theme suggest that the outcomes of the multimodal practices can be beneficial to the students in term of the inclusion of their context and the development of some of their attitudinal characteristics, the question of whether and how these practices can positively impact on the tests grades and graduation rates is not presented.

A second issue is whether similar outcomes can be achieved in different contexts or by targeting different groups of learners. As such, the question is whether digital and multimodal literacy practices should be used in a deterministic form. I argue that a deterministic view is not the optimal approach and may not work for everybody in terms of achieving similar levels of outcome. Therefore, we should not be deterministic in tackling such interventions and should, perhaps, take a complementary approach.

These empirical studies employ aspects of multimodality and new literacy studies (Kress, 2003, 2000). The multimodality and encoded texts are relevant because various literacy practices employed in this study have multimodal dimensions within the Scratch programming environment. Therefore, these dimensions show aspects of meaning-making and representation using new digital media and different modes of representation, while illustrating potential for literacy and language learning.

3.7 Digital Literacy

There is an increased use of digital media and technologies in teaching and learning as well as in everyday social life practices. Yet the term digital literacy is a contested one and it can be seen as an extension of the original debate about literacy. The debate on digital literacy can be conceptualised through two arguments. The first argument is aligned with the recognition of digital literacy as a set of technical, cognitive and functional skills. For example, Buckingham (2006) notes that a functional definition of digital literacy includes "a minimal set of skills that will enable the user to operate effectively with software tools, or in performing basic information retrieval tasks" (p23). Also, according to UNESCO (2011), a functional definition of digital literacy suggests that digital literacy encompasses

> "a set of basic skills which include the use and production of digital media, information processing and retrieval, participation in social networks for creation and sharing of knowledge, and a wide range of professional computing skills" (p1).

On the other hand, the second argument is aligned with a perception of digital literacy as qualities developed through increased awareness and a critical understanding of the role of digital media and technologies in meaning-making and communications (Hague and Williamson, 2009; Newman, 2008; Merchant, 2007; Buckingham, 2006). As such, digital literacy does not refer to the mere use of ICT skills and the delivery of information regarding certain technological tools, but to the learners' digital awareness and understanding of a broader context in which new technology and digital media function (Hague and Williamson, 2009; Buckingham, 2006). Also, Ryberg and Dirckinck-Holmfeld (2010) propose a critical rather than a functional definition of digital literacy in their study that analyses digital literacy in practice.

This position appears to resonate with Merchant's (2007) view regarding critical digital literacy that embraces "critical practices of learning about power, responsibilities and ethical considerations" (p125). Also, using 3D virtual worlds, he offers a transformative educational and literacy practice that challenges the limitations of the cognitive literacy model that restricts learners' and tutors' perceptions of what constitutes literacy (Merchant, 2010).

Following the same line of reasoning, Newman (2008) defines digital literacy as "critical thinking skills in the context of technology use" (p4). Using a critical thinking framework as the main factor for promoting digital literacy, she suggests a five-stage model through which digital literacy can be conceptualised: (1) defining the need; (2) accessing information; (3) understanding and evaluating the information; (4) creating; and (5) communicating information (p4). Taking a similar view, Hague and Payton (2010) define digital literacy as a critical engagement with technology and the development of social awareness and cultural understanding that "shape the ways technology is used to convey information and meaning" (p3). These views and definitions of digital literacy take a similar position to that of the new literacy studies that illustrates a shift towards recognising literacies as a social construct rather than as a set of technical and de-contextualised skills focused on reading and writing.

In my view, these two arguments about digital literacy are crucial in extending our understandings about education in a digitised world. However, there are issues with these arguments that we must address. First, if we agree with the first argument that digital literacy is associated with a set of technical and functional skills, then this position reflects a form of atavistic tendency because it leads us back to square one, where literacy is perceived as a set of cognitive and technical skills, which in effect contradicts the view of literacy as social practices. Put another way, this means that we are simply exchanging the cognitive set of skills for a set of digital skills.

Second, if we perceive digital literacy as consisting of critical qualities and practices developed through increased awareness, ethical consideration and understanding in context, this poses a challenge in terms of standardisation of the delivery and assessment of these digital literacy practices. This effectively raises concerns about this view of literacy, despite the great qualities it promotes.

In effect, these views do not provide us with a comprehensive framework through which we can appropriately employ an education-driven agenda. Given that we are living through a policy-driven era that imposes prescribed educational themes rather than a literacy as social practices. These concerns constitute a gap in the literature on digital literacy teaching and learning. Therefore, this study aims to identify and explore elements that contribute to filling this gap.

These particular issues appear to resonate with the argument that Ade-Ojo (2015) makes about curricularization, in which he offers a rationale for understanding literacy curricula in practice (p14). He notes that the concept of curricularization is defined as a product that represents the content of learning, as well as a praxis that includes the attitudinal dimension of learning and development. This, in effect, serves a notion that prioritises the curricularization of learning practices over pedagogization.

On the basis of the discussion of new literacy studies and the debate concerning the effectiveness of digital technology and new media in teaching and learning, it is rational to suggest that notions of multimodality (Jewitt, 2013; Kress, 2000, 2005) serve to provide a framework for extending the understanding around the debate on digital literacy and new literacies. According to Kress (2005), knowledge is fundamentally multimodal in our contemporary times. Therefore, different types of communication and practice should be practised in a multimodal context. However, a critical question at this point is how to position these multimodal educational practices between a deterministic and a complementary stance, given that real-world educational practices are often blended, not merely constructed socially or applied as a set of cognitive skills. Embracing such a complementary approach of multimodal digital practices is seen as a viable position in contrast to the constraints of the deterministic autonomous model of literacy, as well as in fostering the social literacy practices. The computational perspective adds additional insights to this position, as discussed in Section 3.12 of this chapter. This point of view is seen as beneficial in stimulating an incremental approach to innovation in education using new digital technology that targets tutors and students, as advocated by Merchant (2010), who suggests a need for a change in teacher education and wider educational reform through the application of new digital technologies such as 3D virtual environments and virtual literacies (Merchant et al., 2013).

Finally, it is argued that the inclusion of learners' perspectives is an essential element in literacy practices because these perspectives are often overlooked in digital and multimodal literacy interventions. It is worth mentioning that although the learners' perspective can sometimes be criticised for generating descriptive accounts of learners and their local environment, these accounts can be beneficial in experimenting with new technologies that promote literacy as social practices, as discussed in the next section.

3.8 DIGITAL LITERACY AND SECOND LANGUAGE LEARNING

Many studies and reviews that discuss digital literacy and second language learning are relevant to the ESOL literacy programme targeted in this research. Computer assisted language learning (CALL) software programmes can be traced back to the early mainframe computers, and they have been developing alongside the evolution of the personal computer, the Internet, and web 2.0 technologies (Colpaert, 2010). Perhaps Miller and Gildea's (1987) study is one of the earliest studies that utilised assisted language learning using a personal computer. Their study investigates how young pupils could acquire new words from sentences and pictures displayed on a computer video screen. It concludes that providing visual information on demand "can significantly improve the children's grasp of unfamiliar words", which demonstrates the potential of computers to facilitate the learning of words (p91).

Other studies demonstrate that digital and multimedia forms are essential for language, literacy and intellectual development (e.g. Gilmore, 2007; Kern, 2003; Abraham, 2008). Abraham (2008) investigates eleven studies concerning second language learning mediated through multimedia learning environments with authentic text (Gilmore, 2007). He notes that computer-mediated glosses improve reading comprehension and incidental vocabulary learning, and he suggests that:

> "Language learners have unprecedented opportunities for developing second language literacy skills and intercultural understanding by reading authentic texts on the Internet and in multimedia computer-assisted language learning environments" (p199).

Gilmore (2007) notes three possible roles for the Internet in language learning: first, as a delivery medium, which provides access to authentic resources; second, as an interactive medium, which enables learners to take an active role in searching for relevant information; and third, as a communication medium, which provides opportunities for identifying and communicating with people with similar interests.

Li et al. (2015) suggest that the use of technology offers various possibilities for improving the learning of second language students. They conclude that providing insights into the complex relationship between students' preferences for technology use and language learning can guide the process of integrating technology into language and literacy development for urban adolescents.

Gaming and media production using tools such as Scratch have been perceived to be beneficial in developing second language skills. Warner (2014) argues that video gaming is useful for literacy development. She notes that tutors "can use Scratch to support any array of traditional English Language Arts (ELA) skills like narrative writing, revision, attending to grammar, and organization of ideas" (p187). Also, popular culture and digital media production can be seen to be beneficial to second language learning strategies (e.g. Cheung, 2001; Oxford, 2002) and the development of phonics, spelling and grammar of second language learning (e.g. Gibbons, 2002; Goswani and Bryant, 1990).

In contrast, the findings from various other studies reveal levels of scepticism concerning the positive impact of ICT on young learners. The review by Locke and Andrew (2004) concerning the impact of ICT on students (aged 5 to 16) reveals that investment in ICT in schools does not have a positive impact on literacy development, as is largely believed by educationalists, policy makers and governments. This conclusion poses concerns about the belief that ICT is beneficial to literacy learning because of how it is misused by teachers who do not understand it and because of policy makers who can be insensitive towards it.

A related review by Torgerson and Zhu (2003) concerning the effectiveness of ICT on literacy learning in English for young students (aged 5 to 16) reveals that the use of ICT in schooling to foster literacy development is pervasive. This review covers studies from the early 1990s until 2002, and suggests that, despite a huge investment by the UK government in improving literacy teaching in English, little evidence was provided to support the use of ICT for literacy development. Furthermore, the review by Blok et al. (2001) of the effectiveness of first language word learning software programmes for elementary students, between 1990 and 2001, shows that only five studies demonstrated that the computer-assisted tools were more effective than the traditional learning approach.

In my view, it appears that there is a dispute over whether there is clear evidence for the effectiveness of digital technology on literacy development in general and on language learning in particular. A reasonable explanation for this contention lies in the change that is taking place in digital technology and in teaching and learning contexts. I argue that the rapid changes in both digital technologies and the contextual practices of teaching and learning, using these digital technologies, are possible explanations for the contention regarding the effectiveness of digital technologies in teaching and learning, as well as in language development. Therefore, this study contributes to resolving this dispute through exploring new evidence using the Scratch's complementary and computational interventions.

The rapid change in digital technologies and innovations, such as the Internet, have radically affected our perception of teaching and learning in the digital age (Edwards, 2012). Nonetheless, the path of development of digital technologies contains various innovations that are not necessarily equal in their effects on teaching and learning. For instance, the digital technologies in Miller and Gildea's (1987) study included video material on a computer screen, which is different from, for example, the digital technology of the 1990s (e.g. Blok et al., 2001), a time that was characterised by the eruption of the Internet and personal computers. Similarly, it can be argued that social media and user-generated content, which marked the digital technologies of the 2000s (e.g. Sharpe et al., 2010; Edwards, 2012) can be seen as radical innovations when contrasted with the previous digital technologies.

Consequently, educators and their institutions struggle to cope with the fast pace of development of digital technologies, which are becoming part of young learners' everyday practices (Buckingham, 2006; Jones and Ramanau, 2009; Clark et al., 2009). In this regard, Merchant (2007) notes that the gap between the use of digital technologies inside and outside the classrooms is manifested in the failure to translate cultural resources into cultural capital by the school system. As such, it is reasonable to argue that the rapid change in digital technologies not only constrains the development of pedagogical technologies, but also limits the potential of capturing the effectiveness of these technologies in education.

As an illustration, specialised technology educators and professors can find it difficult to cope with new technological developments in their teaching of new technologies. Jain (2013), a computer networking professor, addressed this rapid growth and change by saying to his class:

> "By the time you finish this course, in any topic, you know you are behind because a lot of things happened in three months…this course has not been offered before, and it may not be offered again because by the time it will be offered again, things will be changed...the knowledge is developed and coming so fast…we [academics] don't move as fast the industry does…because we have to wait for the books to come in" (no pagination).

Although this illustration applies mainly to specific technical courses in computer networking, and may not apply to the pedagogical employment of digital technology in education, it provides an important clue as to how fast digital technologies are growing and expanding while affecting and shaping various societal and cultural domains.

In conclusion, I argue that there are shortcomings in the process of employing digital literacy practices in formal second language learning education. These shortcomings can be summarised as, first, paying little attention to the learners' and tutors' perspectives and their engagement with digital technology in the design and implementation of these digital literacy practices, and, second, overlooking emerging trends such as computational participation in the process of incorporating digital practices into the classroom.

In the following sections, I discuss three perspectives that provide a useful framework in tackling these shortcomings as well as in addressing aspects of the contention on the effectiveness of digital media in teaching and learning. The first perspective addresses young people's engagement with digital technology and the learners' experience; the second discusses digital and computational participation; and the third, offers the view of digital computational technology as a medium rather than a tool. These perspectives are useful in guiding the introduction of the Scratch computational practices in the targeted ESOL classrooms in this study, as well as in extending the understanding of the role of new digital technology in ESOL and language development.

3.9 Young Adult Learners' Engagement with Digital Technology

This research is in line with the learners' research experience approach, which prioritises learners' perceptions of and engagement with digital technologies over the technology itself (Sharpe et al., 2010). Because this approach positions learners in the centre of research, it is beneficial in addressing the research question in this study, which seeks to evaluate the impact of constructionist computational interventions on the achievement of higher levels of literacies among young adult learners. In this context, there are two key debates that provide perspectives on the qualities and attributes of young adult learners through their engagement with digital technology. The first highlights arguments around the digital natives and net generation (Prensky, 2001; Oblinger and Oblinger, 2005) and the second discusses equitable access to digital technology, as well as digital poverty (Edwards, 2012).

3.9.1 Defining and Labelling Young Adult Learners in the Digital Age

Some authors argue that digital technology is embedded in the everyday practices of young people, who naturally grow up as digital natives (Prensky, 2001), the Net Generation (Oblinger and Oblinger, 2005) and the Facebook generation (Roth, 2009). As such, advocates of this view argue that the use of digital technology is ubiquitous, and is being used extensively by the technology generation, as argued by Prensky (2001) in the concept of digital natives. In addition, the idea of "Net Generation" (Oblinger and Oblinger, 2005, p15) suggests that children born post-1980 have qualities such as "hypertext minds", which are not present in older generations.

However, the above views, which are in line with the technological determinist approach, have received many critiques and have been refuted by many authors (e.g. Buckingham and Willett, 2013; Facer and Furlong, 2001; Bennett et al., 2008; Newman, 2009). For example, Hague and Williamson (2009) argue that although some young learners use digital technologies extensively, they may not actually have enough knowledge to use them critically and that their digital knowledge and digital culture are usually overestimated.

Furthermore, Newman (2008) conducted a literature review between 2000 and 2008, focused on the digital literacy of young students (aged 3 to 16). She concludes that there is no agreement on what constitute typical digital literacy competencies in the targeted students' stages and that evidence for digital literacies emerges only from the use of the Internet. She concludes:

> "The evidence therefore suggests that children between preschool and KS4 have poor digital and critical thinking skills when it comes to defining, accessing, understanding, creating and communicating information effectively" (p5).

In my view, the fact that groups of people have grown up amidst the eruption of the digital and social networks does not make them fluent in using new digital media and technologies or that they have equitable access to these technologies. Therefore, it is controversial to label such a group of people, by default, as digitally native. As such, I argue that access to digital technology is essential in developing digital literacy. However, critical engagement with digital technology in context transcends mere access and exposure to it.

From a different perspective, although the proliferation of new digital devices could contribute to increasing access rates to digital technologies, numerous studies illustrate huge inequalities and inequity in learners' access to, and use of, digital technologies (Hague and Williamson, 2009). For example, Edwards (2012) proposes the concept of digital poverty and suggests that digital poverty is manifested in societies across developed and developing countries. Also, Newman (2008) argues that the socio-economic gap among learners is another indicator of inequity in access to digital resources. She notes that there is a significant gap between the young learners' perception of their digital literacy skills and the reality of these. This leads us to the next section, which discusses the learners' perspectives and experience in their engagement with digital technology.

Drawing on this notion of digital poverty, we can argue that anchoring literacy to digital technology will actually deprive some people of access and, indeed, further the course of deprivation that literacy sometimes sets out to address. From another perspective, the proliferation of technologies produces compatibility and interoperability constraints, which can also further the course of deprivation. This, in effect, suggests that mere access to technology does not on its own mean less digital poverty. This, therefore, demonstrates a limitation to the deterministic claim that demands an unmediated central role for digital technology in promoting literacy teaching and learning. Nonetheless, it supports the view of literacy as a social practice in which digital technology is used within a non-deterministic approach, and in which access to digital technology alone does not determine levels of literacy.

3.9.2 THE LEARNERS' EXPERIENCE APPROACH

The students' learning experience approach is conceptualised in different terminologies, including the learner experience research (Sharpe et al., 2010), the learner development model (Sharpe and Beetham, 2010) and the student learning experience (House of Commons, 2009). According to Sharpe et al. (2010), and in the context of the United Kingdom, a review of the research on the use of ICT in teaching and learning reveals a lack of acknowledgement of learners' experience and perspectives in research concerning the use of digital technology and digital pedagogy in learning and teaching. They note that there is more focus on conducting research at the course level than on using and interacting with digital technologies at the learners' experience level. Furthermore, de Freitas and Conole (2010) conclude that research has failed to recognise the learner perspective in the development of digital technological tools and pedagogy. They argue that the development of educational technologies was mainly motivated by the availability of technological resources, not by the needs of the learners.

Sharpe et al. (2010) propose perspectives beneficial to conceptualise and employ the learners' experience approach in this research. They suggest utilising "holistic research" (p7) in order to deeply investigate the role of digital technologies within the broader context of the learners under investigation. This approach provides insights into the learners' lives and their learning practices. Consequently, the authors argue that the learners' experience is a growing field of research, and harvesting meaning-making out from the description of the learner experience is a challenge. Also, in the context of the nature of the rapid change in digital technologies, Sharpe et al. (2010) suggest that:

> "the value of learner experience research has been to provide detailed, rich accounts of actual use alongside an aggregate body of empirical data from which it is possible to extrapolate future trends and patterns of use" (p5).

Therefore, learners' experience entails developing conceptual accounts that explain the learning and teaching practices in, for example, the targeted ESOL population in this study. As such, the analysis and meaning-making of the students' experience using digital technology includes attributes such as confidence and familiarity (Hardy and Jefferies, 2010), decision-making (Seale and Bishop, 2010) and skills and strategies (Sharpe and Beetham, 2010).

Sharpe and Beetham (2010) propose a development model of effective e-learning. Drawing on the Jisc programme entitled "Learning experiences of e-learning", they suggest a student-centred approach that includes "strategies, beliefs, behaviours and attitudes of learners" (p88). This programme consists of nine research projects that utilise forms of extended dialogue in targeting more than 200 students in post-compulsory education. According to the authors, the aim was to construct a deep understanding of the effective factors in learning within a technology-rich environment, as perceived by the students themselves.

Based on this programme, the reported learners' experiences were categorised into a sequence of four developmental stages: (1) functional access through which learners access the required digital technologies, resources and services; (2) skills, including technical, communication and organisational skills which increase confidence in learning through digital environments; (3) practices that facilitate the process of making informed choices about the use of technologies in context; and (4) creative appropriation, which involves learners constructing their personal learning environments through the meaningful use of the skills practices developed in earlier stages. According to the authors, this model provides a presentation of the views of the learners' own voices, and it suggests a framework through which this presentation can be employed in practice.

In this context, focusing on the students' learning experience and perceptions regarding their engagement with digital technologies is an under-researched area. Yet this approach is beneficial in researching the introduction of new digital technology in the classroom. Therefore, this study utilises elements of learner experience research (Sharpe et al., 2010; Sharpe and Beetham, 2010), and one aim of the study is to develop a descriptive account of the ESOL learners' experience and to make meaning from this experience. This is planned through empirical accounts that prioritise the ESOL learners' context and their personal views about literacy development and learning practices.

3.9.3 TUTORS' ENGAGEMENT WITH DIGITAL TECHNOLOGY

There is enough evidence that effective teaching and learning using new digital media depends not only on the students' knowledge but also on the teachers' competence and knowledge, and respect for the knowledge of the learners (Buckingham, 2015). However, the research on teacher professional development is in its early stages, and it is far from reaching concrete conclusions regarding our understanding of the methods of effective practices and their impact on teaching and learning (Lawless and Pellegrino, 2007).

While this study aimed at investigating the impact of computational interventions on ESOL learners in a sixth form college, the role of teachers and educators is essential in providing a comprehensive framework regarding the employment of digital technology in the classroom. Edwards (2012) notes that educators develop their perceptions and competencies relating to the use of computers in teaching and learning at different paces and in various directions. Also, the use of computers in the classroom can support either the cognitive or the social constructivist approach to teaching and learning. This essentially depends on elements including pedagogy, the local context, the subject taught and the teachers' competence in digital technologies (Edwards, 2012).

For example, in a study that aims to develop teachers' instructional practices in an early literacy reading method course, Hubbard (2009) investigates a teacher education programme that utilises digital technologies in providing evidence for a change in the teachers' instructional practices and perceptions. The study concludes that this form of teacher development programme engenders a particular agency in each teacher, which in turn supports her or his early literacy learners.

The second example of teacher training and development is a project entitled Literacy from Scratch. This project is an international model for teacher training aimed at supporting teachers in developing computing and programming skills as a response to the introduction of the new computing curriculum in the UK and other countries (Williams et al., 2014; Williams and Cernochova, 2013). This project provides tutors with techniques and ideas for engaging pupils through the use of ICT practices as a response to the changes in the provision of the ICT curriculum in the Czech Republic and the UK (Williams and Cernochova, 2013). This initiative aims at enriching and developing compulsory ICT education in Prague and, in London, at providing training in using the Scratch programming environment and supporting the primary and secondary initial teacher training programme through networking opportunities, the dissemination of skills and practices, and collaboration with learners and teachers at Charles University in Prague. Also, the project promotes computer coding skills and cross-curriculum animated narratives among pupils (aged 5 to 14), through supporting tutors at Charles University, Prague, the University of Torino, Italy, and De Montfort University in the UK.

While the Literacy from Scratch project may not be considered primarily as a language development programme, it still highlights an essential role for tutors and the importance of developing their computing competencies using Scratch. Moreover, the project is in line with the social constructivist approach to learning, as it encourages students and tutors to construct meaningful Scratch projects in context. Although it is designed to enhance the computing skills of tutors and their pupils, it can be beneficial in extending the understanding of the methods used and the practices required in developing Scratch projects.

As I have stated, tutors play a major role in the incorporation of new digital technology in the classroom teaching and learning. Although the tutors' role is not the primary focus in answering the research question in this study, the utilisation of Scratch in the ESOL classroom is discussed from relevant tutors' perspectives. The tutors' engagement with digital technology is manifested in the process of recruiting and training the ESOL tutors, which is discussed in detail in Chapter 4, entitled "Research Methodology". Also, concepts related to the tutors' engagement with new digital technology, such as resistance to change and affordance of digital technologies, are discussed later in this chapter, in Section 3.12.

3.10 Digital and Computational Participation

Participation is a fundamental concept in teaching and learning practices using new digital media and technologies. There is adequate research discussing concepts such as digital participation and active production of digital media (e.g. Hague and Williamson, 2009; Edwards, 2012). However, given the growing interest in computational thinking and practices, there is promising research that suggests shifting the focus from digital participation towards computational participation (Kafai and Burke, 2014). While there is a consensus among social constructivist researchers that these digital and computational practices should not be limited to technical knowledge and mere access to digital technologies, the shift towards computational participation usually involves prioritising practices such as production (Peppler and Kafai, 2007) fluency and creativity (Resnick, 2007, 2001) using authentic digital materials (Gilmore, 2007).

Hague and Williamson (2009) discuss digital participation in practice and suggest that it is about "making informed use of digital technology and media in one's own life" (p3). They argue that digital participation should recognise opportunities offered by digital technologies to facilitate a positive social and civic engagement. According to them, new digital technologies "must be challenged and questioned rather than accepted passively" (p3). Therefore, digital participation is a contested concept in which not all forms of digital participation, in themselves, can be argued to foster positive outcomes. For example, it can be debated that certain forms of participation engender negative forms of participation, such as "participation in consumer and celebrity culture" or "extremist politics" (Hague and Williamson, 2009, p3). Thus, the mere exposure to digital technologies in itself cannot be expected to inescapably promote digital participation (Edwards, 2012), even if this exposure involves the use of sophisticated technologies (Hague and Williamson, 2009).

The notion of meaningful digital participation can be viewed as an authentic learning approach (Gilmore, 2007) that includes experimental, exploratory and playful learning practices (Resnick, 2007). Yet the participatory nature of these learning practices, such as working meaningfully with new digital media, could be faced with resistance and constraints imposed by traditional pedagogy (Clark et al., 2009; Crook and Harrison, 2008). For instance, in the context of the Scratch programming language, Maloney et al. (2008) note that Scratch projects enabled urban children and young people, aged 8-18, at an after-school learning centre, to develop programming concepts despite the absence of instructions from experienced mentors and tutors. Several coding skills and programming concepts have emerged such as user interaction, loops and variables (Monroy-Hernández and Resnick, 2008), without the young people receiving instructional guidance or support. Although these findings can be seen to show the advantages of such a project, because the children and young people were able to learn concepts and construct meaningful digital projects by themselves, they also raise questions concerning the integration of such computational practices into mainstream literacy teaching and learning, and whether similar practices can be incorporated into classroom settings where resistance and constraints are likely to be imposed by traditional pedagogy (Clark et al., 2009; Crook and Harrison, 2008).

The literature shows that elements of digital and computational practices are not only in line with the above views of digital participation as transcending mere access to digital technologies, but also include notions such as creativity (Resnick, 2007), fluency gap rather than access gap (Resnick, 2001) and computational participation (Kafai and Burke, 2014, 2013). It is argued that these notions provide additional perspectives on meaningful participation within emerging computational and digital practices.

In this context, it is apparent that there is a shift in the focus regarding using digital technology from access to technology towards active participation. This shift involves technical knowledge that is useful for access to and use of digital technologies as well as for an understanding of constructing meaningful and significant objects related to the context and interests of the learners themselves (Papert and Resnick, 1993). Resnick (2001) argues that the fluency gap, or what is commonly labelled the digital divide between the haves and the haves-nots (Compaine, 2001), is becoming a more critical reality than access.

Also, in the context of Scratch programming and authoring environment, Resnick et al. (2009) note that digital fluency "should mean designing, creating, and remixing, not just browsing, chatting, and interacting" (p60). This view portrays the shift that is occurring within the Scratch programming language from local platforms to rapidly growing online forums of Scratch users and educators. The authors note three key design principles related to the Scratch environment and suggest that Scratch users are encouraged to make their projects "more tinkerable, more meaningful, and more social than other programming environments" (p65).

However, the focus on fluency rather than on mere access is contentious, because it can be seen to overlook the existing debate concerning digital poverty and levels of inequitable access to digital technology (Edwards, 2012). Yet the view of a fluency gap suggests a useful notion of participation using constructionist and digital computational technologies.

Drawing from constructionist learning theory, Peppler and Kafai (2007) suggest creative production as an essential curriculum for emerging media education fields, as exemplified by using Scratch while working with economically disadvantaged urban youth at an after-school learning centre. They propose that the inclusion of creative production in media education curricula "can be seen as a new emphasis on critical writing of texts, broadly defined as written texts, software programs, media images, oral discussions or other media objects" (p151). Scratch in this context is viewed as a vital instrument which, when employed meaningfully and constructively, has the potential to

> "facilitate convergence, participation and media mixes; by developing applications or products… and by providing pedagogy that focuses on personal designs within a larger social setting" (Peppler and Kafai, 2007, pp152-3)

Therefore, production using computational technologies is an essential element in fostering participation using digital technologies. For example, Peppler and Kafai (2007) investigate new genres in media education using the Scratch visual programming environment in their three-year ethnographic observation study. Their study depicts a shift in media education from analysis towards production. They argue that Scratch "provides low barriers to artistic expression and civic engagement, a key requirement for inclusion in a media education curriculum" (p153).

In this context, some recent studies propose the concept of computational participation (e.g. Fields et al., 2014; Kafai and Burke, 2013, 2014) as a successor to digital participation, computational thinking and new media production. Kafai and Burke (2013) argue that the concept of computational participation marks a "social turn", in which computing and coding have "shifted from being a predominantly individualistic and tool-oriented approach to now one that is decidedly sociologically and culturally grounded in the creation and sharing of digital media" (p603). They identify three dimensions of this social turn that suggest ongoing shifts towards computational participation practices: (a) from coding to creating applications; (b) from composing to remixing others' projects; and (c) from "designing tools to facilitating communities" (p603). In addition, Kafai and Burke (2014) note that computational participation is a pivotal emerging form of computational thinking. Thus, computational participation is useful for leveraging "social connectivity", "participation" and "communal practice" (p3).

These concepts of digital and computational participation, computational thinking and digital production are essential for extending the understanding of using Scratch computational interventions to enhance ESOL literacy teaching and learning in this study. These are further discussed in Chapter 7, "Discussion and Reflection".

3.11 Analysis of Digital and Media Literacies

Buckingham’s (2006) framework for analysing digital and media literacy is beneficial to the analysis of the literacies developed in the case study in this research. His conceptual framework consists of four essential components of digital media literacy: representation, language, production and audience (pp267-8). First, the representation component suggests that digital media represent the environment and the context of the learners. Learners can critically evaluate both digital material, including digital texts based on, for example, the motivations of the people who created them, and the authority, reliability and bias of the material. Second, the language component suggests that learners are able to use and understand the grammar of a specific form of communication while developing awareness of its broader codes and conventions. Third, the production component encompasses a critical understanding of the practices of media production as well as of communications among commercial and non-commercial sources and interest groups. The fourth component is that of the audience, which includes awareness and understanding of the role of different audiences within a diverse medium through which communications are taking place. This general framework can be used for generating more specific literacies, such as web literacy and gaming literacy (Buckingham, 2006).

This framework is in line with the views of critical approaches to literacy (e.g., Lankshear, 1993; Luke, 2002), which promote the inclusion of formal and informal literacies and cultural practices of the learners in media education (Buckingham, 2006, 2015). Thus, digital literacy is much more than simply retrieving and transmitting information via computers. Buckingham (2006) suggests that young learners’ engagement with technology should include their experience in and out of school because their engagement with digital media out of school is vital for the development of their digital literacy.

He also emphasises that the four components of this framework can be perceived as analytical skills of reading and writing media. Therefore, the analysis and discussion of the case studies in this research utilise aspects of critical and digital literacy offered by Buckingham’s (2006, 2015) framework. The rationale is that Buckingham’s view of digital media literacy serves the constructionist approach adopted in this research. Also, this framework is beneficial to the discussion of the case study in which the young adult ESOL learners were given the choice to use, remix or create Scratch projects.

3.12 Resistance to Change and Affordance of New Digital Technologies

The introduction and integration of new digital technologies in the classroom most often face challenges and resistance from educators, teachers and institutions (Underwood et al., 2010; Trowler, 1998). Underwood et al. (2010) note that the anti-technological lobby (e.g. Colon and Simpson, 2003) rejects the claim that there is considerable evidence for a substantial positive impact on education as a result of using ICT. The view of the anti-technological lobby is relevant to the resistance to change witnessed in the context of incorporating new digital technologies into the classroom. Yet it can be seen as an extension of the debate on the effectiveness and impact of digital technologies on teaching and learning, discussed earlier in sections 3.5 and 3.6 of this chapter.

From a different perspective, and according to Prasad and Prasad (1998), resistance to change can be triggered by power relations and various forms of control including personal, technical and bureaucratic kinds. For example, in the context of this research, the technical skills and computing competencies required to participate in computational Scratch interventions effectively can create resistance to participation. Also, the institutional and bureaucratic procedures are a second source of resistance to change and to adapting to new teaching and learning practices using the Scratch computational environment.

In this regard, the effective introduction of new digital technologies in educational contexts depends mainly on "the ability of technologically minded reformers to understand the realities of the classroom and to enlist teachers as collaborators rather than regarding them as obstacles to progress" (Krause, 2000, p15). Also, based on Trowler (1998), a second factor that could reduce levels of resistance to incorporating new digital technologies in the classroom is maintaining a sense of ownership of change, which can be achieved through experimentation and adaptation.

In my view, the suggestions made by Trowler (1998) and Krause (2000) are obviously reasonable but difficult to achieve. Perhaps the early phases of introducing new digital technology in the classroom are the most difficult. In the same sense, the recruitment of early adapters to a new digital technology and the conducting of the first experimentations with them can be harder than working with subsequent adapters. In this context, I borrow from innovation studies the concept of "penguin effect" (Swann, 2009, p204), which demonstrates the situation in which penguins are lined up near the edge of the ice and are not willing to jump into the water to catch fish due to the potential threat from predators.

Although very few penguins risk jumping into the water at first, if they are successful other penguins quickly follow. Along with this line of reasoning, this thesis researches new practices to improve learning in post-16 institutions, where very few of the "gate-keepers" and potential participants are willing to take part in and experiment with innovative practices. Therefore, a considerable effort is needed from the few researchers and early adapters who are willing to make the jump and encourage second wave followers.

In this context, the notion of the taxonomy of ICT affordance (Conole and Dyke, 2004) is useful to guide the incorporation of digital media into the classroom. Conole and Dyke (2004) developed a notion of the taxonomy of ICT affordances, which extends the understanding of the use of digital technology in education. They built on Salomon's (1993) concept of affordance in developing a taxonomy of affordance that demonstrates the possibilities of actions mediated through ICT tools and artefacts offered to teachers and learners. Salomon (1993) draws on the seminal work of the American psychologist Gibson (1979) about the ecology of perception and the significance of the connection between perception and action that is accomplished through the affordance of objects and artefacts. He notes that the concept of affordance is critical in the design of educational practices, and defines affordances as "the perceived and actual properties of a thing, primarily those functional properties that determine just how a thing could possibly be used" (p51).

According to Conole and Dyke (2004), the affordances include several attributes including: accessibility of information and technology, speed of change of ICTs, diversity of experiences that transcends the local environment, synchronous and asynchronous communication and collaboration, possibilities for reflection accessed or archived beyond face-to-face, and multimodal forms that are underpinned by a pragmatic and non-linear approach to learning.

However, this taxonomy of ICT affordances has some limitations. For example, the accessibility of information and technology can be controversial because there is a problem in distinguishing between passive access and critical engagement. As for the speed of change in new technologies, I argue that coping with the rapid innovation in ICTs and their implications for education constitutes a major dilemma in the domain of digital and multimodal literacy, as discussed earlier in this chapter. Also, the diversity of experiences and online communications can have its limitations. There is an issue of lack of identity and superficial engagement within online and virtual platforms. For example, the complexity of distinguishing between "what is real and what is rendered real via the technology" (Conole and Dyke, 2004, p117).

Despite the limitations to this taxonomy, it is useful because it describes the complex and dynamic relationship between users and technology As such, this taxonomy of ICT affordances is seen to be useful in extending the understanding of affordances and informing the design and use of digital technologies in teaching and learning (Conole and Dyke, 2004). It also provides a framework for analysing, critiquing and identifying the potential and limitations of digital technologies in practice. Therefore, this facilitates taking informed decisions about how Scratch can be employed in the targeted ESOL classrooms.

3.13 COMPUTATIONAL REFLECTIONS AND INSPIRATIONS

In the 1990s, many computer programmers, including this researcher, were overwhelmed by the rapid pace of change and growth that took place in computer programming languages. It had been an area for people with expertise in the field, who could programme or code using special complex syntaxes and compilers. In recent times, however, a computational thinking culture is beginning to emerge (Brennan and Resnick, 2012; Wing, 2011, 2008), which is not a monopoly of software engineering experts, but an essential skill for every learner in all disciplines (Wing, 2006). Computational culture, therefore, encompasses a new medium and paradigms, and affects almost all disciplines. In this regard, the following sections discuss selected literature that helps to construct the context of computational thinking and its role in design-based, dynamic, and interactive literacy learning settings.

3.13.1 COMPUTATIONAL THINKING

Computational thinking is an important manifestation of the emerging computational culture. Essential attributes of computational thinking and its sociocultural medium include forms of digitalisation, abstraction and encapsulation of learners' everyday practices. These forms and attributes also involve several manifestations regarding notions of multimodality, as articulated by the New London Group (Cazden et al., 1996), including the contextualisation of discourses and social practices (Gee, 2001) and the "autonomisation" of learning practices (Benson, 2013).

Equally important, is the fact that the Scratch computational and programming environment, which is the main constructionist tool utilised in this study, constitutes one of the most important innovative contemporary visual computational and authoring environments. It demonstrates various aspects of computational culture. There are four major factors that distinguish Scratch from other traditional computer programming languages. First, there is the primitive visual interface that allows users to drag-and-drop programmable blocks without the need to type complex script or syntax as is the case with traditional programming languages. Second, the exponentially growing online Scratch forum, with millions of users and Scratch projects, makes it one of the most popular tools for visual programming languages (Resnick et al., 2009). Third is the rapid inclusion of the Scratch tool in mainstream education. Since 2013, many countries, including the UK, have adopted a new computing curriculum that employs the Scratch tool (Smith et al., 2014; Brown et al., 2014). Fourth, according to the statistics available on the Scratch website (Scratch, 2015), the vast majority of registered users are young people and children (aged 10-18). As such, Scratch is a relevant social platform for young people. The online Scratch forum enables them to experiment with media education and production as well as to utilise the new media culture in their learning (Peppler and Kafai, 2007).

Brennan and Resnick (2012) suggest that using interactive programming media, as exemplified by Scratch, helps to support "the development of computation thinking in young people" (p1). While they assert that emerging trends of computational thinking are not yet fully conceptualised among different theory and practice fields, they suggest that not all online or digital practices are necessarily computational. Therefore, they draw a contrast between two types of learning. The first is constructed and supported within programming interactive media environments; the second is created by video editing software programmes or video game terminals (Brennan and Resnick, 2012). Furthermore, they note that the Scratch programming environment "provides a context and set of opportunities for contributing to the active conversations about computational thinking" (Brennan and Resnick, 2012, p2).

Wing (2008), on the other hand, adds conceptual and analytical perspectives to the computational thinking paradigm that is based on automation and abstraction. She describes computational thinking as "an approach to solving problems, designing systems and understanding human behaviour that draws on concepts fundamental to computing" (p3717). She also asserts: “Computational thinking is influencing research in nearly all disciplines” (p3719). Further, Cuny et al. (2010) define computational thinking as:

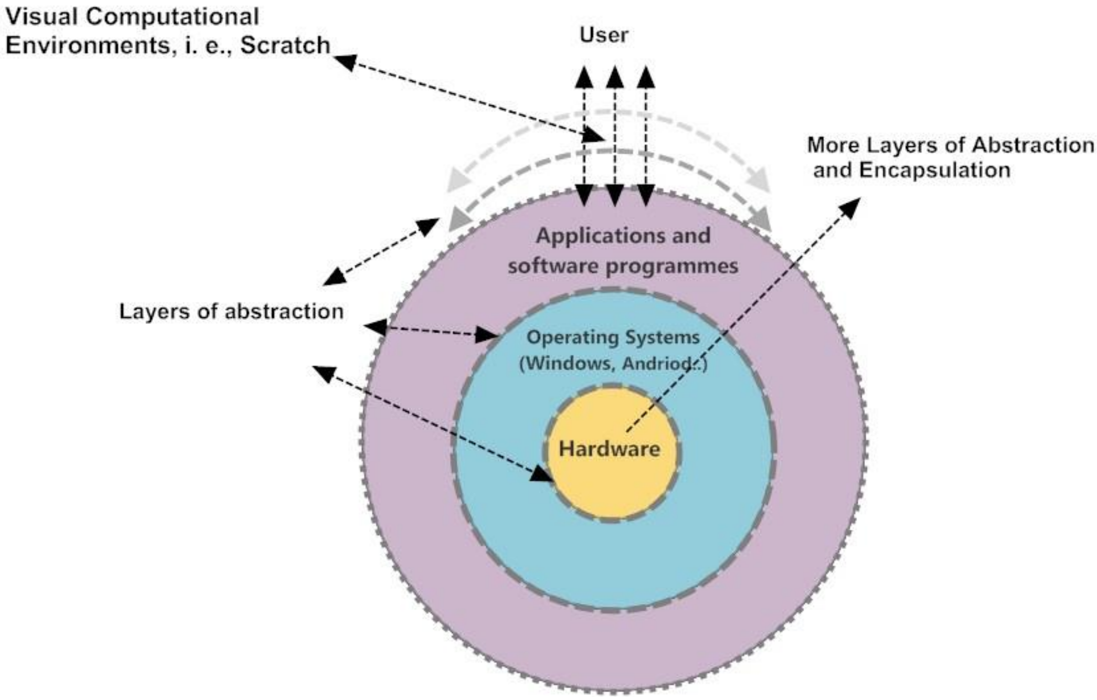
> “the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent” (no pagination).

Wing (2006) identifies several layers of abstraction that describe computational thinking. She presents two key characteristics of computational thinking – “Abstraction” and “Automation” – while noting that computational thinking “will be a fundamental skill used by everyone in the world by the middle of the 21st Century” (pp2-3). Abstraction and automation provide us with the “ability and audacity to scale” (p3). She asserts that computational thinking “is operating in terms of multiple layers of abstraction simultaneously” (p3). I would, however, argue that this conceptualisation of computational thinking as involving multiple layers is more visible at higher levels of abstraction, because the particularities and properties of computational thinking are more about higher levels of abstraction, where they operate, and less about lower levels, down towards the hardware. Further, I suggest that the higher the abstraction, the greater the distance from lower layers of abstraction, and, consequently, the more encapsulation of the lower layers is deployed.

Layers of abstraction and encapsulation are not novel terms that solely apply to computing or computational thinking. However, the computer operating system is one obvious illustration of layers of abstractions. An operating system is a software, such as Microsoft Windows, that manages all of the hardware and underlying resources in the computer machine (Stallings, 2009). Once a computer is powered on, the user waits until the machine boots up, and once the desktop is available, the user can start using any of the applications installed on that computer. In fact, a quick scan of any reference book on computer operating systems shows various forms and terms of abstraction and encapsulation. These layers of abstraction and encapsulation expand with further added layers of the application until the abstraction upgrades into a conceptual computational thinking platform.

For instance, Papert (1993) used the term “computation” to suggest conceptualisation and abstraction of constructionist forms of mathematical learning practices. Therefore, computational thinking retains higher forms of abstraction than traditional computer programming languages, as observed in the circles of abstraction in computer hardware, software and applications that apply to almost all science and engineering disciplines (Stallings, 2009). Such layers of abstraction consist of computer operating systems, compilers, programmes and applications as main structures. To illustrate, Figure 3.2 conceptualises abstractions and encapsulation processes in computing and computational thinking.

Figure 3.2: an illustration of the layers of abstraction and encapsulation in computing machines and devices (Figure developed by the researcher)



According to Brown et al. (2014), the introduction of the new national computing curriculum in UK mainstream education can be seen to be in favour of educational policy on, and industry's interest in, Information Communication Technologies (ICT). While Brown et al. (2014) suggest that the subject of ICT in the 1990s and early 2000s focused on the passive use of technology and software programme, the past few years have witnessed an increased interest in the principles of computational thinking, especially as the new computing curriculum in the UK has become mandatory for pupils from the age of five upwards.

Because computation and computational culture constitute a core element of the learning theory of constructionism, computational developments in particular can be seen as more aligned with the constructionist approach than with sociocultural and psychological cognitive approaches to learning. This is supported by in the context of innovative technological learning approaches and computational thinking environments. The following three reflections provide insights into this argument.

First, the rapid expansion of computational culture and participatory culture create a low barrier to entry (Jenkins, 2006), and computational culture is being increasingly embodied in sociocultural practices. Second, in the past decade, there have been several developments of constructionist kits and projects that emphasise the feasibility of the constructionist approach while demonstrating its growing impact on educational interventions (Resnick, 2007). To exemplify, Scratch, a computational programming environment that is the constructionist tool in this study, has been rapidly adopted not only by the third sector and informal learning institutions but also by mainstream education, as is the case in the UK. For example, Scratch was made popular in the UK through the "Code Clubs" after-school initiative that hosts more than five thousand clubs teaching more than seventy thousands kids (Code Clubs, 2016). Third, the emerging online computational social communities and forums have continued to foster sociocultural practice within constructionism. The Scratch online community is one good example of such online communities and it currently hosts more than 5 million members who have shared more than 7.8 million projects (Scratch, 2015).

In summary, computational thinking constitutes an important emerging field, not only for people interested in the technical aspect of computing but also for almost all learners, as it is projected that computational thinking will become a fundamental skill for everyone (Wing, 2006, 2008). Computational thinking is described mainly through the two processes of "Abstraction" and "Automation" (Wing 2006, pp2-3). However, while this conceptual understanding of the architecture of computational thinking is useful for developing computational thinking competencies, diverse epistemological and pedagogical insights are necessary to construct a comprehensive image of this emerging domain. Therefore, one aim of this study is to contribute to this debate and examine the effects of computational thinking skills and practices on young adult ESOL learners.

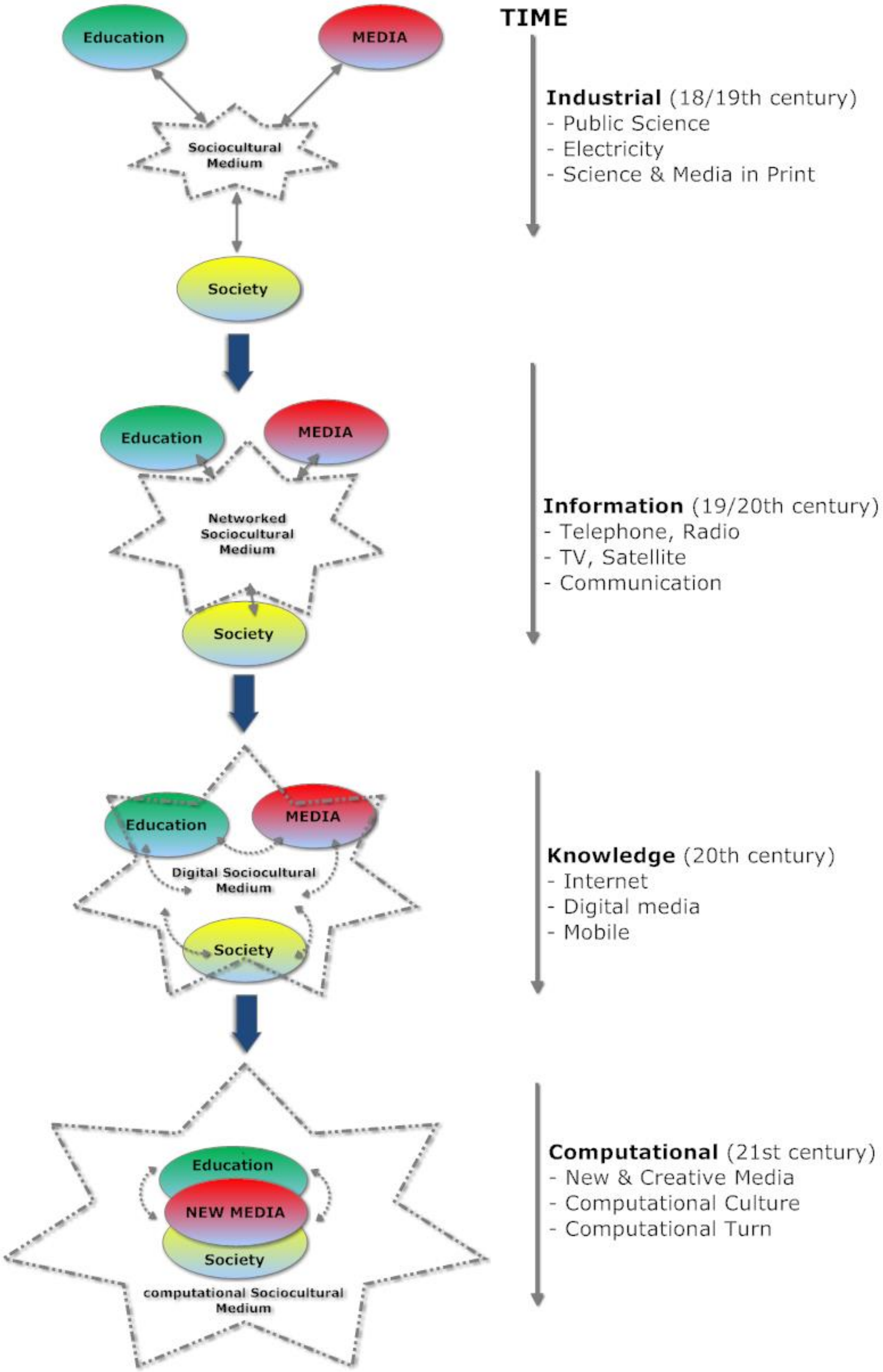
3.14 Dynamic Computational Sociocultural Medium

Drawing on the emerging theories of multimodal representation and meaning-making (Jewitt, 2013; Kress; 2000, 2003, 2005) and the cultural historical activity theory (CHAT) (Wells and Claxton, 2002), and inspired by Papert (1993, 1980), my theoretical conceptualisation of the emerging computational culture is an expanding medium that I have labelled as the dynamic *computational sociocultural medium*. One manifestation of this dynamic *computational sociocultural medium* is that it is expanding and increasingly becoming embedded in everyday learning practices. This new medium engenders innovative learning spaces that are helpful in constructing computational learning spaces that are networked, digitalised and personalised. Figure 3.3 conceptualises some snapshots of the historical progress of inter-correlated societal, educational and media domains in relation to an emerging, expanding, dynamic *computational sociocultural medium*. This conceptualisation describes historical illustration of shifts that include: (1) industrial societies highlighted by the public face of science and electricity (Bowler and Morus, 2010); (2) the communication revolution characterised by telephone, radio, television and satellite broadcasting; (3) knowledge societies marked by digital media and mobile communications, amidst exponential growth of the Internet (Jain, 2003); and (4) the computational culture that mark aspects of creativity (Resnick, 2012, 2008) and new media (Jenkins, 2006).

This expanding medium incorporates forms of digitisation, abstraction and encapsulation of almost all social practices. Therefore, it reflects fundamental changes in the very concept of technology, which should now be seen as the tools people use in their practices. Computational thinking is one of the attributes of this expanding new medium. Within this framework, the line of development of computer machines shows evolving phases, from computing as an isolated discipline for technical expert groups to higher abstract concepts and encapsulations of practices that enable people to conceptualise and model personal and real world views.

Furthermore, it is worth noting that being networked does not override or negate other encapsulating forms of, for example, being digitised. Similarly, being creative also embodies being networked and so on. In this respect, an apt illustration is the networked and social structure notion of Castells (2010), which embraces the effects of networks more than those of technology or computation. Castells (2010) explains that “dominant functions and processes in the Information Age are increasingly organized around networks… [that] constitute the new social morphology of our societies” (p500). According to him, these processes and functions are eventually shaping the “production, experience, power, and culture” of contemporary societies and that the “new information technology paradigm” is a catalyst for the expansion of these processes and functions within the social structure (p69).

Figure 3.3: a conceptualisation of computational culture in its historical context, within the sociocultural medium of education, media and society. (Figure developed by the researcher)



This conceptualisation of this emerging dynamic *computational sociocultural medium* offers a framework that can be useful for tackling the debate about the ongoing innovations of new digital media and tools as well as the distinctive elements of contextual sociocultural learning practices. That is because change is continuous in new digital technology and learning is context-specific and dependent; this proposed medium can offer new understandings in the context of emerging computational thinking and computational culture.

3.15 BLOOM'S TAXONOMY OF LEARNING DOMAINS

Bloom's taxonomy (Bloom et al., 1956) was developed to support higher thinking in learning through classification of the learning objectives into three domains: the cognitive learning domain, which involves knowledge and the development of intellectual skills; the affective learning domain, which refers to the attitudes and the growth in feeling or emotions; and the psychomotor learning domain, which involves the manual or physical skills learned. The taxonomy, if categorised into a pyramid, consists of six key thinking skills. In this pyramid, remembering is the lowest order thinking skill, and it advances through the higher order thinking skills of understanding, applying, analysing and evaluating, with creating at the top.

Bloom's concept of taxonomy has been widely used as an assessment framework for learning and teaching objectives as well as in the design, delivery and evaluation of learning activities (Krathwohl, 2002; Anderson et al., 1996). Bloom's taxonomy was revisited by Anderson et al. (1996), who suggest Bloom's revised taxonomy of the cognitive learning domain. The authors provide a classification of the cognitive model and propose a hierarchical progression through a sequence of stages: remembering, understanding, applying, analysing, evaluating and creating. Meanwhile, the psycho-motor domain of the Bloom taxonomy was further developed by Dave (1975). The author suggests five stages of skills development: imitation, manipulation, precision, articulation and naturalisation.

This taxonomy of the learning domain suggests that learning entails more than just remembering facts, and it is useful in analysing and evaluating concepts, processes and procedures of learning (Anderson et al., 1996). Therefore, this is beneficial to the analysis of the learning outcomes of the case studies conducted in this research, particularly as it was anticipated that the ESOL students would develop different skills that could be analysed from the perspective of the revised Bloom's taxonomy of learning domains.

Furthermore, according to Krathwohl (2002), Bloom's revised taxonomy suggests that there is a metacognitive knowledge that is beneficial to the analysis of language development and literacy learning practices through computational intervention. He notes that the metacognitive knowledge in the revised taxonomy comprises three important types: "strategic knowledge", which brings up knowledge of strategies for learning; "knowledge of tasks and their contexts", which signifies knowledge about various cognitive skills and cultural norms; and "self-knowledge", which is essential to meta-cognitive knowledge (pp224-5).

This assertion about the three types of knowledge is relevant to the cognitive and linguistic gains anticipated in the case studies. I argue that considering these types of metacognitive knowledge in learning and teaching is essential for enhancing teaching and maximising learning potential in ESOL programmes. Also, the computational skills gained in the case studies can be analysed and discussed from the perspective of the psycho-motor learning domain. In a similar sense, several anticipated attitudes towards learning can be analysed and discussed from the standpoint of the affective learning domain.

Bloom's taxonomy of learning domains has inspired the introduction of other versions of the taxonomy such as the taxonomy of digital and information literacy (Beetham, 2013) and Bloom's digital taxonomy (Churches, 2011). Drawing on the revised Bloom's taxonomy (Anderson et al., 1996), Churches (2011) suggests various skills associated with taxonomy including: (1) creating skills that include digital production, publishing, programming, wiking, remixing, mixing, directing and producing, and animating using different technological tools and platforms; (2) evaluating activities that include online commenting and posting, testing, experimenting, collaborating, reflecting and networking; (3) analysing, which includes breaking information into component elements, comparing, organising media, editing and clipping, linking, cracking and mid-mapping; (4) applying, which involves using concepts, ideas and principles across different situations and strategies; (5) understanding, which includes explaining concepts and ideas, interpreting, summarising, classifying and comparing; and, finally, (6) remembering, which involves recognising, listing, describing, identifying, retrieving, highlighting, social networking and searching.

In my view, both of Churches' (2009, 2011) and Beetham's (2013) adaptations of Bloom's revised taxonomy can be useful as frameworks for researching, analysing and evaluating the introduction of new technologies into the classroom.

However, these taxonomies are not without their own limitations. For instance, it must be noted that some of the examples of the technological tools used in Churches' illustrations can be labelled as out of date. For example, the collaborative online word processor website is currently not a unique website because advance features of this service are currently provided through Google Docs (Google, 2016). This is an example of the perhaps recurring problem with researching new technologies, due to the fact that they are constantly changing, as discussed earlier in this chapter. This in effect highlights the importance of conceptualising new digital media and technology as a medium, as suggested in the previous Section 3.13.

3.16 Chapter Summary

This chapter has discussed constructionist learning theory and new literacy studies frameworks, and has shown a convergence between the two approaches to learning while reflecting on related learning theories as well as on sociocultural approaches to literacy. Arguments concerning new literacy studies, including the pedagogy of multiliteracies, that are relevant to literacy development have been presented along with insights into the role of tools, representation and meaning-making in new literacy studies. Perspectives on the role of digital technology in education have been discussed, as have elements of digital literacy and multimodality that are relevant to language learning and development. Finally, aspects of computational thinking have been discussed and the concept of a dynamic computational sociocultural medium has been suggested, to support the theoretical viewpoint of this study.

CHAPTER 4: RESEARCH METHODOLOGY

My ontological orientation in this thesis follows pragmatism underpinned by the philosophical stance of critical realism. We are living amidst everyday complex cultures and practices. In these times, I believe that the epistemological view of pragmatism, that values practice and what works, is more helpful in our contemporary environment than any other philosophical views. This eventually becomes of significant importance in the context of the current complex and dynamic environments that reflect emerging multimodal and "computationalised" practices and cultures that are increasingly altering traditional time-space constraints.

From this pragmatic base, I present my research ideas and commitment to improving the educational environments of young adult literacy learners through my informed and intentional educational endeavour to answer the research question in this study: *To what extent can constructionist interventions such as Scratch contribute to the achievement of higher levels of literacies among young adult ESOL learners?*

Answering this research question required targeting core research participants, young adult ESOL learners in a Sixth Form College in London, using Scratch computational interventions. The work with the core research participants has led to the development of the case study in this thesis, discussed in Chapter 6. Also, the study has benefited from targeting non-core participant students and tutors in order to provide additional insights into the extent the constructionist tools, exemplified by Scratch, can benefit ESOL literacy learners. The research population and project sample are discussed in detail in Section 4.9 in this chapter.

This study utilised a mixed methods research that employs a case study approach. It is in line with non-experimental qualitative research with embedded quantitative subunits collected through surveys (Check and Schutt, 2012). While the study adapts to a primarily non-experimental qualitative research approach, it benefits from quantitative units collected through the survey method. The rationale is that this enriches the findings of the study and provides in-depth perspectives on Scratch computational interventions in ESOL literacy learning and teaching.

4.1 RESEARCH APPROACH

Using the case study research, this thesis aligns to a pragmatist stance towards reality, which values what works within the context of initiating positive change, providing solutions and influencing the research population while constructing new knowledge and contributing to new theories. The proposed plan in this thesis draws from the constructionist approach to learning and pedagogy as well as from an epistemological view of knowledge as a social construct (Cushman et al., 2001; Luke, 2002). This research has multi-disciplinary dimensions and provides a novel study that is built on previous work on the development of media interventions using the Scratch programming environment as well as the sociocultural approach to new literacy studies (Street, 1984, 1995; Gee, 2012; Cope and Kalantzis, 2000). This thesis, therefore, examines the potential of a "computationalised" learning environment for literacy learners within the English for Speakers of Other Languages (ESOL) sector in post-16 learning environments in London.

In this context, the path to the case study and mixed methods approach (Creswell and Clark, 2011) was carefully developed throughout the design and implementation phases of this project. This methodological design best serves an inter-disciplinary kind of research that enables the researcher to tackle the complexity and diversity of the research participants in the ESOL learning environments.

I have opted for this approach because other quantitative research approaches may not be feasible in this kind of research, as they may not tackle the complexity and the depth of the research to the extent that it can be captured by the case study and mixed method research. Therefore, this study represents a multi-disciplinary project, which combines the constructionist learning theory and sociocultural approach to literacy. This in effect, demanded the employment of a set of methods in data collection and analysis. In the subsequent sections, I discuss this research methodology and show its usefulness in tackling the complexity of this multi-dimensional research that involves social and technical elements in introducing innovative computational learning practices into diverse and multi-cultural learning settings.

Originally there had been plans to use an action research approach in the fieldwork. However, the context did not permit the researcher to complete the cycles of intervention due to delays in finding willing partners. This made the time scale too short to complete two cycles of intervention and evaluation. Therefore, the process of conducting this study has drawn on elements of action research. For example, the description of Phases 1, 2 and 3 in Chapter 5 demonstrate an action research planning cycle (Kemmis and McTaggart, 2000) which is evident within the multi-method approach in the case study. Also, changes to future learning approaches were evident in the tutor and the students in the most actively engaged group of participants as discussed in Chapter 7. Nevertheless, the utilised approach is a case study.

4.2 Mixed Methods Approach

Mixed research or mixed methods describe the use of both quantitative research methods and qualitative research methods in a single study. Tashakkori and Creswell (2007) mark a new era of mixed methods in the first issue of the "Journal of Mixed Methods Research". They differentiate between mixing qualitative methods and quantitative methods in a single study and the integration of qualitative and the quantitative methods in a single study. They define mixed methods as:

> "research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry" (p4).

Likewise, Check and Schutt (2012) propose two different types of mixed research: the first is "intermethod mixing" that uses two or more methods at the same time or sequentially, and the second is the "intramethod mixing" through which quantitative and qualitative research methods are mixed within a single method (p243).

In this context, Chris (2010) notes that mixed methods "rejects the either/or choice of qualitative or quantitative research that perpetuated the paradigm war" (p644). Additionally, the mixed methods approach is well suited within a pragmatic ontological and philosophical orientation (Gall et al., 2007; Chris, 2010). According to Gall et al. (2007), pragmatic consequences or usefulness can be determined through the truth value of concepts, methods which is in line with the views of renowned pragmatists, such as Charles Pierce or John Dewey. They observe that authors such as Johnson and Onwuegbuzie draw on the philosophical paradigm of pragmatism and argue that researchers can benefit from mixing quantitative and qualitative research methods in a single study. Therefore, quantitative research and qualitative research, despite being epistemologically disparate, can be utilised and mixed together from a pragmatist point of view, particularly if useful findings emerge from the mixing of the two approaches (Gall et al., 2007).

The literature in social science research discusses the benefits and advantages of mixing quantitative research and qualitative research methods. Wiersma and Jurs (2009) indicate that mixed methods research appeals to a wider segment of the audience; and another advantage of using mixed methods research is avoiding “possible unimethod bias” (p308). Also, Gall et al. (2007) suggest that mixed methods can complement both quantitative and qualitative research methods. They suggest that combining the qualitative and quantitative reviews of a phenomenon provides in-depth and rich insights about the phenomenon under investigation. Similarly, Check and Schutt (2012) note that mixed methods research takes advantage “of the unique strengths of each methodological approach when engage in different stages of the research process” (p239).

In this study, the decision to utilise mixed method was informed by several factors which have continued to emerge from the early design stages of the research: (1) the multi-dimensions of this research project including social, learning, technical and overall epistemological aspects that cut across different disciplines. (2) The analysis and triangulation of qualitative data, quantitative data and available secondary data provide important in-depth understandings about the findings and the social contexts of the research participants. (3) Mixed methods support the validity of the established claims in this research. (4) Provides more than one source of data collection helpful to examine iterative exploratory results and illustrations which enhance the research’s validity (Creswell and Clark, 2011). (5) Given this interdisciplinary approach, the social aspects of this research provide another rationale for combining mixed methodologies in order to harvest various aspects of the constructionist approach. Finally, (6) the mixed methods design constitutes an important methodological component in the design of the case study approach that informs the implementation and development of this research.

Indeed, many authors suggest using mixed methods especially with case study research (e.g., Check and Schutt, 2012; Ragin and Becker, 1992; Gibbert et al., 2008; Woodside 2010). Therefore, it is useful to discuss the rationale for the employment of several research methods and instruments in order to show their relevance and the added value of this design.

The data collection methods utilised were: Surveys in a form of questionnaires, participant observation, interviews, and analysis of produced artefacts. The employment and mixing of these data collection methods was influenced by the need to answer the research question of this interdisciplinary type of research which aimed at evaluating the impact of the Scratch computational tool on the achievement of higher levels of multimodal literacies among ESOL students.

From a different perspective, the use of mixed methods in the development of the case study was informed by the importance of increasing the levels of validity and trustfulness in answering the research question (Ragin and Becker, 1992). The internal validity and reliability of the research are discussed in Section 4.6 in this chapter.

Furthermore, Woodside (2010) suggests that using mixed methods serves to increase the accuracy, complexity and coverage of the case study. He notes that applying alternative research method provides "confirmation and disconfirmation" of the findings emerged from certain research methods. In this view, a survey method could be useful to corroborate or negate certain findings emerged from data collection methods such as interviews and participant observation. The surveys sample conducted with the aim to triangulate the findings from the case study are discussed in Section 4.11 in this chapter.

4.3 CASE STUDY

In this section, I discuss the design and methodological aspects of the case study approach while showing its convergence with mixed methods research. The design of the case study in this project includes multiple case studies in which each case was developed based on the data collected from one core participant ESOL student.

Yin (2009) defines case study from two perspectives that cover the scope and technical aspects of case studies. He describes case study as "an empirical inquiry that…investigates a contemporary phenomenon in depth and within its real-life context, especially when…the boundaries between phenomenon and context are not clearly evident" (p18). This definition is essential for the nature of this research, particularly when "contextual conditions" are pertinent to the phenomenon of the study within a real-life context; unlike experimental research that investigates phenomena within a decontextualized controlled setting. From a technical perspective, Yin (2009) suggests that case study is able to:

- cope with the distinctive technical situation in which there will be many more variables of interest than data points, and as one result,
- rely on multiple sources of evidence, with data needing to cover in a triangulating fashion, and as another result, and
- benefit from the prior development of theoretical propositions to guide data collection and analysis (p18).

The features identified above indicate that case study can include different applications, categorisations, and characteristics. Yin (2009) suggests four different applications in case study research that include: first, to explain certain assumed causalities in contextualised real-life studies with complex variables; second, to provide a description of the interventions in context and as they occurred; third, to illustrate certain themes within an evaluation intervention as illustrated by the descriptive mode of case study; and fourth, to enlighten situations where the intervention lacks an explicit set of outcomes (p19-20). He argues that a case study approach is "preferred in examining contemporary events, but when the relevant behaviours cannot be manipulated" (p11). This description differs from designs in the experimental research where the researcher manipulates one or two isolated variables within a controlled environment.

Similarly, Sturman (1999, p107) suggests four kinds of case studies: single in-depth ethnographic case studies; action research case studies; evaluative case studies and educational case studies. Hitchcock and Hughes (1995) explain that a core element in the case study approach is the clear identification of the boundaries of the case study. They note that the case study approach can be developed through breaking down the case study into "key players", "key situations", and focusing on the "critical incidents" in the lifespan of the case itself (p319). They also suggest that a case study must have a number of characteristics which include: a vivid description, a chronological narrative, a description and analysis of events, a focus on individual actors or groups of actors and their perceptions, a focus upon particular events within the case, an integral involvement of the researcher in the case, and a representation that captures the richness of the situation.

Yin (2009) suggests that single or multiple case studies sometimes referred to as a comparative case study which could be included in the design of the case study. Drawing on the underpinning arguments of the mixed method approach (Creswell and Clark, 2011), and according to Yin (2009), case study research can take the forms of quantitative or qualitative research methods, in which the overall sum of the methods goes beyond single qualitative or quantitative methods. This mixing eventually adds new layers of triangulation and validity that it would not be possible to accomplish through using single quantitative or qualitative research methods (Cohen et al., 2011).

From another perspective, there are three essential aspects of case studies: their participatory nature, the in-depth analysis of the case, and the ability to handle different kinds of data and evidence. "Participatory" may reflect the fact that the researcher maintains lower levels of control if contrasted to experimental research. For example, Hitchcock and Hughes (1995) point out that the case study approach is preferred when the phenomenon under investigation is within a real-world context.

The in-depth analysis provided by case studies draws attention to elements that represent the core concepts of the study, particularly as the case study focuses on specific individual actors, groups, or events (Yin, 2009). Therefore, this allows the case to "capture the richness of the situation" (Hitchcock and Hughes, 1995, p317). In addition, Cohen et al. (2011) as well as Hitchcock and Hughes (1995) note that case study is focused on the richness and vivid description of events related to the case. Overall, this shows the richness of data as well as the in-depth analysis provided through the case study approach, while situating the context that is an integral part of the case study (Yin, 2009).

As for the ability to handle different kinds of data and evidence, Yin (2009) notes that the unique strength of a case study is "its ability to deal with a full variety of evidence – documents, artifacts, interviews, and observations" (p11). He also indicates that case study allows "direct observation of events being studied and interviews of the persons involved in the event" (p11). Also, Cohen et al. (2011) note that case studies preserve many variables and, therefore, recognise collecting data from multiple sources. They conclude that "case studies can blend numerical and qualitative data, and they are a prototype instance of mixed methods research" (Cohen et al., p289).

In the context of this research, a major strength of case study is the fact that its methodological aspects are vital for capturing data from multiple sources and for synthesising findings in diverse and complex environments. The environment under investigation in this study, an ESOL learning context, is a typical environment of such diversity and complexity. It is for this reason that a case study method is preferred.

In essence, the case study approach is utilised in this thesis as it allows assembling a range of evidence collected through both qualitative and quantitative methods in classroom settings, and through the online Scratch programming environment. Furthermore, case study design resonates well with the overall approach and paradigm in this thesis as the "integral involvement of the researcher" is considered an important feature of the case study (Hitchcock and Hughes, 1995, p317)

4.4 Design of the Case Study

The design of the case study in this project is a synthesis of a mixed methods approach that includes: interviews, questionnaires, participant observation, and analysis of produced artefacts. Also, a quasi-experimental embedded design was set up to support the triangulation of findings. This section discusses various design components and elements of the case study as used in this project.

Yin (2009) suggests five essential elements in the design of case study: (1) the question which the case study aims to answer; (2) its propositions; (3) its unit of analysis; (4) the logic linking the data and the proposition; and (5) the criteria for interpreting the findings. Following these guidelines, these components unfold as follows:

1. The case study seek to answer the research question of: *To what extent can constructionist interventions such as Scratch contribute to the achievement of higher levels of literacies among young adult ESOL learners?*
2. The case study propositions (Yin, 2009) serve in operationalizing the research question (Cohen et al., 2011), and they unfold as follows:
    a) Under what conditions might the Scratch programming environment help literacy students in acquiring higher levels of literacies?
    b) How can constructionist tools, such as Scratch, be incorporated within ESOL learning settings?
    c) What pedagogical aspects and contributions of the constructionist tool of Scratch might be helpful for ESOL young adult learners as well as their teachers?
    d) What are the effects of introducing the Scratch programming environment on students' abilities, engagement, confidence, and learning attitudes?

e) How and why the Scratch programming environment can be supportive in multi-cultural and diverse ESOL?

3. The unit of analysis of the case study is the individual core participant students in the targeted two ESOL classes. That is while the case study in this research consists of multiple case studies, each of the core participant students represents one of these multiple case studies discussed in Chapter 6.

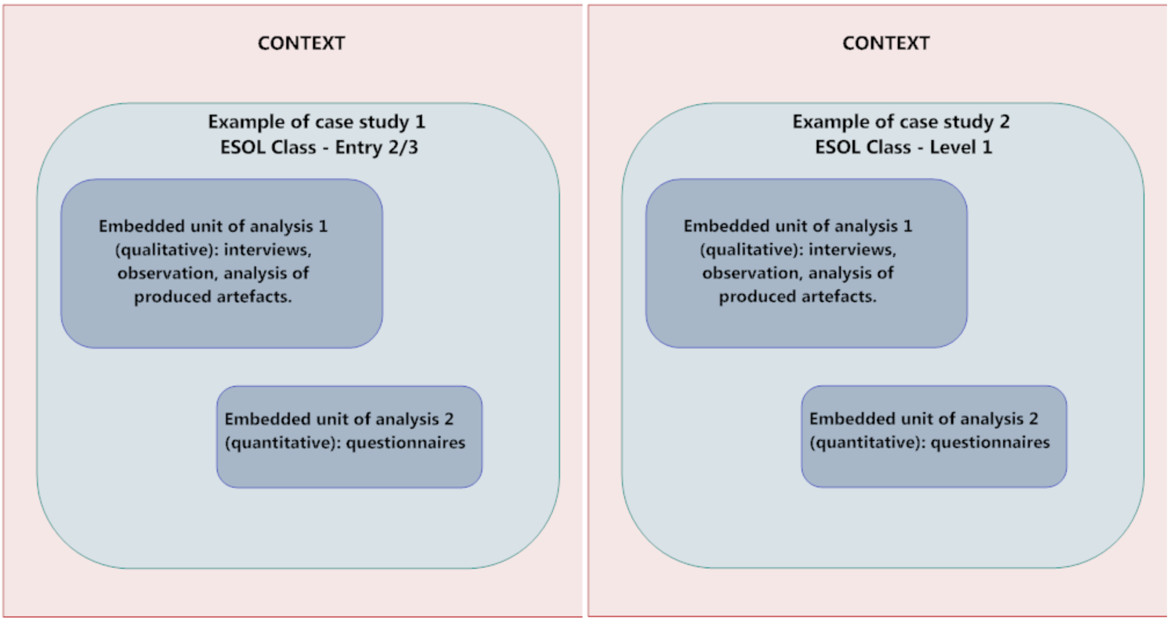
4. The logic linking the data and the proposition utilises the cross-case analytic technique in the analysis of the case study (Yin, 2009), which allows comparing and contrasting the multiple case studies in this research.

5. The criteria for interpreting the findings are synthesised through relying on the strategy of theoretical propositions underpinning the case study (Yin, 2009). Usually, well-defined propositions guide the researcher to include relevant data sets and ignore other non-relevant data sets (Yin, 2009). Also, as the propositions have already shaped the data collection plan in this project, these propositions constitute a relevant analytic strategy to interpret the data.

In this context, the design of multiple case studies with an embedded design (Yin, 2009), includes five case studies, which is useful in the triangulation process. The embedded design follows the mixed method approach and utilises major qualitative units of analysis as well as quantitative subunits of analysis (Yin, 2009). Consequently, the mixed method design allows addressing "more complicated research questions and collect a richer and stronger array of evidence than can be accomplished by any single method alone" (Yin, 2009, p63). Figure 4.1 provides an illustration of the design of multiple case studies with an embedded design.

Creswell and Clark (2011) discuss the embedded design in a mixed method approach and suggest two variations of embedded design: the first is when "one form of data is embedded within another form" (p190) as illustrated when interviews are embedded within an experimental type of research. The second variation occurs when "both forms of data are embedded within traditional designs or procedures", such as case study design or social network analysis (Creswell and Clark, 2011, p190). Based on Creswell and Clark (2011), one rationale for these variations is focused on "the data collection decisions for the embedded design" as well as "the timing of the embedded data" (p190). In line with the

Figure 4.1: a conceptualisation of multiple case study and embedded design which exemplifies two case studies in two different ESOL classes, based on Yin (2009, p46)



guidelines of Creswell and Clark (2011) and Yin (2009), the researcher utilised an embedded quantitative methods within qualitative case study research. The following four reasons inform this design:

a. to develop an instrument useful in conducting a constructionist learning intervention, as described earlier in the introduction of the Scratch programming environment,

b. to validate and support the qualitative outcomes with additional qualitative and quantitative data and, therefore, enhance the internal validity, trustworthiness, and fidelity of the outcomes,

c. to increase the understanding of the effects of the intervention on research participants, and

d. to explore and evaluate the potential of the emerging computational practices and interventions exemplified by Scratch.

Thus, this thesis adopts a case study research and mixed method approach that is a non-experimental research. Nevertheless, the research includes forms of experimentation by its very nature as illustrated in the Scratch projects developed in the case studies in Chapter 6.

4.5 REFLECTIONS ON LIMITATIONS AND STRENGTHS OF CASE STUDY

As with any research method, the case study approach has its limitations and strengths. Major constraints and critiques of case studies have focused on issues around generalizability and causality (Cohen et al., 2011; Hitchcock and Hughes, 1989; Scott and Morrison, 2007). Generalizability raises concerns about whether the case study method can be replicated and become useful to other researchers (Scott and Morrison, 2007; Slavin, 2007). Therefore, this triggers concerns about the authenticity and representation of the case that may lead to biased representations or understanding of the views and events in the case study (Scott and Morrison, 2007). One challenge would be deciding which data collected through the case study will support the representativeness of the case study the most (Slavin, 2007). Meanwhile, causality in case study may not represent clear or causal relationships between cause and effect similar to control-led or "true" experiments (Scott and Morrison, 2007; Yin, 2009). Other concerns about case study research are that it is time-consuming and generates massive documents (Yin, 2009).

However, according to Lincoln and Guba (1985), generalization in the naturalistic paradigm is contextualised as a working hypothesis, not decontextualized nomothetic accounts. They argue that cause and effects are simultaneously sharing each other, and, therefore, the naturalistic research aims to develop "an idiographic body of knowledge in the form of working hypothesis", not a "nomothetic body of knowledge" (p38). Along the same line of reasoning, Cohen et al. note that causality can be established in case study research in which the context of the case study is an influential factor in establishing causality. They argue that the growing number of case studies about certain phenomena leads to greater generalisability. Similarly, Yin (2009) argues that case studies provide crucial evidence to complement experiments that are limited in their ability to explain "how" or "why" certain treatment had certain results (p16).

Yin (2009) argues that case studies aim for "analytic" and "theoretical" generalizations, not "statistical" generalization as in experimental or survey research. He points out that the lack of texts and literature that cover case study research in a detailed manner is one reason behind several critiques or confusions around case study research. Cohen et al. (2011) second this argument and note that "case studies can make theoretical statements" (p295). They argue, therefore, that it is crucial to support the "theoretical statements" of a case study by evidence that requires "the nature of generalization in case study to be clarified" (p295).

This means that well-defined and clarified boundaries of the case study are essential to generate theoretical statements and generalisation. Also, although good case study is "difficult to organise", data in case studies is "strong in reality" and provide insights and perspectives that cannot be attained through traditional experimental methods (Cohen et al., 2011, p292).

Yin (2009) also notes that current case study research is unlike traditional reporting of case study research in a way which avoids prolonged narratives. He argues that the claim about the time-consuming nature of case study is usually mapped to the confusion between case study method and other methods of data collection such as ethnography and participant observation. Moreover, he notes that there is confusion between case study research and case study teaching, in which the latter can be changed to highlight a particular point helpful for learners while focusing less on, for example, evidence, findings, or conclusions.

4.6 Internal Validity and Reliability

Ensuring validity and reliability is a fundamental element of research (Cohen et al., 2011). Epistemological and methodological variations on what constitute validity, reliability, and trustworthiness vary across research paradigms (Cohen et al., 2011; Denzin and Lincoln, 2000). Therefore, validity and reliability in research may not be discussed without referring to their underlying paradigms. In fact, most critiques of qualitative research, including case study, originate from the positivist's views that embrace quantitative principles, such as controllability, replicability, predictability, generalizability, and objectivity (Cohen et al., 2011).

In this regard, to tackle what may appear to be a paradigm conflict, the naturalistic paradigm outlined by Lincoln and Guba (1985) provides insights into the underlying concepts of validity in qualitative research methods including the case study approach. They propose that the naturalistic paradigm is a "logical successor to the positivist point of view" (p47) and assert that there is a convergence between the pragmatic mixed methods paradigm and the naturalistic paradigm. In addition, they argue that the naturalistic paradigm challenges several axioms within the positivist's paradigm, and, therefore, stands in opposition to it. Consequently, they note that the naturalistic paradigm embraces multiple realities and truths, not a single reality while the researcher and the researched are inseparable and influencing each other, not independent. In other words, the inquiry in naturalistic research is "value bound", therefore, the value of inquiry is affected by the researcher as well as by the chosen paradigm, theories and approach to data analysis; on the other hand, positivists embrace "value-free" findings employed through an objective methodology (Lincoln and Guba, 1985).

In particular, ensuring validity is explained by whether the overall research elements, including research instruments, research question, observation schemes and tests are all "measuring the concept they intended to measure" (Swanborn, 2010, p36). Validity is concerned with "truth value" of conclusions in relation to the integrity of the techniques and methods used in the research (O'Leary, 2014, p62). According to Hesse-Biber (2010), validity is "whether or not a method's findings represent the phenomenon they are supposed to measure" (p100). He suggests that pragmatic validity is determined by the degree to which the findings of the research influenced the research population and its context. Moreover, Cohen et al. (2011) note that internal validity can be ensured through:

> "ensuring agreements between various parts of the data, matching patterns of results, ensuring that findings and interpretations derive from data transparency, casual explanations are supported by evidence (alone), and rival explanation and inference have been weighted and found to be less acceptable than the explanation or inference made, based on evidence" (p295).

In this context, ensuring levels of validity is accomplished through the case study approach which employs qualitative data collection methods and embedded quantitative methods. These data collection methods include: semi-structured interviews, participant observation, surveys and analysis of produced artefacts. Therefore, according to Yin (2009), three tactics are helpful to increase validity in case study research: first, collecting data and evidence from multiple sources. Accordingly, this research utilises mixed methods approach (Creswell and Clark, 2011) and multiple embedded design of case study (Yin, 2009), and, therefore, provides triangulation of evidence from multiple sources of data collection that include: multiple case studies, observation, interviews, analysis of produced artefacts, and quantitative embedded subunits. Second, establishing and maintaining a "chain of evidence" (p122) increases both the validity of the evidence and the reliability of information in a case study. This entails that the reader of the case study report can trace the evidence "from initial research question to ultimate case study conclusions" (p122-3).

Third, a validating procedure by having the case study report reviewed by "key informants" (Yin, 2009, p182). This tactic is feasible within a participatory research that encourages an active role for the research participants, especially the tutors. The learning and teaching activities at the research site were jointly planned with the ESOL tutor and the interpretations of the results frequently occurred through a formal interview and/or informal conversations and discussions at the research site.

Triangulation in a case study approach is vital for internal validity (Hitchcock and Hughes, 1995). Denzin (1970) discusses four types of triangulation: the first type is data triangulation, which entails gathering data over segments of time, from different locations, and from various people. The second, investigator triangulation, which involves more than one investigator in observing the object and gathering the data. The third, theory triangulation, which refers to using more than one theoretical approach to analysing and interpreting the data. The fourth, methodological triangulation which refers to using multiple research methods in gathering data.

In this context, this research ensures high levels of internal validity through: (1) gathering the data over an extended period of time, in which the nature of case study approach entails spending a relatively significant time at the research site, and gathering data and information from core and non-core research participants. This is discussed further in the research population and sampling; (2) although the researcher is the primarily responsible investigator in this research, the active participatory role of research participants, particularly the tutor, is argued to provide means for investigator triangulation in this research; (3) theoretical triangulation that provides conceptualisations through utilising theoretical lenses from multiple domains including the suggested framework of dynamic *computational sociocultural medium* (see Chapter 3, Section 3.13); and (4) utilising methodological triangulation which derives naturally from using mixed methods approach.

In addition, according to McNiff and Whitehead (2010), the evidence obtained through the analysis of digital artefacts supports higher levels of internal validity. They note that digital technologies support the validity of knowledge claims rigorously through showing the "living nature of an evidence base" (p54). Therefore, the produced digital artefacts in this research, using the Scratch programming environment, constitute "living" evidence that is expected to be, and remain, hosted online at the Scratch online community.

The above procedures are useful to avoid threats to internal validity which may compromise aspects of validity in this research. Such threats include the problem of absence of establishing causality in explanatory case studies which can be explained by “how and why event x led to event y”; and “the problem of making inferences” in which a researcher may “infer” certain causal relationships between events without a core observation or statement about the events (Yin, 2009, p42-3). Hitchcock and Hughes (1995) note that the “data does not speak for itself, but only through the interpreter” (p324). Their cases refer that the subjective view of the researcher and its effect on interpreting evidence could be another threat to the internal validity if not addressed with appropriate procedures to ensure levels of validity as discussed earlier in this section. Therefore, in conclusion, and in response to threats which may comprise internal validity in this study, the design of this research carefully considers achieving internal validity through the use of the multiple case studies and the integration of qualitative and quantitative research methods. This research project was designed to gather data from several sources, thus promoting triangulation of evidence from multiple sources of data collection. In addition, the participatory nature of this research was helpful in minimising biased interpretation and inference because this nature upholds a sense of team membership and shared goal among research participants including the students, tutor, and the researcher.

4.6.1 Reliability

To conserve higher levels of reliability, this research maintains documentation and descriptions of the implementation procedures. In addition, the research is designed to minimize errors and biases through utilising the mixed methods approach and triangulation of the evidence from multiple sources. This follows the concept of “replication logic” that overlaps between reliability and conceptual and theoretical generalizability (Yin, 2009, p42-5). Also, Morse et al. (2008) argue that maintaining rigour constitutes an essential element of reliability in qualitative research. They note that:

> “[the] rejection of reliability and validity in qualitative inquiry in the 1980s has resulted in an interesting shift for "ensuring rigor" from the investigator’s actions during the course of the research, to the reader or consumer of qualitative inquiry” (p13).

In this context, this case study research project does not echo the positivist’s view of reliability which proposes notions of reliability which are “independent of both the researcher(s), and independent of contextual properties” (Swanborn, 2010, p36). However, this study is aligned to the naturalistic paradigm (Lincoln and Guba, 1985) which proposes alternative views to reliability, such as avoiding bias, minimizing the errors, maintaining detailed documenting procedures, triangulation of the evidence from multiple sources and maintaining and ensuring rigor are all elements of reliability in this study.

4.7 External Validity

According to Lincoln and Guba (1985), the naturalistic paradigm suggests the terms "transferability" and "fittingness" as a replacement for external validity and generalizability (p124). They suggest that applicability of a working hypothesis from one context to another depends empirically on "the degree of transferability [that] is a direct function of the similarities between the two contexts" that they call "fittingness" (p124). They define "fittingness" as "the degree of congruence between sending and receiving contexts" (p124).

Yin (2009) argues that "case studies, like experiments, are generalisable to the theoretical proposition and not to populations or universes" (p15). He explains that case study research provides "analytic generalization" not "statistical generalization" as the goal of an investigator in conducting a case study research is to "expand and generalise theories" and not to "enumerate frequencies" (Yin, 2009, p15). Along the same line of reasoning, Lincoln and Guba (1985) argue that generalization in the naturalistic paradigm aims to develop a "working hypothesis", not a decontextualized single truth (p38).

In this context, this research has retained a detailed operational set of measurements and procedures helpful for maintaining levels of theoretical and analytical notions of the external validity. These measurements and procedures are aligned with notions of transferability and fittingness (Lincoln and Guba, 1985) which demonstrate the importance of the context in examining the relevance of the case study for other populations (Stringer, 2014). In particular, detailed procedures for implementation included: training materials for the ESOL tutor, lesson plans for students, detailed implementation plans and description of the cycles of implementation, detailed record of "what works", a summary of problems and difficulties faced, and the researcher's responses to these problems. In addition, the methodological frameworks and research methods utilised were discussed in detail. In conclusion, all these documentations were essential for maintaining levels of external validity, theoretically and analytically, of the case study and the overall research.

4.8 RESEARCH POPULATION AND PROJECT SAMPLE

This research has utilised purposeful sampling (Creswell, 2011). The rationale behind this was because sampling in qualitative research "purposefully select[s] participants who can best help you understand the central phenomenon that you are exploring" (Creswell, 2015, p77). This echoes one of the central arguments of the naturalistic paradigm that purposive sampling "is done with some purpose in mind" (Lincoln and Guba, 1985, p199).

Creswell and Clark (2011) note that the identification and recruitment of a small number of research participants in qualitative studies can provide comprehensive and detailed information about the phenomenon under investigation. Unlike quantitative research, the sample in qualitative research aims to construct "in-depth understanding of few people" (Creswell and Clark, 2011, p174). They, therefore, note that the sample size in a case study varies between four to ten participants. Also, based on Croswell (2015), there are three important aspects to consider in sampling when designing and conducting a mixed methods research. These include: sample size, identifying the participants in the sample, and instruments used for data collection.

The literature acknowledges that qualitative research does not aim at statistical generalization, and, therefore, uses very small numbers of participants (Creswell and Clark, 2011; Yin, 2009). Therefore, using the following three different triangulation strategies was beneficial to enriching the data from a relatively small sample size; that is the case in this research. First, the data was collected from multiple sources that included core and non-core participant students and tutors. Second, apart from the core and non-core participant students in this study, an additional survey was administered to a group of non-core participant Scratch tutors in the UK in order to corroborate or negate the conclusions and findings of the case studies. Third, the theoretical triangulation built into this study constitutes an important supporting component. For example, the discussion of the emerging "computationalised" sociocultural learning medium has helped in providing the theoretical background, explaining the emerging phenomenon of personalised computational environments, and providing possible projections of future learning environments.

4.8.1 Project Sample

This study drew from a non-probability sample. The sample can also be seen as a convenience and purposeful sampling (Creswell, 2011). In this regard, Willington (2000) suggests that:

> "Non-probability sampling is perhaps more feasible and more informative in qualitative research for a number of reasons. First, due to the intensive nature of fieldwork, convenience sampling on a non-probability basis may be the only option open to a project or an individual. This may also help to overcome the problem of access or gaining entry" (p59).

There are four levels of engagement for the different groups of participants in this study. These four levels of engagement fall into the two groups of core participant and non-core participant students and tutors

1- The core participant students' group consist of six ESOL students from the two ESOL classes at the research site that were taught by the same ESOL tutor who was recruited in this research. The two ESOL classes identified were ESOL Entry level 2/3 and ESOL Level 1 in a Sixth Form College in North London. The students were learners who had arrived in the UK in the last two to three years. Individual students were recruited from each class after they voluntarily agreed to take part in the research and provided consent forms signed by them, and by their guardians if they were under 18 years old. The core participants' sample was selected because it was relevant to the nature of the case study research that requires this project be conducted for an extended period. Hence, there was a preference from the beginning to allocate research site and learner for at least four to six months of learning duration. The case study in this project was developed based on the multiple case studies which represent the core participant ESOL students.

2- The non-core participant students and tutors which consist of the following groups:

   (a) Non-core participant students at the research site: this group consist of 23 students who were not able to engage more fully in the research, but they agreed to take part in certain surveys and interviews after providing their consent. The involvement of non-core participants was useful to gather essential initial data about the population at the research site during the planning phase. This initial data was useful in investigating the willingness of the ESOL students to take part in the study and their connectedness to the internet which informed the design of the introduction of study to them.

   (b) Non-core participant ESOL tutors: this group consists of eighteen ESOL tutors, from thirteen ESOL centres in London, who were invited to be involved as core participants, but did not agree to take part more fully in the study. Those non-core participant ESOL tutors agreed to take part in surveys and interviews served in providing understandings about the reasons for their decisions. The data collected from this group served in extending the understanding of the institutional environment of those ESOL tutors through discussing their personal views. Therefore, this group provided additional data about the context of their ESOL centres as well as the levels of willingness and readiness of these centres to host computational interventions aimed at complementing the ESOL curriculum using Scratch computational environment.

(c) Non-core participant Scratch tutors: this group consists of 77 tutors with experience in teaching Scratch to students in the UK. The tutors in this group responded to Survey 4, entitled "Survey of Scratch tutors in the UK" discussed in Chapter 8, and provided their views on the impact of Scratch on the achievement of their students. In particular, this group of tutors provided their perceptions on the subjects through which Scratch can be used to enhance the achievement of students as well as the skills that can be improved using Scratch. This served in triangulating the findings of the case studies and provided additional perspectives on ways the computational environment of Scratch could enhance the achievements and skills of the ESOL students in this study.

The following Table 4.1 summarises the above groups of core participants and non-core participant students and tutors. It also shows the sample size as well as the methods used in each of the groups.

Table 4.1: sampling and methods used in this study

#	**Sample type**	**Sample size**	**Method used for collecting data**
1	Core participant ESOL tutor	1 tutor	1- Interviews. 2- Personal communications.
2	Core participant Students (case study students)	- 4 students from ESOL Entry Level 2/3 class - 2 students from ESOL Level 1 class	1- Interviews (5 semi-structured interviews) 2- Weekly observation and reflections with the ESOL tutor about the participant group of students. 3- Survey on the usage of the Internet and Scratch (Survey 1). 4- Analysis of produced artefacts.

3	Non-core participant students (taught or co-taught by the same ESOL tutor)	23 students from different ESOL levels at the college.	1- Survey for students who did not eventually agree to participate more fully in the research (Survey 2). 2- Interview (one semi-structured interview). 3- Survey on the usage of the Internet and Scratch (Survey 1).
4	Non-core participant Scratch tutors in the UK	77 tutors with experience in teaching Scratch to students in the UK	1- Survey of Scratch tutors in the UK (Survey 4 discussed in Chapter 8).
5	Non-core participant ESOL tutors who did not eventually agree to take part more fully in the research	18 tutors	1- Interviews. 2- Observations. 3- Personal communications. 4- Surveys for tutors who were not able to participate more fully in the research (Survey 3)
6	Approached site for recruitment	13 institutions	1- Observations. 2- Personal communications.

Regarding the above sample, some authors suggest various requirements for the sample size in order to maintain a representative sample. However, in the case of purposive sampling, it is applied to a particular population in this study such as the population in the targeted ESOL classes, the tutors and students who did not eventually agree to participate more fully in the research, and Scratch tutors with experience of teaching Scratch in the UK context. Cohen et al. (2011) note that sampling:

> "is used to access 'knowledgeable people', i.e. those who have in-depth knowledge about particular issues, may be by virtue of their professional role, power, access to networks, expertise or experience" (p157).

In this context, the core participants' sample can be described as a "homogeneous sampling" (Miles and Huberman, 1994, p28) because they shared a similar context of being at the same ESOL classroom and college and because they were taught by the same ESOL tutor. The participant sample can also be described as "a convenience" and an "opportunistic sampling" (Bogdan and Biklen, 1992, cited in Cohen et al., 2011, p 229) that follows the pragmatic paradigm of this research. I would be, however, careful if referring to the group of ESOL students as homogeneous because they may share as many individual differences as similarities, such as being at the same ESOL classroom or college.

While the research approach is a case-study-based using embedded design (Yin, 2009), a suitable research site would enable access to multiple case studies as this constitutes one of my strategies for triangulation in this project. The data collected from core participant students in the case studies is supported by a set of quantitative and qualitative data collected via the survey method (Creswell and Clark, 2011). I have opted for this approach because it helps to maintain the naturalism (Lincoln and Guba, 1985) of the study, and it provides additional layers of triangulation of the findings from sources other than the core research participants. This contributes to maximising the internal validity and trustworthiness of the study. The survey research instruments are discussed in detail in section 4.11 entitled “Triangulation of Data Sets” in this chapter.

4.9 METHODS OF DATA COLLECTION AND ANALYSIS

This project utilises case studies for individual participants using mixed methods approach that includes four data sets: interviews, participant observation, surveys and analysis of produced artefacts. The data sets were gathered via a number of data-collection methods. The qualitative data sets range from a casual chat in a lift with a core research participant to weekly observations in the ESOL classrooms and several semi-structured interviews. The surveys vary from two surveys consisting of a short questionnaire of four closed questions that can be answered in two to three minutes to an online survey consisting of a number of closed-ended and open-ended questions that was emailed to more than two hundred non-core participant Scratch tutors through utilising online forums and discussion groups dedicating for tutors in the UK. The subsequent sections discuss methods of data collection utilised in this research.

4.9.1 Interviews

Interview is a frequently used method in qualitative research, and it constitutes a key source of data collection in case studies (Yin, 2009). This study has utilised in-depth interview (Cohen et al., 2011) that targeted key respondents through guided conversations about their opinion and experience of using Scratch programming environment while discussing how this project had affected their learning experiences, abilities and, therefore, attitudes. In addition, Cohen et al. (2011) note, using the interview method enables interviewees to discuss their views on the phenomenon under investigation from their own perspectives.

In this regard, the interviews conducted in this study have contextualised the students’ experiences which revealed qualities that perhaps were not visible solely through observation or the analysis of produced artefacts (Wellington, 2000). Consequently, the interviews were in line with the protocol of the case study which includes the case study question and propositions, through asking conversational questions (Yin, 2009). Therefore, I invited research participants to interviews for several reasons that include to learn more about their experience in certain activities using Scratch, gather insights about observations recorded in the classroom, and conducted a sort of evaluation with them about their experience and to what degree they might have benefitted or not through taking part in the research.

In this context, I conducted nine semi-structured interviews with the core and non-core research participants at the end of the study which are listed with dates and coded names in Appendix 6. The nine semi-structured interviews have been conducted as follows: five semi-structured interviews with core participant students in order to discuss the findings with them and develop insights about each individual students; one interview with a non-core participant student to learn more about his reasons for not taking part in the research; one semi-structured interview with the participant ESOL tutor at the research site; and two semi-structured interviews with non-participant ESOL tutors who were not able to take part more fully in the study.

For the participant tutor, it may be difficult to quantify or to make clear cuts between what constitutes an interview and what does not, because many of our meetings and discussions can be regarded as interviews. However, as stated above, there was one semi-structured recorded interview with the ESOL tutor formally scheduled at the end of the project, and it aimed at furthering the understanding about the experience of the tutor as well as to discuss the primary findings and conclusions of the research. However, these formal and informal chats and discussion could have raised some ethical implications which are discussed in section 4.11 entitled "Ethical Principles and Guidelines" in this chapter.

The length of each interview varied between 15 minutes to 60 minutes. Although there were ESOL students who could develop a conversation through an interview that lasted for 45 minutes or more, other students, with lower English language skills, may become overwhelmed if they were interviewed for more than 15 minutes. Hence, there is a difference between interviewing an English speaking ESOL tutor and an ESOL student who recently came to the UK and is currently working on developing his or her English language skills including speaking skills.

I utilised a digital dictating device to record the discussions and responses during interviews. Using this device was helpful as a way to focus on the discussion during the interview without needing to take detailed notes. Also, using a digital dictating device enabled me to record all conversations and all responses that perhaps would not be possible via hand note taking. After each interview, I immediately transcribed the recordings of the sessions. The transcription was examined and reviewed at least three times before being coded to maintain the anonymity and confidentiality of the research participants.

After the transcription of the recordings, I had to listen to the recorded responses and discussions and verify the transcriptions more than one time. ESOL learners sometimes express themselves using poorly structured English sentences or with an accent that is sometimes difficult to understand. The transcriptions, therefore, contain in several instances an additional explanation between brackets for the meaning of the sentences from the responded interviewees. In one occasion, an ESOL student, with a Spanish native spoken language, sometimes used Spanish words in the English conversations during the interview. So, I had to check the recorded interview with another Spanish native speaker to verify certain words in the recorded interview with this student. In two occasions, the researcher had to rely on note taking instead of using a dictating device because the interviewed students expressed concerns about using a dictating device during the interview or to record their responses.

Finally, while having a biased conversation and understanding constitute a major concern in conducting interviews, two elements in this research supported neutral and unbiased conversations in interviews. First, the researcher involved in this project spent a relatively long period of time with the research participants, and, therefore, he should not be considered an "external" person to the interviewees because he spent few months not just observing research participants but also leading them as a team to experiment with new learning practices. Second, it is important to emphasise that interviews, similar to the other methods utilised in this research, were utilised within a wider methodological framework which serves the triangulation of the datasets through different research methods in order to support respondent validity. Consequently, the conversations during interviews were focused on the produced artefacts and learning qualities including self-confidence, attitudes to learning, interest and enthusiasm to learning. This allowed triangulation of the findings from multiple data sets.

4.9.2 Participant Observation and Field Notes

According to Cohen et al. (2011), observation allows researchers to capture "'live' data from naturally occurring social situations" while systematically noting people events, behaviours, and artefacts (p456). They note that observation is helpful in classroom settings. By implication, therefore, it has been useful in this study because it captured facts, such as number of students or books in a classroom; or events, such as amount of discussion or collaboration between students and tutor in a classroom; or behaviours and qualities, such as attitudes of students towards completing specific exercise or addressing themes in assignments. In addition, Yin (2009) notes that participant observation offers unique opportunities for collecting data in case study research. He argues that evidence drawn from observation provides useful information about the topic under observation. Accordingly, in the case of observing new technology or curriculum at schools, he concludes that:

> "observations of the technology or curriculum at work are invaluable aids for understanding the actual use of the technology or curriculum or any potential problems being encountered" (Yin, 2009, p110).

As such, this research has used the "participant-observation" method in which the researcher was not a passive observer but a participant in the events being observed (Yin, 2009, p111). The observation of participants was an essential data-collection method, given the weekly visits to the ESOL classes during two terms, and the participatory nature of the research. Most of the observation remarks were discussed with the core participant ESOL tutor through personal communications as well as during scheduled or unplanned discussions. For example, usually, when the ESOL class finished, I would stay in the classroom and help to arrange the chairs and tables, or assist the tutor in carrying the teaching materials back to his office, especially if we had to take the laptop trolley downstairs using the lift. During this short period of around 10 minutes, we would discuss our observations and our impressions of the class while planning future classes. Similarly, I would arrive at the ESOL class a few minutes early and wait at the door, along with the students, for the classroom to become available. These few minutes were valuable because I could start conversations with the students and receive feedback and reflections, about their studies in general and the Scratch activities in particular.

In this context, I think that almost any corridor or lift talk, conversations while waiting for the classroom to become available, and discussion over coffee with the tutor or students in the cafeteria are all necessary means of communication with core participants, in that they usually lead to important observations. In other words, “participant observation here has a wider embrace, including visual observation, document analysis, interviewing core observation and introspection” (Flick, 2009, p226).

Because this was a “naturalistic observation” or “participant observation” (Cohen et al., 2011; Flick 2009), several types of activities and data collection methods could constitute a framework for observation. These activities and data collection methods include: my experience of observing participants, all discussions, reflections, and interviewing. However, what it initially looks like blurred boundaries between formal and informal conversations in conducting participant observation prompted an ethical dilemma discussed in section 4.11 entitled “Ethical Principles and Guidelines” in this chapter.

In the process of carrying out a participant observation, the role of the researcher can be seen as both observer and participant which could have some advantages and disadvantages. The question here is what implications a participatory role of the researcher could have in conducting observation in classroom settings. To address the effects of this role, it is useful to distinguish between different roles for researchers in conducting participant observation.

Several authors list different types and roles in observing participants. For example, Check and Schutt (2012) suggest the two types of overt participation and covert participation. According to them, the overt participation type maintains an active participatory role in the processes of observing participants. Whereas, the covert participation type keeps the identity of the researcher secret, usually in order to gain entry by acting similar to the targeted participants.

The overt observation has several advantages over the covert observation type such as allowing the researcher to take note and record the phenomena instantly. Also, this allows the researcher to discuss his or her observation with the students and their teacher in a following up interviews or conversations. Another important element in conducting an overt observation is managing the relationships between the researcher and the observed participants in the research setting (Maxwell, 2012; Check and Schutt, 2012).

This relationship has the potential to create a collaborative research environment through which the participant students are able to act normally under observation. However, a lack of planning and attention to managing this relationship could lead to some adverse effects that undermine trust building with the ESOL students. Therefore, this has the potential to lock the researcher in an outsider position that manipulates the behaviours of the students under observation.

In order to avoid the negative implication of the researcher-students relationship, the researcher planned the entry to the ESOL classrooms with the help of the participant tutor, prepared an honest and plausible explanation about himself and the research, and continuously supported the ESOL students throughout the research (Check and Schutt, 2012). These procedures were essential in the researcher's role as an observer and participant with whom the students are well informed about his identity and the purpose of his study.

Participant observation may have disadvantages and limitations. Baumfield et al. (2012) note, "when you do an observation, you are analysing from the moment you begin. Before you even pick up a pencil, you have decided upon what to record, and what to ignore" (p144). Although it is true that my observation was primarily focused on the processes and results of the planned classroom activities, this observation was not only limited to the Scratch activities. However, it was important to focus on the planned Scratch activities as well as to keep an open eye and mind to all other classroom activities and student behaviour.

Furthermore, Check and Schutt (2012) note that observation may entail various errors including "selective observation" that is biased to the observer's preferences; or "inaccurate observation" in which an observer may interpret a situation in an inaccurate way (p6-7). Also, gaining access to groups under observation constitutes a major constraint (Yin, 2009). However, in this case study research, gaining access and recruiting research participants had been determined at an earlier stage of the project and was not only associated with collecting data through observation. Therefore, the constraint of gaining access does not represent a major issue in conducting observation in this study.

4.9.3 Analysis of Produced Artefacts

Artefacts constitute one source of evidence that is beneficial for the development of educational research (Cohen et al., 2011). These artefacts may include technological, cultural, objects, equipment, pictures, physical artefacts, or a work of art (Cohen et al., 2011; Yin, 2009). Projects produced using computers, as in virtual computer projects or printouts, exemplify physical artefacts (Cohen et al., 2001; Yin, 2009). Therefore, projects created using Scratch programming environment constitute valuable artefacts in this research.

According to Cohen et al. (2011), artefacts may include objects in a classroom that are helpful to draw conclusions about the environment of the classroom in which "objects can make a point…very tellingly" (p532). Therefore, in the processes of analysis of certain artefacts, it is helpful to analyse artefacts in conjunction with other methods and sources of data collection. Different research methods converge to draw a holistic picture of the targeted environment and groups under study in this research. In other words, the analysis of artefacts using multiple research methods is helpful to avoid making inference or biased understanding by the researcher; because "[i]nferring a total picture from the artefacts alone may be dangerous as they may signify very different or discrepant realities" (Cohen et al., 2011, p532).

The analysis of the produced artefacts is underpinned by a framework incorporating the two models of computational thinking (Brennan and Resnick, 2012), multimodal literacy (Jewitt, 2008; Kress, 2000). The analysis of artefacts produced within a computational thinking framework (Brennan and Resnick, 2012) provides useful insights into the work of students using Scratch programming environment. According to Brennan and Resnick (2012), computational thinking is defined by the following three dimensions: computational concepts, computational practices, and computational perspectives. In particular, they suggest three approaches to assess aspects of computational thinking and learning when young people engage in programming computational artefacts; these are: (1) project portfolio analysis; (2) artefact-based interviews; (3) design scenarios.

Multimodal literacy (Jewitt, 2008) offers a useful model for the analysis of the digital artefacts in classroom settings. This includes multimodal communication and visual literacy which provide a lens for analysing the classroom language learning through the mediation of digital Scratch artefacts. Also, the multimodal literacy model offers a discourse analysis approach in investigating the classroom discourses from the social semiotic perspective (Jewitt, 2008; Kress, 2000). The elements of discourse analysis within the multimodal literacy framework are essential in the analysis of the digital artefacts because they enable the researcher to carry out a contextual analysis of the artefacts which includes the discourses emerged around the construction of these artefacts.

The analysis of the produced artefacts is carried out within the context of the case study. Therefore, the analysis of the artefacts is discussed along with elements of the case study which investigate enhanced levels of multimodal literacies. This includes analysing the artefacts from the perspectives of Bloom's taxonomy of learning domains (Anderson et al., 1996; Bloom, 1956). In this context, the analysis of the artefacts is helpful in mapping the computational practices within the Scratch programming environment into the learning outcomes of ESOL students. These artefacts produced and hosted at Scratch's online community are essential to assess dimensions of computational thinking and learning as well as their effects on achieving higher levels of literacies. In addition, artefacts produced by students constitute an essential input to other data collection methods of interviews and participant observation.

4.10 Triangulation of Data Sets and Quantitative Embedded Design

As the population of this study is small, the research has utilised embedded quantitative tools within the larger qualitative design. This approach has served the triangulation of the findings from multiple data sets that included core and non-core participant students and tutors. According to Creswell and Clark (2011), the "embedded nature occurs at the design level… [and, therefore,] the embedded method is conducted specifically to fit the context of the larger qualitative design framework" (p68).

Many authors noted that the triangulation of data sets could provide additional insights into the phenomenon under investigation. Denzin and Lincoln (2013) argue that the qualitative research inherently multimodal in focus. They suggest that "the use of multiple methods, or triangulation, reflect an attempt to secure an in-depth understanding of the phenomenon in question" (p9). Ragin and Becker (1992) note that specialised or key informants, who are willing to share information about the research population, can provide valuable insights about the phenomena under investigation. Also, Blenker et al. (2014) review propose an educational research framework that permits the triangulation of a primary data source with data collected from outsider research collaborators in order to gain in-depth and analytical generalizable studies. As such, the triangulation of the data sets helped in providing additional perspective in answering the research question in this study.

Flick (2014) notes that "triangulation refers to combining different sorts of data on the background of the theoretical perspectives, which are applied to the data" (p184). He argues that triangulation is "less a strategy for validating results and procedures than an alternative to validation” and points out that triangulation, as an approach, can extend the knowledge gained using qualitative research methods. He also suggests that:

> “triangulation (of different methods or data sorts) should allow a principal surplus of knowledge. For example, triangulation should produce knowledge on different levels, which means insights that go beyond the knowledge made possible by one approach and this contributes to promoting quality in research” (p184).

In this context, the data segments in this study were collected from multiple sources other than core participant students and tutor. These data sets, which gathered through surveys and interviews methods, have provided an additional layer of data to either validate or negate the findings and conclusions of some aspects of the research emerging from the case studies. In other words, the surveys were used “to support or refute a hypothesis about certain population” (Cohen et al., 2011, p256). Furthermore, triangulation necessitates multiple methods to be utilised when collecting data (Maxwell, 2012). This strategy is useful to protect the data, and the findings, from validity threats. As such, the data collected through the surveys and interviews is considered an important component of the evidence which was used in the triangulation of data sets in this study.

4.10.1 Survey

Surveying involves the collection of data through questionnaires that ask a group of individuals a similar set of questions regarding their views, opinion, or attributes (O’Leary, 2014). The research instrument of the online and paper-based surveys was employed within the qualitatively driven mixed methods design in this study which includes quantitative embedded research methods. The qualitative and quantitative data collected from the surveys provided information on the research question from a larger sample, which includes the non-core participants. The following two sections discuss the survey sampling and the method of data analysis of the surveys conducted in this project.

The surveys in the form of a questionnaire administered to students and tutors follow the principles of the non-probability purposive sampling. Table 4.2 lists the surveys conducted in this study and their response rate.

Table 4.2: a list of the surveys administered and response rates (%)

Survey #	Name of the survey	Respondents	%
Survey 1	Survey on the usage of the Internet and Scratch.	13 core and non-core participant students (N= 15 active students)	92.85

Survey 2	Survey of the students who did not eventually agree to participate more fully in the research.	7 (N= 9 non-core participant students)	77.77
Survey 3	Survey of tutors who did not eventually agree to take part more fully in the research.	4 (N=15 non-core participant tutors)	26.66
Survey 4	Survey of Scratch tutors in the UK (discussed in Chapter 8).	77 (N= 225 non-core participant Scratch tutors)	34.22

Survey 1 (Appendix 2) on the usage of the Internet and knowledge of Scratch is a paper-based survey and was administered to students at the targeted two ESOL classes. A total of 13 students (86.86%, N=15 active students) responded to this questionnaire. The non-active students are defined as students who are registered for the course but never attended the class or who attended only a few times during the spring and summer terms. Therefore, I opted to exclude this group of students in the data analysis.

Survey 2 (Appendix 3) targeted the non-core participant students in the two ESOL classes and received seven responses (77.77%, N=9). Survey 3 (Appendix 4) was administered to non-core participant tutors and received a low response rate of 26.66% (N=15). Despite the low response rate in Survey 3, additional data was collected through interviews with two of the non-core participant tutors. Surveys 1, 2 and 3 are discussed in Section 5.2, entitled "Findings from Surveys which Served in Developing the Context of the Case Study" in Chapter 5.

Survey 4 (Appendix 5) targeted Scratch tutors with experience in teaching Scratch in the UK. The survey utilised the maximum variation sampling strategy (Lincoln and Guba, 1985; Wellington, 2000), and targeted Scratch tutors with mixed gender and diverse experience, age and school/college levels where they teach. A total of 77 tutors (34.22%, N= 225) responded to the survey. The findings from this survey provide essential triangulation to the findings that emerged from the case studies through discussing the views of knowledgeable people. This survey is discussed in Chapter 8.

Given the nature of this case study project, the diversity and the teaching experience of the Scratch tutors provided significant perspectives in this research. According to Bernard and Ryan (2010), the respondent Scratch tutors can be described as specialised or key informants who are well-informed people about their culture and context and willing to share this knowledge with researchers. They argue that once the researcher identifies knowledgeable people, “even fewer informants are needed” (p360). The authors illustrate this by noting that “[t]here is growing evidence that 20-60 knowledgeable people are enough to uncover and understand the core categories in any well-defined cultural domain or study of lived experience” (p360).

4.10.2 Method of Data Analysis of the Surveys

The surveys in a form of questionnaires were designed to allow respondents to answer closed-ended and open-ended questions. The expectation was that, as argued by Cohen et al. (2011), open-ended questions allow participants to respond to the questions as well as express and explain their views as they wish without the limitations of the closed-ended questions. Therefore, the analysis of data collected through surveys draws considerably from the principles of descriptive statistics (Fink, 2006) as well as thematic coding and content analysis (Flick, 2014). All the survey questionnaires in this chapter include a form of multiple choice and binary questions that were analysed quantitatively through the principles of the descriptive statistics. The findings from the quantitative analysis are presented in the form of charts and tables.

With particular reference to the questionnaire administered to Scratch tutors in the UK, the qualitative analysis of the responses to the open-ended questions was in line with the principles of thematic coding and qualitative content analysis (Flick 2014). According to Flick (2014), thematic coding is useful in data reduction that includes disparate and varied responses as the “underlying assumption was that in different social worlds or groups, different views can be found” (p423). In particular, Braun and Clarke (2006) defined thematic analysis as:

> “a method for identifying, analysing and reporting (themes) within data. It minimally organizes and describes your data sets in (rich) detail. However, frequently it goes further than this, and interprets various aspects of the research topic” (p.79)

Flick (2014) notes that the procedures for applying thematic coding follow “a multi-stage procedure” in which data cleaned and any irrelevant data removed before the analyses which included cycles of thematic coding (p424). Each cycle included the identification of a group of themes. Consequently, the cycles of thematic coding resulted in generating broad thematic headings. As such, the procedure for thematic coding aimed at developing an essential "system of categories" for the analysis of data in which an open coding is applied initially before a selective coding procedure is carried out (Flick, 2014, p425).

4.11 Ethical Principles and Guidelines

This research was designed taking into consideration ethical requirements. As a research study with human subjects, it follows precise ethics principles to avoid any bias or harm to all participants. This includes distribution of detailed descriptive materials for participants that clearly show the purpose of the study and their rights in this research. The ethical framework in this research ensures safeguarding confidentiality and anonymity of research participants. Also, this research complies with the principles and advice of the British Education Research Association (BERA, 2004) that education research should be carried out with an ethical consideration regarding: persons, knowledge, democratic values, quality of the research conducted, and academic freedom. Examples of the core participant consent form and the project information sheet are available in Appendix 1.

Data collection commenced immediately after ethical approval was obtained from the University of Greenwich Research Ethics Committee (UREC). The informed consent form and the project information sheet were prepared and administered during the course of recruiting core research participants. The project information sheet aimed to ensure that the participants understood the nature of the study. The consent form was designed and worded as simply as possible so that it can clearly inform potential participants about their rights, including their right to take part in, withdraw from the study, and to ask questions about the project.

In line with the guidelines set out in the ethics application, the data gathered in digital form were stored for a suitable period in a password-protected cloud on the University of Greenwich servers. These include the digital files of the recorded interviews, in-classroom video recordings, the transcriptions of the interviews, discussions notes, and field observations and notes. All the work reported in the thesis has upheld the ethical guidelines and the considerations for protecting all research participants and has avoided any bias or harm to them. This includes safeguarding the confidentiality and anonymity of the research participants (Cohen et al., 2011). Therefore, any personal information about the participant students is coded, and, if necessary, anonymised using a false name.

Although the designs of the surveys usually have fewer ethical implications than that of field research (Check and Schutt, 2012), the surveys in this study followed precise ethical procedures and guidelines to avoid any bias or harm to all respondents to the online and paper-based surveys. With the data collected from non-core participants through the online and paper-based surveys, a consent form was provided at the beginning of the survey. The first page of the online surveys required respondents to read the consent form and agree to its content before they complete the questionnaire. Similarly, with the paper version of surveys, expectations were carefully explained with a focus on voluntary participation and the protection of personal information.

The students who were invited to complete questionnaires or participate in interviews throughout the course of this study were given the choice not to participate if they wish so. The researcher and the tutor explained to them that filling a questionnaire or accepting invitations for an interview is done on a voluntary basis. Similarly, all questionnaires administered online contained consent information which was displayed on the first page of the questionnaire. Therefore, only tutors and students who read and accept the consent form were able to proceed and start filling the survey. Examples of the consent forms provided in the conducted surveys are available in the Appendices 9, 10, 11, and 12.

The age of eligibility (18 years) was also clearly emphasised. Obtaining consent from students who were considering participating in the study required a sensitive procedure that needed careful planning and follow-up. Issues arose during the recruiting of students to take part in the project were:

1- Age of participation: There was the possibility that some of the participants might be under the age of 18. To address this, the researcher ensured that for students under the age of 18, their consent and that of their guardian were required before they could take part in the study.

2- Safeguarding communication: It was anticipated that some of the younger participants might have guardians with limited ability in the use of the English language. This means that there is the potential for them not to understand fully the documents that would be given to them, such as the consent form.

To address this situation, the researcher consciously ensured that the consent form and the project information sheet were written in simple English. While this might be a necessary condition for safeguarding communication, it was felt that it might not be a sufficient condition. As such, the necessary information was provided repeatedly and slowly to participants and their guardians. Both participants and their guardians were encouraged to ask any question. No question was considered stupid or irrelevant.

Another ethical issue which arose in conducting this study is the question of whether, and under what conditions, the informal and casual conversation could be considered part of the research data. According to Cohen et al., this issue triggers "the problem of ethical dilemma" (p89).

In this regard, there are four views that provide insights into this ethical dilemma; the first view suggests that the background, experience and personal values of each researcher determine whether a discussion with participants could be ethically considered part of the research data (Sikes, 2006; Frankfort-Nachmias and Nachmias, 1992). The second view advocates that this dilemma is driven by the methodological design of the qualitative or interpretive research (Hitchcock and Hughes, 1995). The third view proposes that this dilemma can be explained as a conflict between the rights for the researcher to produce new knowledge via conducting research versus the rights of the research subjects to safeguarding their privacy, respect and dignity (Frankfort-Nachmias and Nachmias, 1992). Moreover, the fourth view shows the maintenance of good relationships between a researcher and participants allows making clear-cuts between what constitute formal and informal conversations to be included in qualitative research data (Cohen et al., 2011).

While each of the above views tackles aspects of the inclusion of informal or casual conversations in the research data, I think it is necessary to return to the basic ethical principles and guidelines which ensure avoiding any bias or harm to all participants; their right to be fully informed about the nature of the study; and their rights in this research including their right to take part in, withdraw from the study, and to ask questions about the project. Along with maintaining a good and honest relationship with the research participants, these ethical principles and guidelines informed the process of inclusion of informal chat or discussion with the core participants into the research data. The following summary further explains this view.

In summary, several factors ensure the ethical principles and guidelines in this study, including formal and informal conversations or chats. First, the participant students were fully informed about the purpose of the study and my role as a researcher at their college. Second, similar to the ethical principles in conducting interviews and surveys, during the investigator's conversations with the participant students, the students were usually reminded about the purpose of the study in informal words, which could be convenient to them as ESOL students. Third, the researcher shared and discussed a summary of what he noted and observed with the participant students during the interviews, which were scheduled at the end of the study. Fourth, as the researcher is not an insider in the institution where the study took place, the relationships developed with participant students and the tutor were managed more efficiently than it is the case in the research environment where the researcher is an insider. This helped in avoiding negative implications triggered by power relations issues inside the institution.

Finally, the researcher obtained the Disclosure and Barring Service (DBS) certificate to work with ESOL students at the research site. This certificate was requested by the ESOL department manager and submitted to the college, as on many occasions the researcher had to interview students and work with them in groups or on a one-to-one basis at their college and outside of the usual teaching hours.

4.12 Chapter Summary

This chapter has discussed the research methodology that utilises a case study approach and mixed methods research. Convergence has been shown between the ontological views of pragmatism, mixed methods, and the case study approach. The methods of data collection were discussed in the context of case study research. The research validity, reliability, and trustworthiness have been established through designs that provide triangulation at the theoretical, methodological, data collection levels. Also, techniques and models of analysis of case study research have been discussed. The chapter has also discussed the research sampling procedures which utilise the purposeful sampling. Finally, the chapter has discussed the ethical principles and considerations applied in this project and their implication.

CHAPTER 5: THE CONTEXT OF THE CASE STUDY

This chapter provides the context of the case study and it falls into three parts. The first part describes the communications and planning for the case study through the three phases of piloting and recruitment procedures (Phase 1), the process of securing the research site and recruiting ESOL tutors (Phase 2), and the project implementation process as well as the commencement of the work with the ESOL students (Phase 3). The second part discusses findings from Survey 1, 2, and 3, which served in developing the context of the case study. The third part discusses the planning process for the commencement of the work with students and the development of the case study in this project. The three surveys that served in constructing the context of the case study are: the survey on measurement of the usage of the Internet and knowledge of Scratch (Survey 1) as well as the two surveys for the non-core tutors and students who were not able to participate more fully in the research (Surveys 2 and 3).

Survey 1 (Appendix 2) was administered to the students at the two targeted ESOL classes before they were introduced to Scratch. The data collected through Survey 1 was essential to examine the students' willingness to take part in the research as well as to investigate their connectivity to the Internet and knowledge about Scratch. This was important because part of the Scratch activities were planned to utilise projects in the online Scratch forum.

Survey 2 (Appendix 3) was administered to the students who were invited to participate but did not agree to take part more fully in the study. The surveys aimed at providing understanding about the reasons for which those students were not able to participate. The opinions and views of those students constituted a useful addition to the context of the case study and contribute to extending the understanding about the targeted ESOL programme at the research site and more widely.

The findings from Survey 3 (Appendix 4) targeted the non-core ESOL tutors. This survey provided insight regarding the reasons and motives of individual ESOL tutors for not being able to take part in the research, as well as the context of their ESOL centres.

Therefore, the findings from the three phases and the surveys have served in providing the context of the research population as well as in preparing and planning of the commencement of the case study discussed in the last section in this chapter. According to

Yin (2009), this context of the case study research is an essential part of the case study itself and it allows an in-depth investigation of the phenomenon within its real-life context. As such, the findings of the three surveys contribute to drawing the context of the case study.

A second note which supports the importance of inclusion of the context of the case study is provided by Flick (2014) who discusses the importance of including significant and relevant context within the case study research. He illustrates this by exemplifying a case study concerned with school problems of a child, and notes that a possible context of this case study includes the everyday life of the family of the child, the role of the child's teacher, and the child environment with other pupils. He suggests that these factors are all possible inclusions in the case study concerned with school problems of a child.

However, deciding what is significant as an inclusion from the environment and the context of the case study also means focusing the design of the case study to answer the research question, and, therefore, eliminating unnecessary elements in the context of the case study. It is for this reason, the case study propositions were presented and discussed in Chapter 4, Section 4.4 entitled "Design of the Case Study". In other words, these case study propositions served in the identification and inclusion of relevant and significant elements from the context of the case study as well as helping to exclude unnecessary elements that do not add value to the case study.

In this context, this chapter demonstrates the relevant and important context of the ESOL programme and the ESOL students at the two targeted ESOL classes, including their reasons about whether to take part in the research, their connectivity to the Internet, and their previous knowledge of Scratch (Survey 1). The inclusion of the views of the non-core ESOL students and tutors and investigating the reason for their decision is a valuable inclusion to construct the context of complex, diverse and heterogeneous ESOL programmes. Therefore, interviewing and surveying ESOL students and tutors (Survey 2 and 3) served in constructing the context of the case study through providing insights about why some students and tutors were not able to participate more fully in the project.

5.1 Communications and Planning of the Case Study

My initial research proposal aimed to target literacy learners. The focus was on learners in the further education sector, including community centres and schools that provide literacy programmes for: (a) English for speakers of other languages (ESOL), (b) learners who are Not in Education, Employment, or Training (NEET), or (c) English as an additional language (EAL). It was important to keep an open mind about several literacy programmes in several contexts. One reason to think so is that, for example, ESOL programmes are much contextualised based on several factors including the host institution as well as the communities and learners who are benefitting from these institutions.

As such, although ESOL programmes are expected to be "theoretically" the same, two ESOL programme in two different institutions may vary dramatically. For example, an ESOL programme in a mainstream college or a community college will not be the same as an ESOL programme in a community centre that provides support for asylum seekers or refugee learners. The two institutions, most likely, will vary in terms of, for example: the infrastructure of the institution; the existence of an ESOL department; or having regular ESOL tutors based at their offices; the type and context of the ESOL learners attending the classes, or whether those learners were attending the classes discretely or in more regular fashion. It is in this context that keeping an open mind about several literacy programmes in different contexts is crucial for a successful recruitment of research participants as well as for securing research sites in this study.

This chapter presents the unfolding learning practices that I have developed, during my journey, to recruit research participants and secure research sites, and through the course of the data collection processes. This journey has evolved through iterative cycles of planning and learning practices and is conceptualised through three main phases of communication and data collection discussed in the subsequent sections.

5.1.1 PHASE 1: PILOTING RECRUITMENT PROCEDURES

Phase 1 constitutes the initial approach for securing research sites and recruiting research participants. It was designed as a top-down model that targets the principals and managers at selected further education and community colleges in London. Consequently, the process of seeking approval for involving colleges in the study was initiated through posting formal letters to a list of principals of further education and community colleges. The initial plan was that the principals would carefully consider the request to get involved in this project if they were approached through posting official letters, forwarded by a senior research staff at the University. As such, my supervisors and I expected that this would be a more effective and efficient strategy than approaching the colleges' principals through personal communications, and provide them with the project information sheet and consent form via email.

Phase 1 targeted five community colleges of further education: Bromley College, Lambeth College, Greenwich community college, Lewisham and Southwark colleges (LeSoco). These five colleges were carefully identified as relevant and the most convenient, and, therefore, approached because: (1) they represented major colleges in the mainstream further education in the area; (2) they offer a diversity of literacy learning programmes for students; and (3) these institutions maintained professional and academic relationships with my faculty at the University of Greenwich, as they often offer placement positions for trainee teachers from the University. This description about the selection samples echoes the concept of convenience sampling discussed later in the project sample section in this chapter. This initial phase of recruitment served as a pilot phase in the process of data collection.

The response received from these colleges was disappointing. We received one prompt negative response, and I had to follow up the other letters with the principals' offices and their assistants for about two months through phone calls and emails. The follow-up process was time-consuming, and the remaining colleges responded negatively to the invitation; except one college whose principal was interested in such a new research and decided to take a further step in consideration for the request of involving his college in the research. Because the principal thought that this research has the potential to benefit the students at his college, he nominated one tutor from his college and referred me to this tutor to investigate further ways of collaboration and participation.

Despite the principal's general interest in seeking ways for collaboration and participation, the nominated tutor had no interest in exploring the research or in taking part in the project. Apart from a single brief meeting at the nominated tutor's office shortly after the request from the principal, it was not possible to hold follow-up meetings. Although a meeting was agreed, the tutor did not show up for this meeting.

Though my experience with the five colleges was not particularly positive in terms of recruitment and resulted in moments of frustration, this experience enhanced my planning in the next cycles for recruitment of research participants and securing research sites. In conclusion, the top-down approach adopted in the first phase of communications and data collections was not successful. Therefore, there was a crucial need to adapt to a new approach inspired by a bottom-up approach. Consequently, in the pursuit of access to institutions, there is no reason to follow a predefined order. In essence, it is not important whether one approaches the principals first and the tutors next, or vice versa. We discuss access in detail in Section 5.3.3 in this chapter.

The results that emerged from Phase 1 necessitated the exploration of new strategies and the need to renew my efforts to identify research sites and recruit research participants. Therefore, based on the evolving learning practices developed through reflections and discussions with my supervisors and other colleagues in the field, an evolved modified plan for data collection was developed. These iterative learning practices were vital for the development of the case study for several reasons including:

1- Construct insights and deeper understandings into several literacy learning programmes, and learn about their needs and possible ways of intervention.

2- Focus on a specific literacy learning programme that best suits the type of the research project. Consequently, leading to the focus on ESOL programmes

3- Develop a framework or a computational template for using Scratch to support ESOL learners.

4- Adapt the project to a new approach, driven by a bottom-up strategy, developed while reflecting on the experience and lessons learned in the first phase of the work on data collection.

5- Utilise networking and snowballing processes (Moser and Kalton, 1971) for recruiting research participants and securing research sites.

6- Develop the study and align its design and methodology accordingly. In other words, this follows the principles of the naturalistic research that suggest that there is an "emergent nature of design" (Lincoln and Guba, 1985, p251).

5.1.2 Phase 2: Securing the Research Site and Recruiting ESOL Tutors

Unlike Phase 1, the strategy for Phase 2 was essentially built around a bottom-up approach. It aimed to recruit participants and secure research sites through personal networking with tutors and principals using the snowballing process (Moser and Kalton, 1971). Snowballing describes the process of securing research sites and recruiting participants, the sample of the study, in which “one case suggests another who suggests another”, and sometimes referred to as “recommendation sampling” (Willington, 2000, p62). Lincoln and Guba (1985) discuss a similar strategy in naturalistic research. They describe this strategy as emergent and sequential. In this context, the use of the bottom-up approach was more fruitful in terms of achieving scheduled meetings, securing opportunities to make presentations, and interviews to discuss research plans, and eventually led to a successful recruitment of research participants at a Sixth Form College in North London.

In Phase 2, the focus was on developing a template for using Scratch programming environment to support and help ESOL learners. Because “the design of learning environments is linked to issues that are especially important in the processes of learning” (Bransford et al., 2015, p116), the learning template evolved through several stages and was informed by meetings, presentations and discussions on the project plans. The invitations to participate were extended to several ESOL tutors and department managers. In particular, the process of recruiting participants was focused on linking opportunities in Scratch environment to the pedagogy and ESOL model of learning, while maintaining mutual inspiration and interpersonal skills with the targeted ESOL tutors and ESO learning centres.

Most ESOL learning resources focus on utilising Information and Communication Technologies (ICT) in their ESOL classrooms. For example, the Teacher’s Notes learning materials for ESOL Entry Levels (Excellence Gateway, 2014) discuss using ICT in the ESOL classroom noting that:

> “Most units include suggestions as to how Information and Communication Technology (ICT) might be incorporated into the learning programme. These activities are optional, and an alternative approach is usually included. It is recognised that ESOL learners will be at different stages of familiarity with using ICT and in many learning contexts there may be no access to such resources. However, given the increasing role of ICT in everyday life, and its many advantages in increasing motivation and self-esteem, it should be exploited as a resource and an area for skills development where possible.” (ESOL Teacher Notes, 2014, page viii)

However, these ICT resources mainly include hardware in facilitating learning. Such hardware includes computers and overhead projectors which though helpful and necessary equipment, are not as efficient when compared with the capacity and affordability of new technological tools, particularly in terms the increasing potentials of these tools on ESOL learners. Drawing from my experience as an ESOL learner, I am convinced that limiting the relevance of current and emergent technological tools and devices to their use as hardware equipment effectively reduces opportunities and potential that computational frameworks might offer for learners in general and ESOL learners in particular.

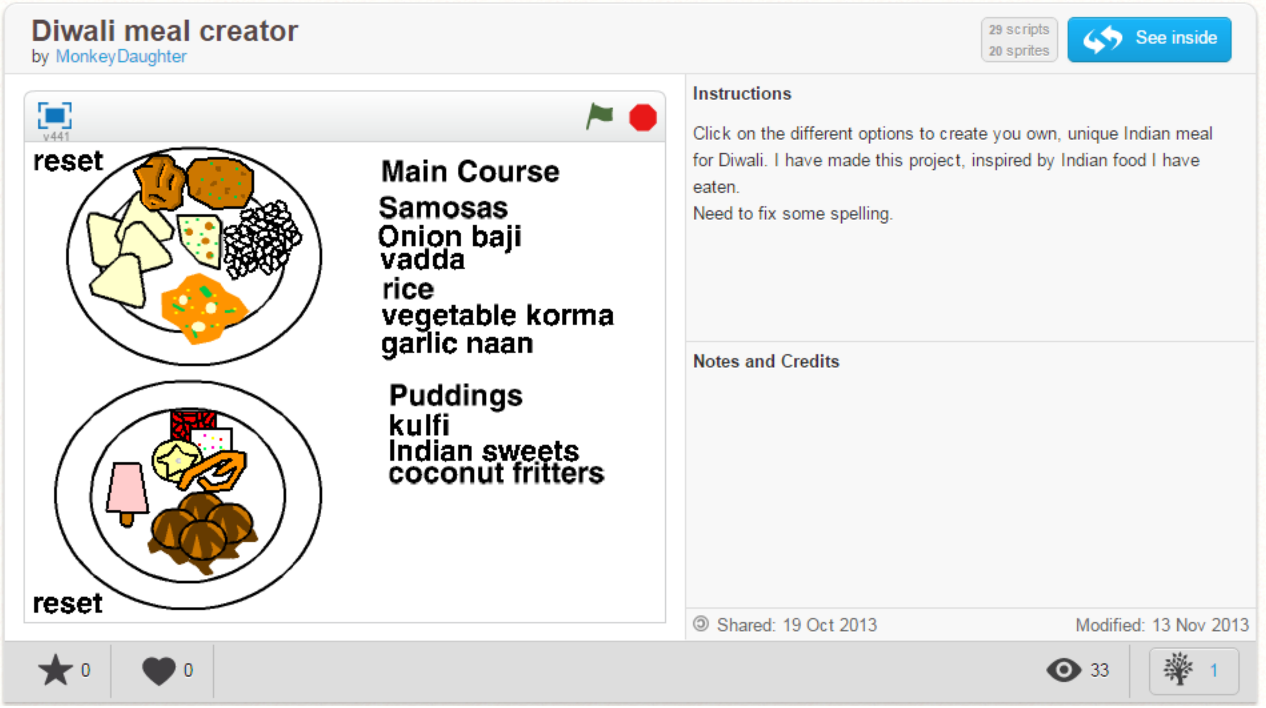
This view about using ICT in ESOL classrooms, drawn from the ESOL materials, was helpful because it serves as the basis for presenting my perceptions of the importance of using new computational frameworks in learning to ESOL tutors and managers. Consequently, it enabled me to highlight the benefits of computational interventions, such as Scratch, in ESOL teaching and learning.

The cultural diversity of ESOL learners was another window for communicating the potential importance of using Scratch and for negotiating access. Using the opportunity presented through meetings, I demonstrated how Scratch could help to accommodate the cultural diversity of ESOL learners by providing Scratch examples from various cultures. This demonstration highlights the social context of learning and the social constructivist principles. In particular, it echoes Vygotsky's (Cole et al., 1980) notion of the significance of interaction and collaboration within learners' cultural settings through they are able to practise their "spontaneous concepts" based on their social practices (p131).

To illustrate the relevance of Scratch to meeting the needs of diverse learners, I presented several Scratch projects, shared with the Scratch online forum, that reflect cultural diversity. This illustration also shows how many of these Scratch projects can be linked to the ESOL learning materials. For example, one of the exercises in the ESOL learning materials (Excellence Gateway, 2014) requires students to prepare a mini-project, in English, about their own cultural festivals and demonstrate this by presenting a piece of writing with images about the Diwali festival (a Hindu cultural festival). A quick search for the keyword Diwali on the Scratch online forum retrieved more than 150 projects that celebrate the festivals in an interactive fashion. These Diwali Scratch projects included: Diwali cards, Diwali fireworks and Diwali recipes. See Figure 5.0 for an illustration of a Scratch project about Diwali recipes.

This illustration was helpful to exemplify how ESOL learners can use Scratch to develop interactive versions of their ESOL projects in a way that complements the existing ESOL curriculum and resources. In other words, using new digital media provided through computational environments provides a new dimension or medium for cultural and creative expression in the ESOL curriculum. This illustration was a point of attraction for many tutors and other colleagues in colleges.

Figure 5.0: a snapshot of Diwali Scratch project by a Scratch user called "Monkey Daughter"



5.1.2.1 Results from Phase 2

Using a bottom-up approach during Phase 2 produced some significant outcomes. A total of 12 institutions including colleges, community centres and schools agreed to host meetings and presentations to their tutors, principals and managers. Consequently, this resulted in securing the research site, the Sixth Form College in North London. The two phases of recruitment consumed 11 months of the project time.

The experience developed through communicating and networking with the targeted institutions in Phase 2 was helpful to develop understandings and construct new learning practices about the ESOL programmes. In the following three examples, I discuss my communications and negotiations for access and participation with selected ESOL Centres A, B, and C which were approached in Phase 2.

The first example was approached through personal networking and communications that led to a few visits to centre A, a community centre, which offers various levels of ESOL programmes. Consequently, a meeting with the teaching team at the centre was scheduled, and seven tutors and two managers attended. Drawing on my observations and reflections on the experience in centre A, several reasons may explain the unsuccessful recruitment of the ESOL tutors including: first, time constraints; second, lack of confidence in working on computing-related projects as the majority of tutors have no technical background; and third, the effects of principles of an assessment-led, or instruction-led, curriculum model (Gosper and Ifenthaler, 2013) appear to be another potential problem area. One middle-aged tutor who is familiar with the technology and the Scratch software commented on the proposal to introduce Scratch to ESOL students by saying “there is no available set of instructions for the ESOL students” (Yacoub, personal communications, 16 June 2014). This response from the tutor sheds light on an assessment-led culture that enforces traditional teaching and learning.

The second example of the approached institutions in the recruitment process is an ESOL centre B, which is a centre that provides services for refugee and asylum seekers including ESOL programmes. Similar to ESOL centre A, targeting community centres and programmes that mainly provide ESOL programmes for refugees and asylum seekers was not helpful for a successful recruitment of participants.

Based on my personal communications and field notes with the manager and the tutors in centre B, the tutors were not working in full-time jobs, and the students were not visiting the centre regularly, as in mainstream further education institutions. ESOL centre B, and community centres generally, aimed to help and support refugee and asylum seekers in an impromptu way, unlike mainstream colleges that offer registered students various ESOL programmes and levels regularly along with other main courses.

On a different observation, centre B was not well equipped with computing and IT tools, such as computers. During a visit to centre B, I tried to access the Internet using a desktop computer located in a common area. The computers were running Windows XP, an operating system, which is more than ten years old. Therefore, it was almost impossible to navigate the Internet on these computers. A nearby staff member responded and said, “These machines will not work, you cannot use them, they are old”.

Equally important, is the fact that although there were tutors who showed interest in exploring this project, it was not possible to secure their commitment for an extended period. Also, it would be unlikely to recruit students over a similar extended period at the same centre. In conclusion, in addition to the poor infrastructure, having unstable attendance for tutors and learners at centre B made it difficult to recruit research participants.

The third example is ESOL centre C which is a private college located in East London. This college had stable ESOL tutors and regular ESOL students, and the administration of the college was interested in the directions of the research and helped in scheduling a presentation for three available ESOL tutors at the college. Scheduling the meeting with the tutors was very straightforward, unlike scheduling meetings at centre A or centre B. At the meeting, the tutors reflected their understanding of the project and the invitation to participate. However, this did not come to fruition because of time constraints necessitated by the workload imposed by this private institution.

My experience developed in the course of communicating and visiting ESOL centre C suggests that securing a private college as a research site may require additional incentives. This goes beyond the expectation of taking part in research for the sake of creating new knowledge and exploring innovative ways for ESOL learners. It appears that private centres and colleges are profit and human-capital focused institutions. This private institution, therefore, may seek an economic added value, such as to establish a partnership with the university hosting the research or to market their institution, which would justify or encourage investment in staff time and available resources.

These three ESOL centres (A, B, and C) exemplify the process of communications and the planning for securing research sites and recruiting participants in Phase 2. Again, the snowballing process (Moser and Kalton, 1971) continued to be helpful in networking and approaching more sites. As a result of personal communication, several emails were exchanged with an ESOL tutor at a Sixth Form College in London. These communications led to a meeting at the centre to further discuss the project and potential participation. The ESOL tutor was a professional and enthusiastic teacher. The college was very suitable for this research. Consequently, after sharing and discussing the project information sheet, consent form and expectations, the tutor agreed to participate in the project.

In conclusion, after more than two dozen visits, meetings and presentations at various institutions, the communication and networking activities were concluded with the selection of the Sixth Form College as the research site for this project. Although the communication processes and planning cycles took more time than expected, the process was productive in that it enlightened me about various ESOL programmes and learners' contexts. This process served as a valuable input for the planning and implementation of the project at the research site.

5.1.2.2 The Problem of Access and Identification of Gate-Keepers

Flick (2014) discusses gaining access to research sites in qualitative research as a problematic, difficult and complicated process. He notes that gaining access to qualitative research sites and research participants requires significant attention and careful planning. The question of access becomes more problematic when the researcher requires access for an extended period of time. This is because the researcher will have to deal with several levels of gate-keepers that include gaining the proper authorisation from the administration of the institution and other research participants.

Therefore, recruiting participants in naturalistic research requires considerable attention to the question of access and gate-keepers, particularly the type of research where the researcher is not researching within his or her own institution. The journey towards gaining access to the research site shows that access was gained through a snowballing process and personal communications with the ESOL tutor. The ESOL tutor was the key player in unlocking access to the institution, possibly because he is interested in the research field and he shares, with me, a genuine interest in using technology and computational frameworks in learning.

Several studies suggest that access to individuals, such as ESOL tutors and ESOL students in this project, requires first gaining access to the institution (e.g. Flick, 2014; Cohen et al., 2011). Cohen et al. (2011) note that:

> "The first stage thus involves the gaining of official permission to undertake one's research in the target community. This will mean contacting, in person or in writing, an appropriate official and/or the chairperson of the governors if one is to work in a school, along with the head teacher or principal" (p81).

My endeavour to gain access and, therefore, recruit research participants in Phase 1 reflects a similar pattern. Though it looks logical to seek firstly official permission to access an institution, my experience shows that a pragmatic view is more helpful in tackling the issue of access. The key question is the identification of the gate-keeper/s who is appropriate to facilitate access, and this does not follow any pre-defined pattern. However, holding a pragmatist view does not advocate an unethical bypass of necessary communication with managers and the site administration. On the contrary, it is more beneficial and convenient for the researcher and the participant ESOL tutor, the insider gate-keeper, to work together and jointly gain access from higher management level inside the institution.

In this context, Lincoln and Guba (1985) note that “appropriate individuals” facilitate gaining access and approaching research sites through “formal and informal aspects” (p252). This is especially useful for “building and maintaining trust” (p256) as well as mutual inspiration and interpersonal skills. Pursuing a similar theme, Cohen et al. (2011) note that:

> “Achieving goodwill and cooperation is especially important where the proposed research extends over a period of time: days, perhaps, in the case of an ethnographic study; months (or perhaps years)” (p82).

Accordingly, in the case of mainstream further education colleges, usually, there are management hierarchies that consist of several levels of managers. Therefore, as discussed in Phase 1, the top-down model to secure access may become very complicated, and thus limit access to an institution. As such, approaching the ESOL tutors first and securing their initial commitment before moving towards upper levels to gain access may make it easier for top management level to approve the recommendation of the managers at lower administration levels regarding the involvement of the college in the research.

5.1.3 Phase 3: Recruitment, Planning, and Implementation

The process of securing the research site and recruiting the ESOL tutor included several email communications and two visits to the college. These correspondences and on-site meetings were necessary and helpful for both the tutor and the researcher to:

a. share and discuss the project information sheet and the consent form as well as discuss participants’ rights;
b. learn about the background, experience, and the expectations of the ESOL tutors;
c. learn about the college and observe its facilities and the context of the students;
d. share and maintain mutual inspiration and interpersonal skills with the ESOL tutors;
e. plan next steps that include the design and preparation of the tutors’ training at the research site, and
f. discuss the preparations and ideas for recruiting the targeted ESOL students at the college.

The recruitment process had to be well planned and had to take into consideration the local context at the targeted college and the community of learners, especially the targeted ESOL tutors and students. As an illustration for this, Lincoln and Guba (1985) note that:

> "naturalistic inquiry is always carried out, logically enough, in a natural setting, since context is so heavily implicated in meaning. Such a contextual inquiry demands a human instrument, one fully adaptive to the indeterminate situation that will be encountered" (p187).

The selection of the research site was convenient for this type of study for the following three reasons:

1. The site allows the researcher to access the college continuously for two semesters while working with the participant students and tutors. This situation would not have been possible at other locations that had an irregular attendance of students and tutors over the academic year.
2. The site is a relatively newly established college and it is well-equipped with IT laboratories and modern classrooms and computer overhead projectors, compared to other approached community colleges or not-for-profit community centres. The ESOL department also maintains a mobile trolley of laptops that can be easily moved into classrooms when needed.
3. The recruited ESOL tutor is an experienced ESOL tutor who has a basic understanding of computer programming and technology. He also maintained a willingness and enthusiasm to learn about Scratch that he heard about previously. It is also worth mentioning that the recruitment of a white British ESOL tutor was helpful to preserve a neutral influence on the students, who have different ethnicities, without actually affecting or manipulating their decisions about whether they should take part in the research.

5.1.3.1 Training of Tutors and Forward Planning

The training on using Scratch programming environment was essential to the commencement of the project. The training was designed and scheduled in coordination with the ESOL tutor. Accordingly, four training sessions, one hour and a half each, were scheduled during November and December 2014. The training served the participant ESOL tutor, who accepted to take part in the research, and other tutors in the college who were interested in exploring the Scratch programming language and learning about the research. The training outline and schedule are provided in Appendix 7.

The training aimed at: (1) providing the tutors with the necessary knowledge about Scratch programming environment and basic visual coding skills; (2) involving the tutors in planning and reflections on processes and procedures for complementing the ESOL curriculum with Scratch activities; and (3) initiating joint iterative planning cycles with the tutors for inviting and recruiting students.

The followings provide description and reflections on the tutors' training programme before commencing the work with the ESOL students:

Session 1: two tutors out of three tutors who were initially planned to participate in the training attended the first session. This session provided an overview of Scratch and introduced its functions and screens. Different themes for Scratch projects related to ESOL teaching and learning were explored. While it was important that the tutors choose their own project and preferred themes to get started using Scratch, several projects and themes were discussed. Therefore, the tutors were aware of the diversity of the Scratch projects. It was agreed in this session that the tutors would continue building on their selected project that they were expected to develop during their training.

Session 2: in this session, I worked with the participant tutor, and we explored the advanced functions in Scratch programming language. These include: various types of sensing functions, variables and lists. These were useful to navigate and showcase several English alphabet and spelling Scratch projects available at the online scratch forum. While the tutor continued developing his project, other functions in Scratch tool were explored such as remixing and sharing projects through Scratch online forum.

Session 3: the tutor finalised the Scratch project and discussed it with the researcher who provided constructive feedback. At this stage of experimentation with Scratch, it becomes clearer, for the tutor, and for the researcher, how Scratch can be utilised in an ESOL classroom setting. This discussion was a good start to reflect on relevant pedagogical elements of Scratch themes that included discussion on using Scratch in solving the ESOL exercises and mini-projects.

Session 4: the focus in the last session was on planning for the introduction of Scratch to ESOL students and exploring the Scratch's themes useful for them. Therefore, the next step was to select Scratch themes and projects helpful for the introduction of Scratch to the students and, consequently, to invite them to take part in the research. The goal was to engage the students to develop their English skills and support their learning in the classroom using Scratch projects.

The planning for introducing Scratch to the students in these two ESOL classes can be summarized as follows: (1) A fresh start to the project with the students at the beginning of the spring semester was considered to be more convenient than rushing and starting the project by the end of autumn semester; (2) the complementary activities for Scratch in the classroom time were emphasised to incorporate Scratch within the ESOL curriculum and the tutor's teaching framework. Several themes for the introduction of Scratch were discussed and agreed, including:

a. *Storytelling*: Scratch storytelling projects encourage and support writing, reading and speaking skills. It was absorbing to discuss various possible scenarios for storytelling using Scratch in an ESOL class. The ESOL tutors and the researcher derived inspiration from thinking about the potential offered through using storytelling not only from a linguistic perspective but also from cultural points of view.
b. *Games*: Scratch games can be utilised in a broad range of learning activities, such as spelling games that enrich and help learners in their spelling, reading and writing.
c. *English word roots including common prefixes and suffixes*: using Scratch projects to enhance the spelling and extend the English vocabulary of the students.
d. *Concept cartoons*: this can only be applicable through a dedicated class time. Also, it was not feasible to use this in complementing the ESOL curriculum with Scratch activities because the concept cartoon requires the entire class time.
e. *Communicating with others*: this suggests students use Scratch to create greeting cards, describe daily tasks such as shopping or record their voices to ask others for common information such as questions about directions or about the time.

These iterative processes of planning, acting, reflecting, and re-planning shows how the outputs of the correspondences and meetings with the ESOL tutor informed the tutors' training programme. Similarly, the outputs from the training served as an input for involving the students and the commencement of project with students, and so on.

5.2 Findings from Surveys which Served in Developing the Context of the Case Study

This part describes and discusses the survey of measurement of the usage of the Internet and knowledge of Scratch (Survey 1) as well as the two surveys on the non-core tutors and students (Surveys 2 and 3). The findings of these surveys are discussed in order to provide insights into the context of the Case study discussed in the next chapter.

Survey 1 is an initial or a pre-study questionnaire (Farrell and Lim, 2005; Ragin and Becker, 1992) which was administered to the students at the two targeted ESOL classes before they were introduced to Scratch. The data collected through Survey 1 was essential to examine the students' willingness to take part in the research as well as to investigate their connectivity to the Internet and knowledge about Scratch. This was important because part of the Scratch activities were planned to utilise projects in the online Scratch forum. The findings from the Survey 2 and 3 provide additional insight into the targeted research population and the context of ESOL tutors and students. The rationale for conducting these surveys is stimulated by the mixed methods research that utilise a case study approach, which aimed at providing in-depth data on the case study through including its context. This rationale is discussed in detail in Chapter 4, Section 4.8, entitled "Research population and Project Sample".

5.2.1 Measurement of the Usage of the Internet and Knowledge of Scratch

There was a need to measure the level of usage of the Internet and knowledge of Scratch in the targeted two ESOL classes. This was important because the degree of online accessibility of Scratch was an essential indicator for planning the case study. The data on the frequency and locations where the students used the Internet was relevant because part of the Scratch project in this study would be explored through the Scratch online forum. Also, investigating the students' previous knowledge or usage of Scratch was essential because this information could shape the planning of the project. Therefore, Survey 1 entitled, "Survey on the Usage of the Internet and Scratch", in the form of a questionnaire was administered to collect data from the students at the earliest possible opportunity, before the commencement of the work with the students.

Survey 1 can be considered a pre-study questionnaire because it sought to investigate the context of the case study. Some case study research recommends utilising pre-study data in order to inform the design and the development of the study. For example, Farrell and Lim (2005) employed pre-study interviews in order to establish the context of their case study research concerning the conceptions and beliefs of English language teachers and their classroom practices.

In this context, this questionnaire (Appendix 2) consists of four simple closed-ended questions which suit the level of the English language of the ESOL students. The expectation was these simple questions would allow the small group of ESOL students to respond to the questionnaire as easily as possible and provide their input regarding their willingness to participate including their connectivity to the Internet and knowledge of the Scratch tool.

The data collected from Survey 1 was essential for constructing an understanding of the environment of the participant students at the research site. For example, if the students had previously been introduced to the Scratch programming language, this might change the nature of the overall intervention or, more importantly, it could have compromised aspects of validity and trustworthiness of this project if the targeted students were existing users of Scratch.

This questionnaire was particularly helpful for the researcher and the participant tutor as it enabled them to make informed decisions about how to progress with the introduction of Scratch in the ESOL classrooms. For instance, one direction we were investigating was whether to encourage the students to work on Scratch projects at home. Therefore, it was important to understand how and where the ESOL students were accessing the Internet in order to prepare the introduction of Scratch to the targeted ESOL students.

5.2.1.1 Findings from Survey on the Usage of the Internet and Scratch (Survey 1)

The questionnaire on the usage of the Internet and Scratch was administered to the core and non-core participant students who volunteered to fill it in. A total of 13 students (86.86%, N=15 active students) in the two targeted classes responded to the survey. This response rate is considered representative of the targeted population in the two ESOL classes.

As illustrated in Figures 5.1a and 5.1b, it was interesting to discover that more than two-thirds of the students used the Internet for more than four hours most days.

Figure 5.1a: the frequency of using the Internet by the targeted students.

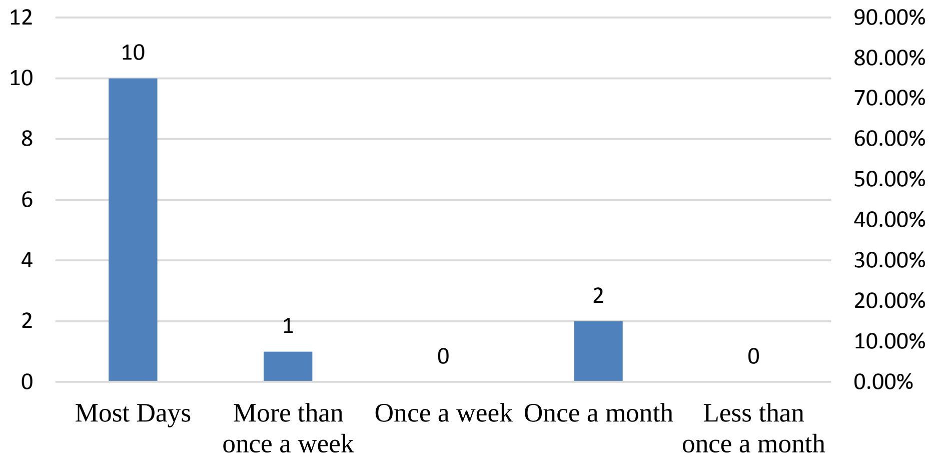
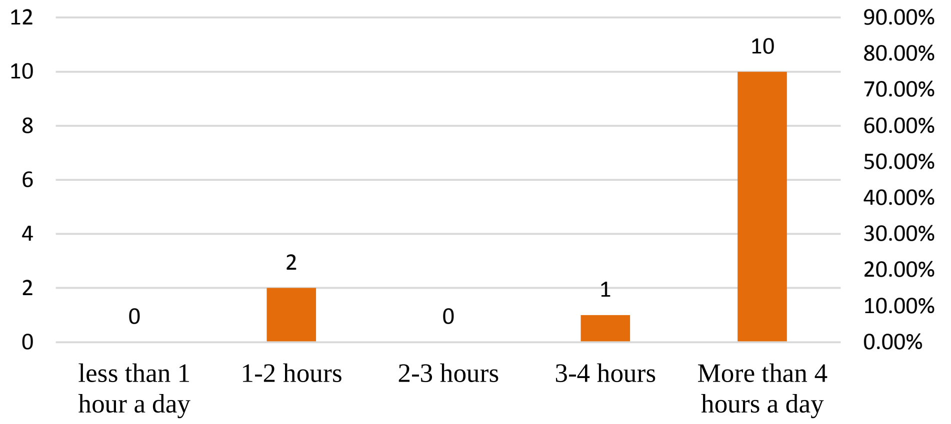


Figure 5.1b: the number of hours the students used the Internet in most days.



As shown in Figures 5.1c and 5.1d, around two-thirds of the students usually accessed the Internet at home and more than half of them at school. One-third of the students reported that they use the Internet on their mobile devices. Also, the vast majority of the students indicated that they use the Internet for school-related work, while about two-thirds of them use the Internet for social media. The bar chart in Figures 5.1c indicates that a student could access the Internet from more than one location, such as at the college and home. Similarly, the pie chart in Figure 5.1d indicates that a student could have more than single online activity at the same time, such as browsing the Internet for school related topics and entertainment.

Figure 5.1c: the locations where the students usually accessed the Internet.

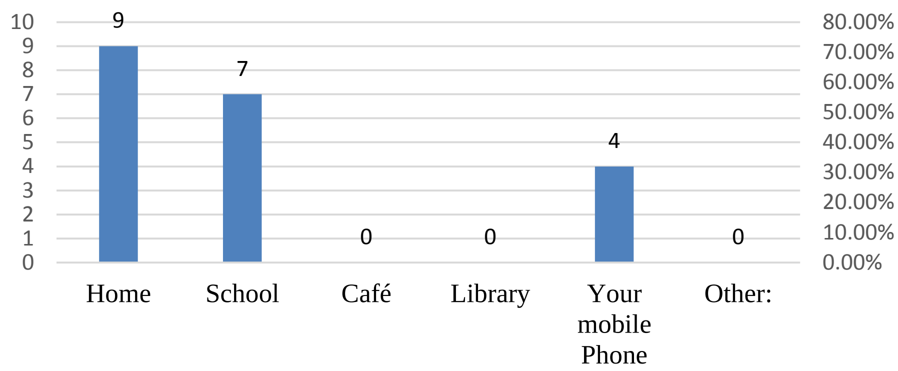
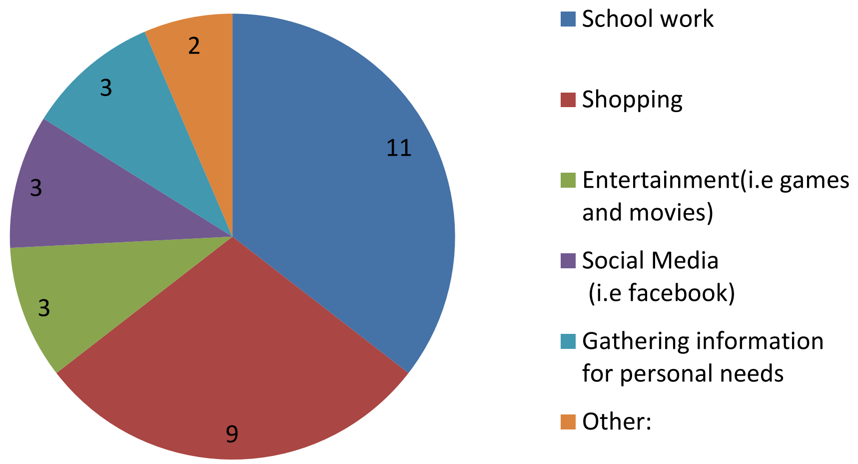
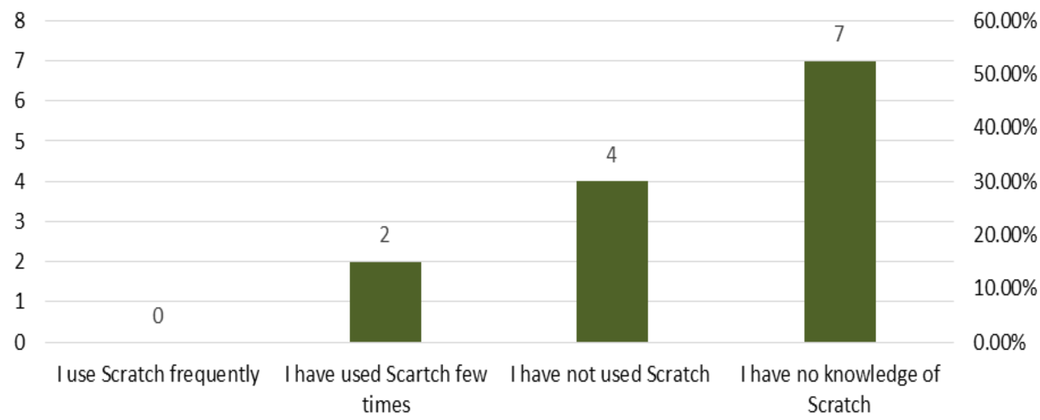


Figure 5.1d: the categories of the students' online activities – by the number of responses for each category.



The second focus of the questionnaire was to find out whether the students had used the Scratch software before being introduced to them in the classroom. Figure 5.2 shows that 13 out of 15 students had neither used Scratch software before nor have any knowledge of it. Two students reported that they had used Scratch a few times, and none of the students reported frequent usage of Scratch. It was crucial to investigate any previous or frequent usage of Scratch because this could have shaped the introduction of the programme to the students.

Figure 5.2: the students' previous knowledge and usage of the Scratch software prior the commencement of the study – by the number of respondents.



5.2.1.2 Discussion of the Findings from the Survey on the Usage of the Internet and Scratch (Survey 1)

The findings of this survey indicate that the students in the two targeted ESOL classes were not existing users of Scratch at the commencement of the study. The findings also show that they had a good connectivity to the Internet at home and school. This finding is supported by other secondary data on Internet access in the UK that show that the access gap to the Internet is narrowing rapidly. For instance, the report on Internet access for households and individuals shows that 76 percent of adults in Great Britain accessed the Internet every day, a figure that has almost doubled since 2006 (Office for National Statistics, 2014).

However, the proliferation of devices, which provide connectivity to the Internet, raises the issue of compatibility because not all devices can run all types of computer software programmes or applications. For example, the official Scratch programming language requires "Adobe Flash Player", a computer programme that does not run on Apple mobile and touch devices, such as iPhones and iPads. In this project, this produced an access constraint for some students who used to access the Internet using Apple mobile devices at home.

In conclusion, it was beneficial to learn where and to which degree the students in the targeted two ESOL classrooms used the Internet, and it was essential to collect an initial data about whether the students were users of Scratch in order to plan actions accordingly.

These early findings were helpful to inform the process of introducing Scratch to the students at the commencement of the project.

5.2.2 Tutors and Students Who were Not Able to Participate More Fully in the Research

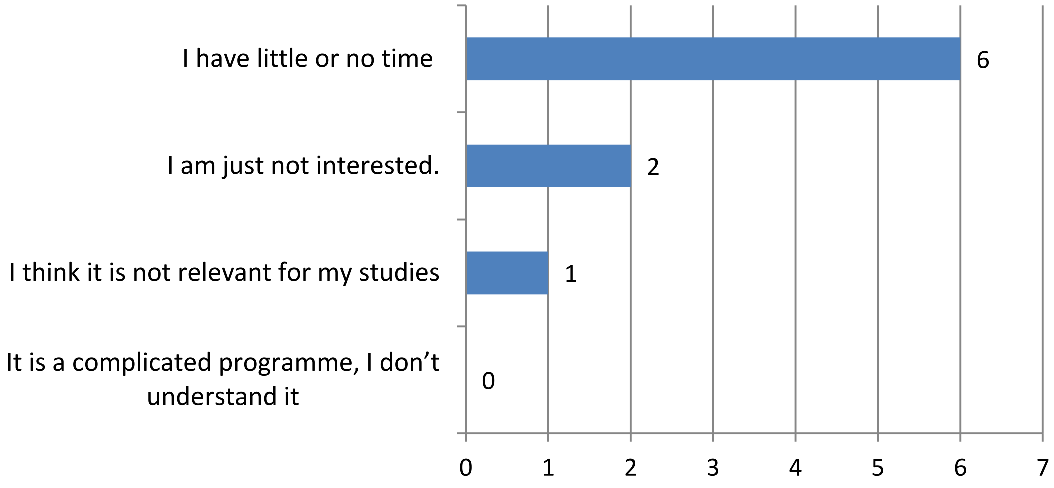
In order to investigate why some invited ESOL students and tutors did not agree to take part more fully in the research, surveys 2 and 3 were administered to those non-core participant students and tutors. Survey 2 was administered to the students at the two targeted ESOL classrooms, who were invited to join the project and were not able, or not interested, to participate. The questions in the survey were straightforward, simple and easy to understand. The students were invited to fill the survey in by answering multiple choices and rating scale closed-questions.

Meanwhile, Survey 3 was administered online to the non-core tutors with the objective to explore reasons behind their choice for not taking part more fully in the research. The survey was short, and it was designed to take about five minutes to fill it in. In addition to the data collected through the survey, additional interviews were conducted with two of the non-core participant tutors and one of the non-core participant students in order to further investigate their reasons for not being able to participate in the study.

5.2.2.1 Findings from Survey for Non-Core Students (Survey 2)

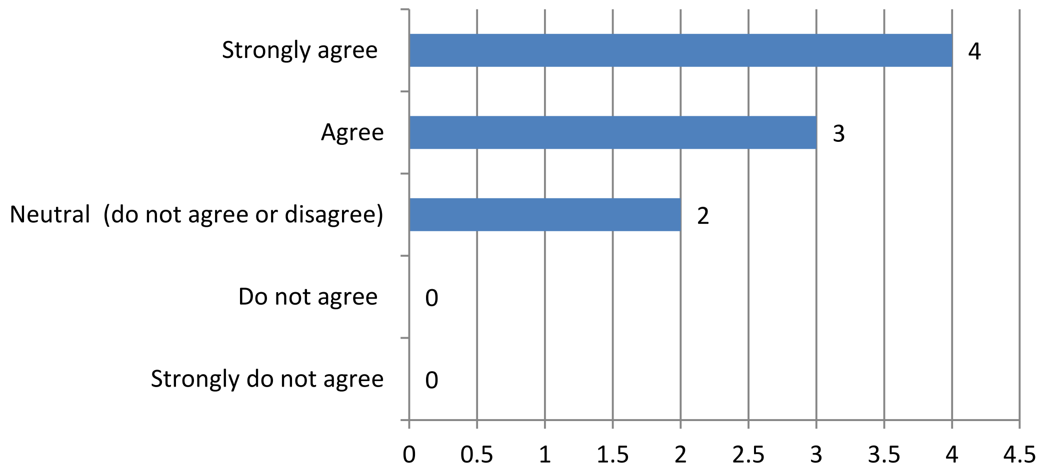
All non-core participant students (9 students) in the targeted two ESOL classrooms volunteered to complete and return the survey. As shown in Figure 5.3, seven of them indicated that their decision not to participate in the Scratch study was because they have little or no time. Three students pointed out that they think that Scratch is not relevant for their studies or they are just not interested. None of the students indicated that they were not able to take part because they considered the Scratch programme a complicated computer application.

Figure 5.3: the reasons why the non-core participant students were not able to take part more fully in the study.



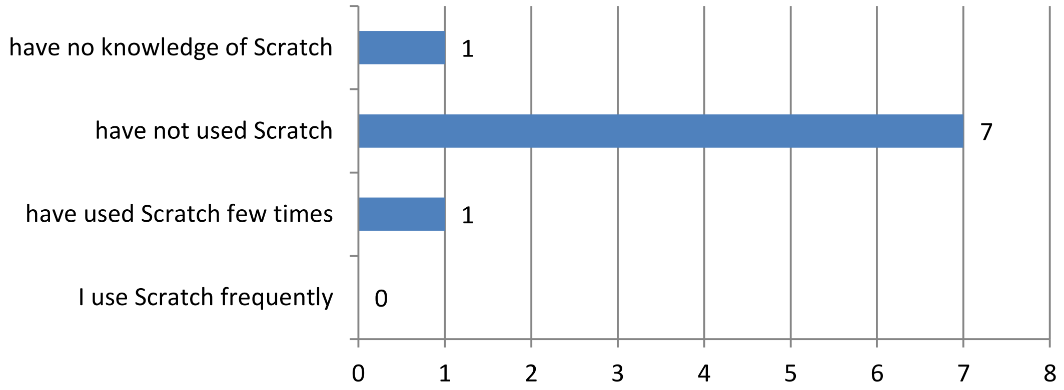
The non-core participant students indicated that they were given enough information to make a decision about their participation in the study. Figure 5.4 shows that seven out of nine students strongly agree or agree that they have been given enough information to make a decision on their participation in this study, and the remaining two students held a neutral opinion.

Figure 5.4: the non-core participant students' views on whether they have been given enough information to make a decision on their participation in the study.



The findings show that all non-core participant students disagree or strongly disagree that the opinions and comments of other students in the class affected their decision not to take part in the study. The findings also show that only one student used Scratch software few times before the commencement of the project, and the remaining students reported that they have not used Scratch nor have knowledge of Scratch before the start of the project as shown in Figure 5.5.

Figure 5.5: the non-core participant students' previous knowledge and usage of Scratch.



While the findings of this survey are useful to construct an understanding about the reasons of the non-core participant students for not taking part in the study, the students were invited to discuss their opinion at the end of the project through short interviews. One student agreed to be interviewed regarding his decision for not taking part in the study. AML1 is an 18-year old student at the ESOL Level 1 class. He explained his decision for not participating in the study by saying "I am not interested" and that "it may be useful, but I don't like it… I am not interested" while indicating some of the constraints he has at the college. AML1 pointed out that he is not interested in taking part in the study because he only seeks to complete his education at the college and pursue a career as a public servant. He also indicated that he is concerned about studying at university because he is not confident, yet, and also because his limited budget.

5.2.2.2 Findings from the Survey for Non-Core Tutors (Survey 3)

Most of the tutors who were not able to take part in the study did not respond to the invitation to complete the questionnaire despite the two reminder messages sent to them. Only four tutors (26.66%, N=15) responded to the survey. The comments of the four tutors were focused on either showing that they are simply not interested in the study or to point out that they are unfamiliar with Scratch and computational subjects in general. Respondent 2 (Survey 3) illustrated that: "I am not sure what 'Scratch' is and therefore, was uncertain as to my usefulness to the study - that and I have been exceptionally busy. There are simply not enough hours in the day". The second illustration is from Respondent 4 (Survey 3) who stated, "I don't see a direct relevance [of Scratch] to the ESOL teaching". Although the response rate was low, this may constitute one of the findings: that tutors were not genuinely interested in the topic of the research, or perhaps not interested in investing the time and effort in this project.

These views can be seen from the perspective of resistance to change triggered by power relations and various forms of control including personal, technical, and bureaucratic forms of control (Prasad and Prasad, 1998). In particular, the tutors' responses indicate personal and technical forms of resistance to change. The technical form of resistance can be explained through the process of introducing a new computational tool in ESOL teaching which was perceived to some of the tutors as a specialised technical tool with no relevance to English language teaching and learning. Furthermore, the personal form of resistance to change can be clarified through the tutors' attitudes towards trying new methods in teaching as well as through their enthusiasm about experimenting with new tools with genuine support from the researcher.

In addition to this questionnaire, I was able to interview two of those non-core participant tutors. The first tutor, called DM, is a male ESOL tutor who teaches at a private college in East London. This tutor holds a Certificate in Teaching English to Speakers of Other Languages (CELTA). He commented that he was not able to take part in this study mainly because of the time constraint imposed by the employer. Furthermore, he pointed out that most of the students attending this private ESOL centre are focused on passing the exams rather than experimenting with new forms of technology or computing programmes. This view exemplifies forms of organisational control (Prasad and Prasad, 1998) in a private ESOL centre which prioritises profit over investing resources in experimentations of new tools and ideas. Also, this underpins the effects of the assessment-led principles discussed in section 5.1.2.1 entitled "results emerged from Phase 2".

The second interviewed tutor is NF. She is a female tutor who volunteers two hours a week in a community centre in South East London to teach ESOL students who are mainly refugees and asylum seekers. NF has a degree in anthropology, and she holds a CELTA qualification and is planning to study PGCE this year because she would like to establish a career in teaching ESOL.

NF indicated that she was not able to take part more fully in this research because of the nature of the limited voluntary time as well as the limited resources at the community centre where she teaches. She pointed out while interviewing her, “teaching ESOL in a community setting in [name of the centre] is not determined by yourself; it is very much like you teach whenever there is availability”. She noted that the ESOL lessons there are different from the ESOL lessons in mainstream colleges in terms of available resources, the nature of the learners, and the tutors who attend the college regularly. NF mentioned that because she works a full-time job and only volunteers for two hours a week, she was not able to dedicate the necessary time to planning the learning strategies and to be able to familiarise herself with the Scratch programme.

NF thought that the technical aspect of Scratch was not an obstacle. However, she re-affirmed that it is about the time available within the two hours a week as well as the logistics of providing laptop computers. She noted that there are no laptop computers in the community centre where she is volunteering, and her own laptop computer may not be enough for a group of ESOL learners. NF noted that although she is a very enthusiastic about Scratch she still has many questions such as:

> “I don’t know how it works with the students working together because I wouldn’t [make] a miss where it’s so “teacher-centred”. And I do not know how to get away from that if I just got one laptop, I can’t do anything. Obviously, there is a way around it, and I know there is because I am excited to have technology for ESOL and go forward with it, but I do not know how to do that. I would definitely like to find out more and really want to familiarise myself of how it works and how you can shape what you wanted to do”.

The above response from NF demonstrates a positive attitude and willingness to experiment with the new Scratch tool, despite the lack of infrastructure in the ESOL centre she is teaching at, which is triggered by the continuous cuts for the ESOL programmes in England.

As the survey for, and interviews with, the non-core tutors provided insights into the context of the environment of some of the approached tutors and ESOL centres, this contributed to constructing a deeper understanding of the context of the ESOL programmes and the non-core tutors. Overall, it is useful to investigate contributions and conclusions achieved as a result of these interventions as well as possible ways to reduce the level of resistance to change and the effects of power relations.

The approach adopted in this project in recruiting of ESOL tutors contributed to shedding light on the role of experimentation and hands-on experience in reducing the resistance to change and the effects of power relations. According to Trowler (1998), the tutors' response to change requires an "ownership of change" which is very difficult to achieve. He notes that this sense of ownership can be developed through providing and encouraging opportunities for experimentation and adaptation through hands-on experience. As such, drawing on Trowler (1998), experimenting with new approaches to learning is a prerequisite to reducing levels of resistance to change as well as fostering a sense of ownership to change. This is actually the essence of inviting ESOL tutors to take part in this study.

5.3 Planning the Case Studies

This project commenced by late November 2014 by the training of tutors. The work with the core participant students took place over a period of six months, from early January 2015 to June 2015. During this period, I visited the research site twice a week and participated in two of the ESOL classes along with the participant ESOL tutor who teaches these two classes. The discussions with the ESOL tutor, about the most convenient ways to introduce Scratch to the students, concluded with the development of Scratch's project templates for students to get started using the programme. These templates included: Scratch interactive projects that served communications activities, such as job interview scenarios and greeting words and sentences; games helpful for practicing word spelling, word roots, and extending the English vocabulary; and recording learners' conversations and pronunciations.

The goal was that these templates would serve to fulfil and extend the ESOL core curriculum (Steeds, 2001) using computational practices and link the introduction of Scratch projects and templates to the topics discussed in the classroom. These templates enabled the students to experiment with Scratch more easily in their first encounter with this computational environment. Accordingly, these templates encouraged the students to explore Scratch projects that initiate interactions, e.g., interactive conversations or storytelling using text or recorded words and sentences.

The tutor and I sought to encourage the students to get started using Scratch after providing them with an orientation about the programme. The orientation included a simple introduction of Scratch screens and functions and examples of Scratch project. The students, therefore, were able to employ the programme's functions without a detailed introduction about each of the programming concepts and functions of Scratch. As such, the students were provided with the opportunity to learn about various programming concepts and functions as enquiries emerged and as their ESOL learning activities progressed.

In this study, Scratch was introduced to the students in a different way from that used usually in computing classes. The students were introduced and encouraged to use Scratch in a meaningful fashion with less emphasis on instructions. In short, Scratch was introduced to the ESOL learning in a way which complemented the ESOL curriculum as well as served the constructionist approach. Therefore, the students were encouraged to construct meaningful practices in line with the ESOL curriculum, as discussed in the case studies in the next chapter.

The one-hour ESOL classes took place twice a week. Usually, the work on Scratch in the ESOL classes occurred in the second half of the class and sometimes in the last 20 or 15 minutes, depending on the lesson activities in each session through a parallel co-teaching approach (Rytivaara and Kershner, 2012). While the core participant students worked on Scratch projects and activities, the non-core participant students continued their work on classroom activities that were assigned to them. In addition to the Scratch activities that took place during the normal classroom teaching hours, there were several one-to-one Scratch sessions scheduled with the core participant students at the research site outside these teaching hours. Also, the entire class time was allocated to those students on some occasions when the tutor was away from the college.

The tutor introduced the ESOL lesson according to the curriculum, and then the tutor and the researcher collaborated with the students using templates of Scratch projects to link the topic discussed in the class to the Scratch activities. This approach, of providing templates and channelling the discussed topic in the class to Scratch activities, was useful to overcome the problem of the limited classroom time. It was also helpful to enable the students to develop a sense of completion of meaningful Scratch projects while focusing on language learning activities.

As such, Scratch projects, particularly the remixed projects, were developed easily. The students, therefore, experienced the benefits and the outcomes of their Scratch activities without the need to navigate, in detail, various programming concepts offered by Scratch. I argue that this approach exemplifies a more natural way of learning Scratch than instructing the students about different programming and computing concepts.

I describe the core participants in this study as the “Scratch team” because this was instrumental to the maintenance of a sense of belonging and ownership to the project. The notion of a “team” was inspired by my experience in recent years working with young learners in afterschool programmes and informal learning settings, during which I recognised the importance of maintaining the sense of belonging and ownership with the participant youth in projects.

5.3.1 Description of ESOL Programmes and Curriculum

A description of the learning strategies and outcomes of the Adult ESOL Core Curriculum (Steeds, 2001) provides an essential framework to discuss and analyse the outcomes and findings of the case study. The English for Speakers of Other Languages (ESOL) programmes aimed at improving the English skills of learners. According to the national qualification framework (Steeds, 2001), the ESOL programmes consist of different ESOL levels. There are three ESOL Entry Levels: Entry Level 1, Entry Level 2, and Entry Level 3). Upon completion of the Entry Levels, the students can progress to Level 1; and the qualification of ESOL Level 2 is equivalent to the GCSE A-C. See Appendix 8 for a detailed breakdown of the UK national qualifications framework.

The Adult ESOL Core Curriculum (Steeds, 2001) provides the ESOL learning strategies through which we can capture and discuss possible improvements and achievement on the ESOL learners. It recommends four ESOL learning strategies necessary for learning of vocabulary, word recognition, spelling and phonics. These strategies are: (1) visual strategies to recognise words with a range of letter combinations and silent letters; (2) structural strategies including read and understand words with common suffixes and prefixes; (3) contextual strategies helpful to work out the meaning of unfamiliar words from the general context; and (4) phonic strategies that include activities, such as reading a story and “sound out” an unfamiliar name (p230). In addition, the ESOL curriculum notes issues that affect the delivery of the curriculum at the different ESOL levels.

Meanwhile, the Adult ESOL Core Curriculum has four skill areas with breakdowns of each skill. These breakdowns of skills areas are utilised in the discussion of the case studies. The followings list these skills as indicated by the Adult ESOL Core Curriculum (Steeds, 2001, p8):

1- Speaking
    a. Speak to communicate
2- Listening
    a. Listen and respond
3- Reading
    a. Text focus: reading comprehension
    b. Sentence focus: grammar and punctuation
    c. Word focus: vocabulary, word recognition and phonics
4- Writing
    a. Text focus: writing composition
    b. Sentence focus: grammar and punctuation
    c. Word focus: vocabulary, spelling and handwriting

5.4 Chapter Summary

This chapter has presented the context of the case study and the targeted ESOL programme. This context included learning practices developed through the recruitment and data collection phases of: Phase 1, a piloting phase that took place before the research site was secured and the research participants recruited. Phase 2 discussed the process of securing the research site and recruiting research participants. Also, the chapter has reviewed the training of ESOL tutor and the preparations to commence the project with the core participant students. Phase 3 has discussed the project implementation process and the introduction of Scratch to the core participant students. Next, the chapter presented the findings from the survey on the usage of the Internet and Scratch, which showed that the students were well connected to the Internet, and they were not existing users of Scratch. Finally, the findings from surveys for students and tutors who did not eventually agree to participate more fully in the research contributed to constructing the context of the targeted ESOL programme, and, therefore, the case study. Reasons provided for not taking part in the project included: time, lack of interest, lack of computing equipment, and the nature of the environment at the institutions which offer the ESOL programmes.

CHAPTER 6: CASE STUDY

6.1 INTRODUCTION

The case study in this chapter consists of multiple smaller case studies about individual core-participant students. These case studies demonstrate perspectives of linguistic and computational improvements including improvements in English language learning skills (Reading, writing, speaking and listening) and enhanced computational skills. They also illustrate developed learning attitudes including personalised learning, independence and autonomous ESOL learning practices and increased level of confidence. In particular, I equate in a nominal sense, the domains of knowledge offered by Bloom (Anderson et al., 2001; Krathwohl, 2002), discussed earlier on page 81 in this study, to the three areas in which the case studies have made gains, cognitive to the linguistic gains, psychomotor to the computational gains and affective to the attitudinal gains.

The case studies narrate the story of the learners in this project and illustrate successful learning practices as well as challenges faced in employing the Scratch computational environment in the ESOL programme. They also provide empirical evidence that contributes to answering the research question of: to what extent can constructionist interventions such as Scratch contribute to the achievement of higher levels of literacies among young adult ESOL learners?

The discussions on the impact of computation interventions on the participant young adult ESOL learners unfold through the analysis of the Scratch projects and artefacts used or created by these learners. Therefore, there are two parallel directions in the analysis and discussion of the case studies. The first is focused on the language development and enhancement of the learners' English language skills while the second is focused on the computational practices that contributed to the language development. Ultimately, this shows a synergism between the computational and the linguistic directions, through which the case studies were developed.

The case studies discussed in this chapter represent the group of students from the two targeted ESOL classes at the research site: (1) the case of GFL1, who is a female student with mixed African and Spanish origins; (2) the case of SFL1, who is a female student with a Middle Eastern origin; (3) the case of JFE2, who is a female student with a Chinese origin; (4) the case of KME2, a newly immigrant male student from Greece; and (5) the case of

SME2, who is recently immigrant male student from Greece as well. All the students in the case studies were full-time students who were enrolled on ESOL courses in addition to other main courses at the college. One core participant student (DFE2) was not able to engage with Scratch projects similar to the other students. Her attendance was poor and, therefore, affected her ESOL class activities as well as the Scratch team activities. The tutor reported that the student's poor attendance was the primary cause for not passing her ESOL tests. She eventually left the college and could not be reached via email or mobile.

As presented in the Chapter 3, Section 4.9, entitled "Methods of Data Collection and Analysis", the case studies utilised three data sets: interviews, analysis of produced artefacts, as well as participant observation and field notes. As for the data collected through interviews, the case studies utilised data collected through six semi-structured interviews, one with each of the students and the ESOL tutor. All of the interviews were conducted at the research site by the end of the study. These interviews have been recorded using a Dictaphone device except two because the interviewees did not give permission to record the interviews and they were not feeling comfortable recorded their responses. See Appendix 6 for the list of semi-structured interviews conducted in the project.

The students have used dozens of Scratch projects and developed many others. These projects constitute the artefacts in this study. However, the following Table 6.1 lists the artefacts discussed in the case studies that illustrate the contribution of this project:

Table 6.1: a list of artefacts (Scratch projects) and their associated figures discussed in each case studies.

#	Titles and descriptions of the artefact (Scratch projects) used and constructed in the case studies.	Figures	Case Study
1	Greetings sentences	6.1	GFL1
2	The job interview project for recording a question and an answer that simulates a job interview conversation.	6.2	GFL1
3	A cross-language translation Scratch project (English, Spanish, French and Bambara)	6.3	GFL1
4	English words spelling	n/a	GFL1
5	A remixed Scratch project entitled, "Teens at the Castle".	6.4	SFL1

6	A remixed Scratch project on the spelling of English words - a vocabulary drill and a gap-filling project.		SFL1
7	The English word roots Scratch project. Project demonstrate the root “spec” which means to see or look visually.	6.8	SFL1
8	Music project and animated lyrics, entitled “Listen to mum words”.	6.9	JFE2
9	A scratch project that animates greeting sentences.	6.10	JFE2
10	The Scratch project entitled, “Phonics Shooter” illustrates using Scratch to develop phonics.	6.11	JFE2
11	Animating greeting sentences in English	n/a	KME2
12	Greek and Latin roots Scratch project	6.13	KME2
13	Remixed Scratch project of Greek and Latin roots of the English that shows two newly added roots.	6.14	KME2
14	Greek and Latin roots of English words	6.15	SME2
15	The algorithm	n/a	SME2
16	The coffee-making robot	6.16	SME2

6.2 CASE STUDY 1: GFL1

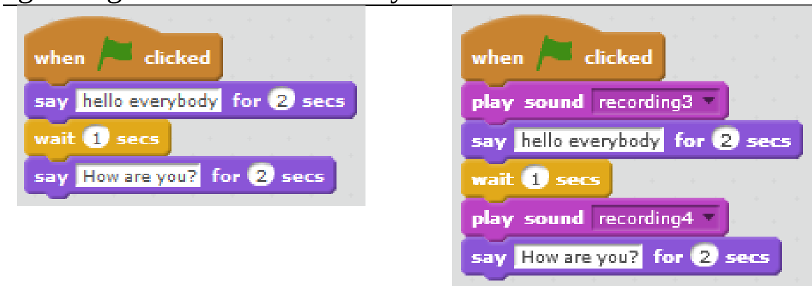
GFL1 is a 17-year-old female student in the ESOL Level 1 class. She is an enthusiastic person who moved to the UK three years ago from Spain with her family. GFL1 has a mixed African and Spanish background. In addition to the ESOL course, GFL1 studies art and design as her main course at the college. She is enrolled on the ESOL course because the college felt that she needed to develop her English language skills. There are two interesting facts about GFL1: she speaks three different languages in addition to English, and her ambition is to get a place at the University of the Arts London, the largest university in Europe that specialises in art and design. The languages she speaks apart from English are Spanish, French and Bambara, a local language in Mali, West Africa.

According to the Adult ESOL Core Curriculum, learners at Level 1 are aware of variations between spoken English and written Standard English, and can write and speak complete sentences with different competencies (Steeds, 2001). GFL1 demonstrated competencies in reading, writing and speaking using complete English sentences, but this was usually with grammatical and structural flaws and occasionally weak pronunciation. Although her literacy levels in Spanish, her mother tongue spoken language, encouraged the utilisation of her transferable skills, there were problems with her speaking and spelling in English. She was not able to spell certain words correctly, such as those with the suffixes “ious” and “uous” as in “curious” and “ambiguous”. Her pronunciation of multi-syllable words was sometimes poor, such as when pronouncing the word “interest” in two syllables instead of three.

6.2.1 Project 1: Greetings Sentences Scratch Project

The introduction of Scratch to the ESOL students, including GFL1, involved the animation of simple greetings sentences. After a quick demonstration, GFL1 constructed a simple project that used the “cat” sprite to animate the greeting sentence, “Hello everybody”, followed by the sentence, “How are you?” Later, GFL1 recorded her pronunciation of the greening sentences using the Scratch recording function. As a result, the Scratch project illustrates the animated greeting sentences and also plays her recordings of these sentences. See Figure 6.1 below for screenshots of the Scratch script used in this project. The figure on the left shows the initial script. The figure on the right shows the added recorded sentences and the added sound script.

Figure 6.1: a Scratch script that animates two consecutive greetings sentences created by GFL1.



6.2.1.1 Linguistic Outcomes of Project 1

Within this project, there is evidence of properly written sentences. For example, the student was able to generate written sentences that people could understand. The two greetings sentences in this demonstration – “hello everybody” and “How are you?” – show that the student was able to construct, write and speak English sentences correctly.

In this context, in addition to the evidence gained from the project itself, my intention was not limited to just the outputs of the Scratch project as the produced artefact. This is because significant evidence was also observed as emerging from the interaction with the student. Therefore, I wanted to see the impact of what the student had learned in the project, through her normal use of language, even though this might be just spoken. As such, the following is the transcript of two of my dialogues with the student, which indicates the progress that was made in terms of asking questions, and providing answers to questions:

GFL1: How you put the words here? [pointing to the Scratch screen].

Researcher: Click on the "Looks", the blue section here [referring to the "Looks" section on the computer screen], and drag this block to the script area here.

GFL1: It's not working? [while she is trying to run the project by clicking on the green flag].

Researcher: First, you need to add the "green flag" block, click on "Events" please [pointing to the Events section], and drag the "green flag script" into the script area here.

GFL1: Like this? [dragging the block of script].

Researcher: Yes please, put it on the top, like a hat.

GFL1: Yes, thanks [student satisfied after figuring out how to animate the text].

When the student was trying to add the recordings of the sentences, I had a second conversation with her regarding the difference between the two blocks of "play sound (recording3)" and "play sound (recording3) until done". This conversation was initiated as the student was trying to play her recorded sentence at the same time as the text appearing on the screen. The following excerpt illustrates this conversation about sound functions and blocks in Scratch:

GFL1: The voice is coming before the words, I want them together.

Researcher: That's because you are using "play sound (name of recorded file) until done", if you choose the block 'play sound (name of recorded file)', then you will have the voice and the sentences together at the same time.

GFL1: So, which one…what's the difference? [between the two sound blocks]

Researcher: Okay, the first, 'play sound (name of the recorded file)', will play the recordings and allows the script below to run [researcher is pointing at the script screen]. The other script ending with "until done" will allow the script below to be run only until the playing of the recorded file is done.

GFL1: What's that …I don't understand? [Enquiring about the operation]

Researcher: Drag this "play sound (name of the recorded file)" and you will have the text and the voice together, and you'll see the difference.

GFL1: [the student is dragging and dropping the "play sound (name of the recorded file)" into the script area].

Researcher: That good.

GFL1: Okay, thanks.

In the first response, the student demonstrated that she could ask questions, even though there are grammatical flaws ("How [do] you put the words here?"). Nevertheless, these sentences can be understood, taking into account that the student is in an ESOL Level 1 class. Also, there is a structural problem in the sentence "it's not working", as the correct way to ask the question is "Is it not working?" There is an indication that this student is replicating the way in which questions are formed in her mother tongue language. Nonetheless, she was still able to fluently ask this question.

From this demonstration of the two dialogues with the student, we can see the relationship between the sentences she utilised, in that one sentence leads to the other. This means that the student can now construct sentences and ask questions. For example, the sequence of two questions, "So, which one…what's the difference?" shows that the student can combine two questions in a coherent manner within the same sentence. This may then generate complex sentences.

Furthermore, through this activity, this student can use tone to ask questions, she actually says, above, “It’s not working?” The student used the Scratch environment as a medium through which to express herself, which encouraged her to practise and keep up an on-going conversation. Therefore, as we can see from the second dialogue with the student, she could construct complex sentences: “The voice is coming before the words” and “I want them together”. The student started to generate compound and complex sentences such as these while engaging in this project. Lastly, according to the Adult ESOL Core Curriculum, this Scratch project helped the student to communicate, speak clearly, use simple and compound sentences with appropriate word order, and make requests and ask questions.

6.2.1.2 Non-Linguistic Outputs from Project 1

The student was able to listen for and understand explanations and instructions, as well as to clarify and confirm understanding. The student’s engagement in this Scratch project supported her in creating new abilities which contributed to the development of her attitudes towards learning. The team working and actively participating in group discussions are an illustration of these gains. Other illustrations of the non-linguistic gains include: team working and actively participating in group discussions, a willingness to learn, hear, respond and react. Further attitudes enhanced include openness to develop a new experience in the classroom and to value a learning activity inside her ESOL classroom, as exemplified by the Scratch activities, projects and conversations.

6.2.1.3 Computational outputs of Project 1

By doing this project, the students had learned the computational concepts of sequence and events by using the “Looks” script to animate sentences. She was able to familiarise herself with the “Sound” block and added her own recording of the sentences to the Scratch project. The student was also introduced to the computational concepts of “sequence” when she experimented with snapping Scratch blocks together. She also developed an understanding of the computational concept of “parallelism” as she used the timing while constructing the animation of the greeting sentences.

6.2.2 Project 2: The Job Interview Scratch Project

Using the cover letter she drafted as part of the ESOL exercise, GFL1 responded to the question: “Why do you think that you are the right person for this particular job?” The student’s recorded answer was:

> “I am a very loyal person who can work under pressure; I am very trusted. My skills are: I am a good listener, patient, able to learn fast, organised myself, and a translator. I can translate to three different language[s], I can translate to Spanish, French and Bambara”.

Figure 6.2a: a snapshot of the “Interview question – GFL1” Scratch project for recording a question and an answer that simulates a conversation in a job interview.

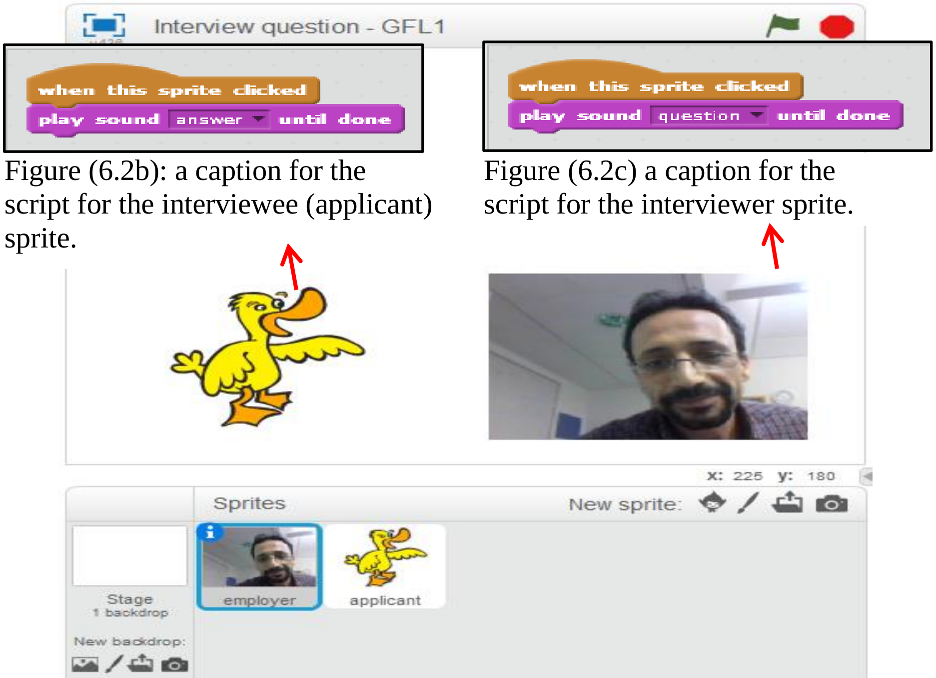


Figure (6.2b): a caption for the script for the interviewee (applicant) sprite.

Figure (6.2c) a caption for the script for the interviewer sprite.

Within this Scratch project, the student showed that she could generate written sentences and create a meaningful Scratch project based on her written assignment in the ESOL class. However, similar to Project 1 discussed earlier in this case study, I wanted to find out if this principle could be applied to a wider discourse. Also, I wanted to observe and guide the student in constructing computational Scratch blocks. Therefore, I engaged with the student to investigate other language and computational elements gained and/or under development as a result of constructing this Scratch project. The linguistic examples that GFL1 was able to articulate are provided in the transcript below of my engagement with the student:

Researcher:	Can you tell us how it works? [the Scratch project]
GFL1:	This is me [the duck/applicant sprite], and when you, like, click here [on the script of the applicant] it will animate the sound.
GFL1:	Like this…[student demonstrating clicking on the script and the recording of her sound is played]
Researcher:	That's very interesting.
Researcher:	Instead of running this script when clicking on the script block, why don't you try using the "Events" script to run the recording file when the "applicant" sprite is clicked?
GFL1:	Which script do you mean?
Researcher:	Go to "Events" [pointing to the "Events" section on the computer screen], and select "When this sprite is clicked" block.
GFL1:	This one? [pointing to the script using the computer mouse]
Researcher:	Yes please, drag and drop it.
GFL1:	Shall I, like, drag it on the top?
Researcher:	Try to see where it can fit in your script.
GFL1:	Aha, this is, like, fitting on the top, like the "green hat" block [similar to the green flag block]
Researcher:	Wonderful, that's great. Now try to test it by clicking on the applicant sprite please.
GFL1:	Yes, I see.
Researcher:	So, what else may you do to improve this project?
GFL1:	I think I may gonna make, like, an animation and movement with shadows.
Researcher:	That great, let me know if you need any help.

GFL1: Aha, thanks.

From the above transcript of my engagement with the student around constructing and revising her Scratch project, it is obvious that she can generate simple, complex and compound sentences as well as use tone for asking questions. According to the Adult ESOL Core Curriculum, this meets the requirements in several ESOL skills areas: speaking to communicate and engage in discussion, and listening and responding. In addition, we can see from the project itself that the student demonstrated written composition skills using grammar and punctuation, including properly written sentences and a varied English vocabulary.

In this excerpt from my dialogue with the student, she shows grammatical improvements that she gained during her engagement with Scratch projects. For example, the student asked, “Which script do you mean?”, which is a correctly articulated grammatical question of the type that she could not articulate at the early stage of her involvement in this study, as illustrated by her recorded dialogue in Project 1 that was discussed earlier. As such, this recorded snapshot shows explicit evidence of improvement in written and spoken English as well as of serving the ESOL core curriculum.

6.2.2.1 Evidence of Learning and Employing of New English Vocabulary

In the project illustrated above, the student labelled my picture as “employer” and her sprite (the duck) as “applicant”. In doing so, the student learned new words. The student did not know the word “applicant”, and she was not able to use the word “employer” before her engagement in constructing this project. The word “applicant” was a new word for the student. She could understand the meaning of the word “employer”, and use this word in her project, something she was not able to do before in any other context. As such, there is explicit evidence of the learning of some new words, as demonstrated in the following excerpt from my dialogue with the student while constructing this project:

Researcher: That’s good, now do you want to change the name of your sprite to “applicant”?

GFL1: Applicant? [student is asking question with a tone]

Researcher: You are the “applicant” [pointing to the duck sprite on the project screen], and I am the employer [pointing to the employer sprite on the project screen]; you are the person who is applying for this job, and doing this interview.

GFL11: [student thinking]…Like, from job application? [asking question with a tone]

Researcher: Yes, “applicant” and “application” are nouns, but the applicant is the person who submits the application.

Researcher: Do you want me to change the name for you?

GFL1: Yes, please.

Researcher: [is changing the name of the sprite from “duck” to “applicant”]

GFL1: Ah, like, [an] applicant for the job.

Researcher: Yes, the person who is submitting the application and doing this interview is called “applicant”.

As demonstrated above, the process of remixing this Scratch project incorporated a complex conversation that helped the student to acquire and employ some new English words, listen and respond to questions and provide an answer.

6.2.2.2 Using Scratch to Share and Discuss the Writing Assignments in the Classroom

As this project was constructed in an ESOL writing session, what distinguishes it from normal classroom writing exercises is that it allowed the student to share and discuss her writing assignment with the other students in the class and with the tutor. Therefore, in this project, the student was able to write, share and discuss her written assignments with the tutor and other students in the class.

Based on my observation in the ESOL writing session, the tutor provided the students with guidelines for writing based on the “Functional skills” curriculum for English Level 1 (C. G. P., 2012). These guidelines included: the number of words required (about 60 words), the time allocated (15-20 minutes), and a reminder of writing skills, including about the text, sentence grammar, punctuation, words and spelling.

During the writing session, the students were instructed to write on a selected topic, such as writing a cover letter for an application for a job at the local shopping centre or writing a message to the principal of the college regarding the college's facilities. The ESOL tutor then followed up on the progress of each student on a one-to-one basis. As such, in the ESOL writing session, the teaching was mainly focused on the written form and no group discussions or presentations of the submitted writing assignments took place. When the students had finished the writing exercise, they submitted the assignments to the tutor. The tutor then reviewed the assignments, provided written feedback on the assignment form, and returned these to the students in the next class. Also, the tutor discussed the feedback with the students on a one-to-one basis.

In this context, the job interview Scratch project provided the students with a unique way to share and discuss their writing assignments not only with their tutor on a one-to-one basis but also with the rest of the students in the ESOL class as GFL1 presented and discussed her project with them. This also helped the students to vocalise what they had written. As such, this was in line with the strategy that fed into integrating ESOL skill areas.

Therefore, the job interview Scratch project provides explicit evidence of the students being allowed to share and discuss their writing assignment in the ESOL classroom. In other words, the Scratch programming environment provided a medium through which the students could develop their English language using cross skills areas that combined writing and speaking to communicate and engage in discussion, along with listening to respond.

6.2.2.3 Analysis of Project 2 Outputs

This project provided the student with the opportunity to demonstrate new ways of presenting structural repetition and review at the individual and class levels. At the individual level, the student could use her recorded response, embedded in the Scratch script, to review her speaking and writing at any time that was convenient for her. Also, this project helped the student to identify structural and grammatical errors. For example, after presenting this Scratch project to the class, she was able to identify and correct the grammatical flaw of using the singular form of the word “language”. Additionally, GFL1 used this Scratch project, in the following weeks, as a foundation for developing another project that showed her skills in the other three languages she speaks, as discussed later in this case study.

At the class level, presenting the project to the entire class resulted in the development of social skills, which emerged through discussions with other students. The recorded response aroused the interest of the other learners in the class. For example, they wondered about the student's third spoken language, "Bambara". In the process of reflecting with GFL1 on her experimentation with Scratch in this example and other projects, she indicated that using a Scratch script to record her conversations was an absorbing activity for her and other students as well. The project, according to her, attracted the attention of other students and sparked a discussion about the languages she speaks, particularly Bambara:

> "I said "Bambara", [the other students were thinking] what is "Bambara", I did not hear Bambara in my life. Where does that come from? And you know, because "Bambara" is just a language from Mali, I think they were, like, a little curious. Because it is not something that you just hear it every day. And that just something that people will never heard [before], if a person does never know until you told them".

6.2.2.4 Linguistic Outcomes of Project 2: Serving the ESOL Core Curriculum

GFL1's Scratch project illustrates the utilisation of phonic and visual ESOL learning strategies as recommended by the Adult ESOL Core Curriculum (Steeds, 2001). This entails the student vocalising the written language corpus in order to be able to record her conversation using the Scratch script. There was also an indication of improvement in the listening and responding skills of the students, in that they had to listen carefully while watching the demonstration of the recorded question and answer within the context of a job interview. In addition, the response of GFL1, in the job interview context, included words that expressed professional qualities such as "good listener", "patient", "organised", and "able to learn fast". These words and expressions were probably added to the vocabulary of the ESOL students as well.

The use of this project was even more relevant because it was directly aligned to the curriculum requirement for the class. The project was based on a curriculum item in the scheme of work for the class, the exercise of writing a cover letter for a job application. GFL1 utilised the Scratch environment and built on her draft of a cover letter for an imagined job application in order to capture and share her experience in an interactive and computational fashion.

6.2.2.5. Non-Linguistic Outcomes of Project 2

This Scratch project provided GFL1, and other ESOL students, with additional ways of communication, interaction and expression using the Scratch computational environment.

She utilised the environment in her language learning practices inside the ESOL classroom to rehearse their listening and speaking within the context of a job interview. Consequently, the other students in the class used the provided Scratch template to record not only excerpts from their cover letters but also other conversations. For example, a student took on the role of the presenter of a radio programme and recorded random sentences in a formal, but humorous, fashion, which he then played out loud to the class.

Another dimension of this project is the recording of a "live" snapshot of a learning activity in the classroom that is different from capturing learning practices via, for example, video or audio recordings. The difference in recording between a computational environment and a non-computational video/audio recording is discussed further in the third project in this case study. Furthermore, the students not only shared and appreciated their cultural and linguistic differences but were also able to draw from the confidence shown by GFL1, which inspired them when she recorded and discussed her response.

From another perspective, the job interview Scratch project enabled the tutor to provide feedback to the student in front of the rest of the class. For example, he praised GFL1 by saying, "Excellent, well done" in front of the other students, after she had demonstrated her project using the available computer projector. Based on my observation, this was more rewarding to the student than receiving feedback on a one-to-one basis, and the tutor confirmed this in my discussion with him at the end of the class when we were arranging and sorting the learning materials together (the mini-dictionaries, booklets, etc).

6.2.2.6 Computational Outcomes of Project 2

For GFL1, this was her first experience of remixing a Scratch project. As her base starting point in remixing projects, therefore, she was able to identify visually the purple colour that refers to available sound functions, read the Scratch script, and drag the recording script to record her response to a question I provided this as a demonstration to the students (see Figures 6.2b and 6.2c.

When GFL1 constructed Project 1, she had to navigate and use a few different sections of Scratch, which helped to enhance her computational thinking skills. For example, the student experimented with the computational concepts of sequence, events and parallelism (Brennan and Resnick, 2012) in order to be able to construct this project. GFL1 understood that she needed to play the recorded sound after the event of clicking the duck sprite.

For the direct computational outputs, the student constructed Scratch script and programmable blocks, as seen in Figure 6.2a. There are two sprites, or objects, in this project, the first is a duck that represents the applicant, and the second is a picture of the researcher that represents the interviewer. Figures 6.2b and 6.2c show snapshots of Scratch scripts and programmable blocks of these two sprites. These programmable blocks, or Scratch script, illustrate the visual programming blocks in the visual computational environments. They consist of puzzle-like blocks and shapes that learners drag, drop and snap together to construct a programme.

For instance, Figure 6.2b illustrates the script for the duck sprite. It consists of two programmable blocks: the first is the "event" programmable block labelled "when this sprite clicked". As the label suggests, this block runs the blocks beneath it when the duck is clicked. Meanwhile, the second programmable block in Figure 6.2b is a sound block labelled "play sound [answer] until done". This programmable block, or script, runs a computer sound file entitled "answer" when it is executed. In conclusion, when the duck sprite is clicked, the programmable blocks, or script, for this sprite will run (Figure 6.2b). Consequently, this will play the indicated sound file. A similar description applies to the intervener sprite (Figure 6.2c). See Chapter 2 for a detailed discussion about the Scratch programming environment.

6.2.3 Project 3: A Cross-language and Cross-cultural Scratch Project

This project is a computational and cross-language translation projects relevant for the ESOL students, who speak one or more additional languages. GFL1 utilised her Scratch project in Project 2 (Figure 6.2a) to construct a more advanced Scratch project that shows her skills in the other languages she speaks. She developed a project through which she translated her recorded response in the job interview Project 2, discussed earlier, from English into the three other languages she speaks (Spanish, French and Bambara). See Figure 6.3a below for an illustration for Project 3, developed by GFL1.

Figure 6.3a: a snapshot of Cross-language translations Scratch project (English, Spanish, French and Bambara) by GFL1.

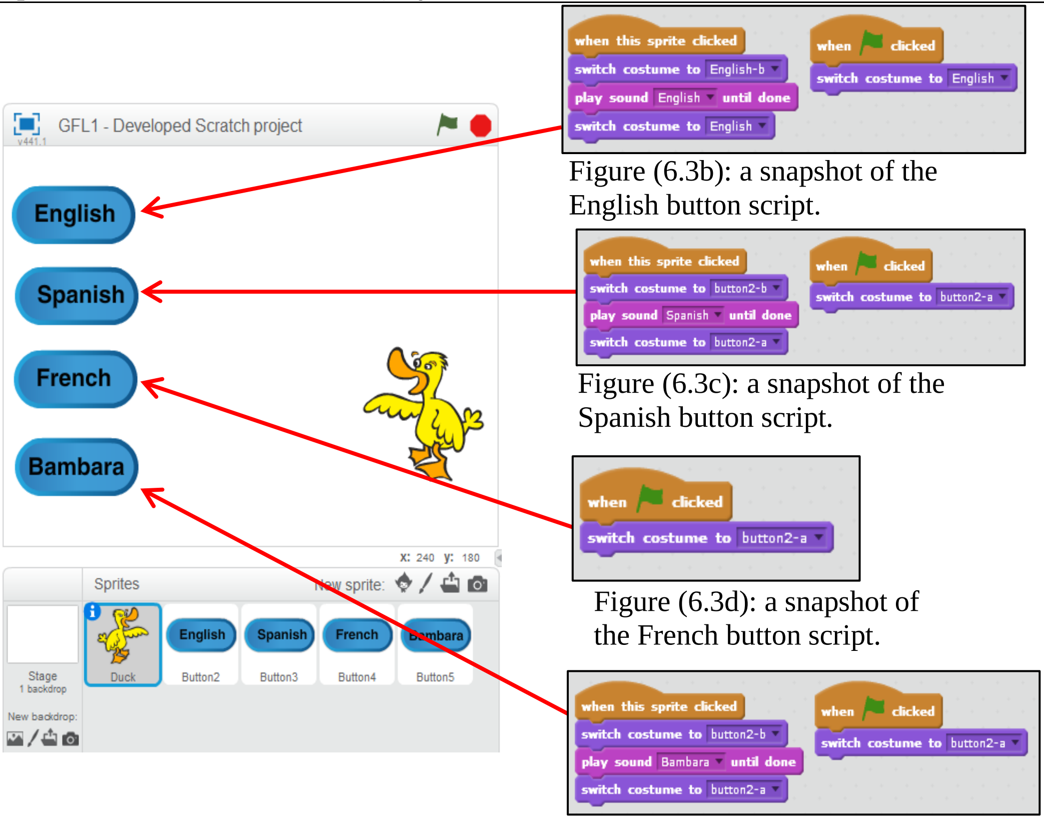


Figure (6.3b): a snapshot of the English button script.

Figure (6.3c): a snapshot of the Spanish button script.

Figure (6.3d): a snapshot of the French button script.

Figure (6.3e): a snapshot of the Bambara button script.

6.2.3.1 Outputs of Project 3

The project entitled “GFL1 developed Scratch project” (Figure 6.3a) was constructed using similar computational blocks and skills to those developed in GFL1’s second Scratch project entitled “Interview question – GFL1” (Figure 6.2a). She created four buttons to represent the four languages she speaks, and she wrote a script that played her recorded sentences in a language associated with each of the buttons. For example, when a user of this project clicks on the button labelled “English”, the script block that appears in Figure 6.3b will be executed. As a result of this script, GFL1’s recorded sentences in English will be played and heard. Similarly, when a user clicks on the Spanish button, the script block that appears in Figure 6.3c will be executed. Consequently, the recorded sentences in Spanish will be played and heard. The same applies to the remaining two languages, French and Bambara. See Figure 6.3a for screen snapshots of this project.

6.2.3.2 Linguistic Outputs from Project 3 and Evidence of Learning New English Words

Within this project, there is evidence of properly spoken sentences in the different languages that GFL1 recorded. I also had several conversations with GFL1 while she was constructing this project. I provide two excerpts of my dialogue with the student as an illustration of the complex level of discourse that took place around the development of this Scratch project. The first is of my discussion with the student about changing the direction, or rotation, of the "duck" sprite, as she wanted to position it so that it was looking to the left instead of the right. The second discussion is about changing the costume (the colour) of the languages' buttons when a user clicks on any of these buttons. The purpose of this was to show an indication for a user click on a button or selection for a language.

Conversation 1, the student is taking the initiative and starting the conversation by asking a question in connection with a demonstration the researcher has done of movement and costume changes:

Researcher: Yes, GFL1, how can I help?

GFL1: How can you make, like, make it go to left side?

GFL1: I want this [student is pointing to the duck sprite] to go to the left not to right.

Researcher: Click on the sprite information [the sprite header] and change the directions or the rotations as you wish.

GFL1: From here?

Researcher: Yes, please.

[the direction is not changing exactly as the student want]

GFL1: Which one, the rotation or direction?

Researcher: Rotate this little handle to change the degrees.

GFL1: That's confusing.

Researcher: Continue holding the mouse's click while rotating.

GFL1: Still not working [the sprite has rotated, but it appears upside down]

Researcher: Okay, let's have a look.

Researcher: Aha, please change the rotation style, from here.

GFL1: You mean from here? [the student is pointing to the rotation style position in the Scratch editor]

Researcher: Yes, please.

Researcher: Try to change the rotation now.

GFL1: Aha, thank you.

The above transcript describes a simple, or casual, computational task in the student's engagement with Scratch activity while working on developing her Scratch project. Yet, this casual task entails a complex sequence of sentences, even though they are only spoken rather than written. This dialogue consists of a sequence of eight sentences that contain relevant linguistic vocabulary that enabled the student to speak to communicate, ask questions and follow-up questions, listen carefully and respond, and participate actively in the conversation. In terms of generating new words, the student used new words such as "rotation", and she employed the word "direction" in a new computational context. Such complex conversations are not observed in the average ESOL Level 1 class.

Conversation 2, in order to further investigate the discourse around the construction of Scratch Project 3 with GFL1, I decided to engage in another conversation with the student around a different computational activity. I suggested that she add a Scratch script that would change the costume (the colour) of any of the buttons after she, or a user, clicks on any of the buttons. This served to show an indication of a user selection. The following is the transcript of my dialogue with the student:

Researcher: I am just wondering, why don't you let the script change the colour of this button after you click on it? This will show that the programme is running this script and playing the recording?

GFL1: Like, making animation?

Researcher: Yes, exactly, the colour will change when the sprite is clicked.

GFL1: Can you show me?

Researcher: Sure.

Researcher: Can you please select one of the buttons?

GFL1: Which one?

Researcher: Any button.

GFL1: Then what?

Researcher: Can you click on costumes, please?

GFL1: Aha.

Researcher: There are two different costumes for this button, blue and pinkish. So, we just need now to change this colour when this button is clicked.

GFL1: Can you make animation moving and have the shadow of it?

Researcher: We'll change the colour and see how it looks. Go to "Looks", the blue section here [pointing to the computer screen], and drag "switch costume to (button2-b)" into the script.

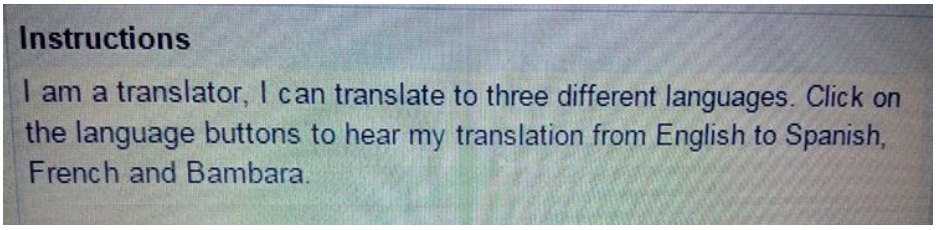
GFL1: Where should I put this? [the Switch costume block]

Researcher: We need to put it here [pointing at the computer screen] exactly just before "play sound (Spanish) until done".

Similarly to Conversation 1, Conversation 2 incorporated linguistic and computational elements. The student was able to engage in a sequence of questions and answers, listen and respond, ask questions, and clarify that she understood or did not understand any part of the conversation. Noticeably, GFL1 was creating a project not only for herself but also for other students. This attitude incorporates design skills and demonstrates communication skills as well.

Furthermore, the student prepared a description of and instructions for the project on the Scratch project information page. Figure 6.3f below shows a snapshot of the project information as it appears in the Scratch programme. There is evidence of properly written sentences and proper punctuation. For example, the student has correctly used the plural and singular forms of “language” in the sentences, “I can translate to three different languages” and “the language buttons”. As such, this student can now generate compound sentences, all meaningful and coherent. On the basis of that, I think that the student has continued to make progress in the use of language.

Figure 6.3f: a snapshot of the project description for the cross-language translation project created by GFL1.



In my view, the discussion with GFL1 involved complex sentences and words. For the average English speaker, the words costumes, rotation, events and parallelism may serve linguistic meanings. However, these words entail computational concepts (Resnick and Brennan, 2012) that need computational skills to be perceived properly. GFL1 had learned various linguistic elements and computational skills by the end of the spring term, as can be seen in the transcripts of my dialogue with her around constructing this Scratch project. This progression in language learning and computational skills provides an indication of synergism between computational thinking practices and language development.

6.2.3.3 Analysis of Project 2 Outputs

This multilingual project enabled the student to express herself using translations across the different languages she speaks. The Adult ESOL Core Curriculum (Steeds, 2001) recommends that learners who are literate in their mother tongue translate and compare sentences. The cross-language translations between English and the student’s other three spoken languages are an illustration of the ESOL curriculum recommendation. Furthermore, using Scratch to record the sentences and translations was helpful to GFL1, who reported that:

> "when you are presenting something in front of everybody, then, it's like, you may just panic or something like that. But if you are recording your own voice…[that's a different thing], sometimes when you [are] presenting something, you just don't know what you said, it just came out your mouth, and it is like, what is just I said? But if you record, it is just, like, more calm. And just nobody say [nobody interrupt], and then you can hear it again, and say if what I say was enough? was that good? was I talking clearly? Was my voice sounds good?"

GFL1 has shown how Scratch can help to utilise her transferable skills. By doing Project 2, GFL1 demonstrated that Scratch cross-language projects can contribute to enhancing speaking and listening skills through listening and responding to the interview question, speaking and communicating with the interviewer, and engaging in a discussion with other students about the project.

6.2.3.4 Non-Linguistic Outcomes of Project 2

By constructing this project, GFL1 has shown how Scratch can help to increase cross-cultural and cross-language expressions and translation in ESOL learning activities. When the student provided translations from English into her other languages, she developed translation skills that helped to incorporate her cultural background into the ESOL learning activities. In addition, in the case of this participant cross-language and cross-cultural activities encouraged the development of an autonomous learning skill. For instance, the computational environment enabled the learner to integrate different ESOL skills by constructing a personalised Scratch project.

This project demonstrated how computational environments can support the learner's social and cultural contexts as well as the multicultural and diverse ESOL classroom. It helped to enhance the student's educational endeavour and personal development while demonstrating her professional qualities in the different languages she speaks. This contributed to a higher level of motivation, through the incorporation of the student's other spoken languages in her ESOL classroom activities. In this regard, a comparison between the translated sentences in English and the other spoken languages was achieved.

6.2.3.5 Computational Outcomes of Project 2

This example depicts a notion of progression in language learning and computational practices. One attribute of the computational thinking practices is that they maintain a greater focus on the process of development than on the final result. For example, an "incomplete" Scratch project is a step towards creating a fully developed project. Consequently, it is normal, and encouraged, to develop a Scratch project gradually through testing, experimenting and exploring with the computational tool (Resnick et al., 2009). An illustration of this notion can be seen in the French button (Figure 6.3d) that the student has not fully developed, yet. A demo version, or incomplete Scratch project, will serve the goal of enabling GFL1, or other students, to use the programme and express themselves.

This project enabled the student to explore and develop a number of computational thinking skills, including "sequences", "loops" and "events" (Brennan and Resnick, 2012). As demonstrated in Figures 6.3b to 6.3e, with help from the researcher the student was able to switch the costume when a language button was clicked, changing the colour of the clicked language button from blue to pinkish. In this project, GFL1 utilised the computational concepts of events and parallelism as illustrated through the running of the Scratch script for each language button when a button was clicked. These are all illustrations of computational thinking skills that the student developed in constructing this Scratch project.

The utilisation of the Scratch script from Project 2 in Project 3 is an illustration of the remixing process carried out by the student. The learner demonstrated the ability to remix her project, and other projects available in the Scratch online forum. In this context, the same principle applies to ESOL learning activities and language development. The language development results in the two examples show elements of progression, with the outcomes of Project 1 being accumulated and addressed in Project 3.

Therefore, using Scratch to record the pronunciation of words and sentences enables projects, including learning activity materials, to be shared with the remainder of the ESOL class and the entire Scratch online forum. In addition, GFL1 started Project 3 by utilising and remixing the script from Project 2. As such, remixing served as a base from which to launch another project. The student was able to store her Scratch project in the Scratch online forum and re-use it later, with the forum serving as a repository for projects created by her and other Scratchers.

In this context, non-computational video or audio recordings could be helpful in recording group discussions, and be used, for instance, as an assessment tool (Marshall and Drummond, 2006). However, programmable or computational recording files are dynamic and have more potential for learning. That is, the non-computational video or audio recording files are static when compared to the programmable blocks of Scratch. Programming blocks, or the student's recorded answers, using the Scratch scripts in Projects 2 and 3, can be remixed through other projects, as discussed in this case study.

6.2.4 Project 4: English Words Spelling Scratch Project

GFL1 had frequent spelling flaws, as did other students in her ESOL class. In response to this, she was encouraged to explore and use a Scratch spelling project or games. Most of these projects function as a word drill and a gap-filling exercise. GFL1 found these spelling and vocabulary Scratch projects interesting, and they attracted her attention, as I observed her exploring and using them on a number of occasions. In fact, GFL1 illustrated this in an interview: "I feel using Scratch with spelling grammars because I got problem with that, and also recording my voice to see, like, my reading".

The Scratch project in this demonstration is built around a list of English words that are pronounced one at a time. The project provides a sentence that explains the word in question while providing a hint about the number of characters in the word. GFL1 used this project by typing the right spelling of the English words she heard. In particular, GFL1 reported, and was observed, using a Scratch project entitled "Spelling Game" by a Scratch user called "srearley". She also used several of the remixed projects that were based on the "srearley" Scratch project. These remixed Scratch included one by the same Scratch user "srearley". The remixed Scratch project entitled "Spelling Games Vocab #5" by a Scratch user called "JeslynCG" is an example of the remixed Scratch projects used by GFL1.

6.2.4.1 Linguistic Outputs from Project 4

When GFL1 used Scratch spelling games, she had to develop her English spelling as well as her English writing skills. Indeed, there is explicit evidence that, by using this project, GFL1 both learned the spelling of new words and increased her vocabulary. This evidence is illustrated in the following excerpt from a conversation I had with GFL1 in an interview.

The student confirmed that Scratch helped her to learn new words and improve her spelling. I therefore asked her to provide examples of new words or the spelling of new words she has learned while using Scratch:

> "Yeah [student thinking], if I was going to spell 'ambiguous', I will probably will miss, like, I don't know, some letters and just got it wrong. Then I think the programme will actually help me to see how is the writing. Because, you know, the game has little lines to see how many letters as I go [in the spelling of the word]. So this tell[s] me how many amounts of it [number of letters in the word] like how long it is [the word]. You know sometimes I added some extra [letter] "O", "U", "O", "E" at the end, but it did not meant to be there".

In this project, GFL1 also explored and used remixed versions of Scratch projects, such as the one entitled "Spelling Games Vocab #5". For GFL1, this Scratch project contained new words and sentences. Although several of the words used in this remixed project were new for GFL1 or beyond her level of English, this project provided a more competitive Scratch project that she was able to try at her convenience. See Appendix 9 for a complete list of words and examples of the words used in this project.

In this context, examples of new words that GFL1 learned were: "asleep", "beneath" and "tripod". I can confirm that the student benefited from her experimentation with Scratch, which contributed to her learning new words and enhancing her spelling and writing as well. In my interview with the tutor at the end of the project, he added that:

> "I think it's interesting with [GFL1] because she had a very open attitude, she is always very willing to volunteer, and to take part. I think, you know, because of that; that allows her to access things and to benefit from the situation in a really positive way".

6.2.4.2 Non-Linguistic Outputs from Project 4

Indeed, GFL1 perceived these projects as a form of game because they had elements of competition. The following excerpt from an interview with GFL1 illustrates her reflections on Scratch spelling projects and games:

> "Because, you know, the first I use[d] a project, I really enjoy it because really, like a fun, and he is [it is] like a game, it was not actually a game, it's like learning from your mistakes. I think it was, like, really good way of improving your writing. Because apart from the game, you are actually enjoying it but after you learning, and you just learning from your mistake. And you see how, you know, you spell[ing] something or stuff just looking a boring dictionary; yeah".

In this context, using Scratch spelling projects and games contributed to the development of new abilities and, therefore, enhanced learning attitudes, such as enabling the ESOL students to be more autonomous and independent learners. This, in turn, contributed to the personalisation of the student learning environment. In order to confirm this, I discussed these games and projects with the ESOL tutor several times, and he seconded my views regarding their helping students to develop new learning attitudes. Indeed, in my interview with him, he said:

> "I think that it's really valuable that the students can understand the new tool which would enable them to do something for themselves. So it helps them with their independence and gives some possibilities to explore things for themselves, you know, according to their interests" (The ESOL tutor, 2015).

From another perspective, the Scratch spelling projects were used and remixed by different students in the Scratch team. This resulted in more interaction in the classroom, between the core participants. For example, GFL1 was observed to engage in conversations with SFL1 (case study 2) about Project 4 and other remixed versions of this project that were available in the online Scratch forum. This resulted in there being more peer interaction between the two students. Also, because the two students were using the same Scratch project, this led to there being more competitive elements while they were using this Project.

6.2.4.3 Computational Outputs from Project 4

Although the student did not create or remix Scratch projects in this example, she was able to interact with Scratch projects and read sections of the script that contained the English words in question in the spelling projects. After she had used the Scratch projects discussed in this section, she started looking for more remixes of these projects. I observed GFL1 exploring several remixes of the spelling projects before choosing one. Based on this observation, it appears that the student knew that she could explore the list of words in a given remixed Scratch project and then decide whether to proceed to use it or to skip to another remixed project. There are around 24 remixed Scratch projects that are based on the examples discussed in this section.

6.2.5 Discussion of GFL1's Case Study

The description and discussion of the Scratch projects in this case study illustrate the constructionist approach (Papert, 1980, 1993), underpinned by the broader social constructivist epistemology that perceives knowledge as a social construct rather than as a “commodity” that can be transmitted passively to recipient students (Edwards, 2012, p82). These projects demonstrate the potential for enhancing ESOL literacy skills through constructionist practices that involve the utilisation of multimodal and computational artefacts in a social context related to the interests of GFL1. The projects show how GFL1 enhanced her English skills through the acquisition of meaningful designs using new digital, programmable and computational media (Resnick, 2007; Kafai and Resnick, 1996; Papert, 1993). These multimodal computational practices are especially valuable when discussed from the perspective of the student’s learning experience (Sharpe et al., 2010), as illustrated in the dialogue excerpts provided in this case study.

For example, consider Project 2, “The Job Interview Scratch Project”. This project demonstrates the use of computational artefacts in the service of GFL1’s personal and social context. It is a practical illustration of how the social learning environment is an essential element of the process of constructing a project. Also, Projects 2 and 3, through which GFL1 shares her literacy in the other languages she speaks, can serve Vygotsky’s emphasis on multiculturalism and diversity in learning theory (Kozulin, 2003).

The Scratch projects in this case study are in line with the perspectives of new literacy studies (Cope and Kalantzis, 2009) that embrace multiple and multimodal literacies and discourses (Jewitt, 2008; Gee, 2001). They show how the social context and practices are multiple and that many literacies can be acquired within these contexts. In other words, these projects provide a fresh computational perspective on the sociocultural view of literacy, which suggests that literacy practices and meaning-making are always contextual and cannot be understood without their wider social context (Lankshear and Knobel, 2006). As such, I argue that this case study illustrates one way to tackle the challenges of using digital and computational technologies as part of the sociocultural literacy approach in an ESOL classroom. Therefore, the case study can be seen as illustrative of a complementary pedagogy that serves to unlock the constraints imposed by the determinist views that perceive literacy as a set of cognitive skills.

6.2.5.1 A View of Multimodality in Practice

The literature review suggests that notions of multimodality (Jewitt, 2008; Kress, 2000, 2005) and digital literacy (Buckingham, 2006; Merchant, 2007; Hague and Williamson, 2009) are essential to extending the understanding of new literacy studies in contemporary digital and computational practices. In this regard, essential elements of multimodality

(Jewitt, 2008; Kress, 2000, 2005) are evident in the Scratch projects in this case study. These elements include: writing multimodal text on paper and on the computer screen, as GFL1 had to draft her job application and interview questions using her notebook before using this text in Scratch Projects 2 and 3; GFL1's oral responses, which she recorded using Scratch ; and using digital images and music. What distinguishes GFL1's Projects 2 and 3 from other multimodal practices, such as using digital text or video blogging platforms, is that a number of multimodal practices are evident in a single Scratch project that promotes interactive and meaningful ESOL learning practices.

Consequently, this view extends the understanding of ESOL literacy and English language development in practice. We can conclude that the computational, or programmable, objects provide opportunities for ESOL teaching and learning that are not presented by the passive usage of digital resources, such as online ones, even if they offer some interactivity, such as when uploading user-generated content.

6.2.5.2 Convergence with Vygotsky's ZPD

The literature review suggests that the role of collaboration and social context in learning is fundamental to social constructivist learning theories, including constructivism (Piaget, 1967), Vygotsky's ZPD (Cole et al., 1980), Bandura's (1977) learning theory, and constructionism (Papert, 1980, 1993). However, as demonstrated in GFL1's case study, the constructionist approach emphasises the use of digital and computational artefacts that support meaningful learning practices in context. Therefore, the Scratch projects developed in this case study can be seen as a catalyst for promoting ESOL learning using digital and programmable artefacts as well as computational thinking skills.

Drawing on Vygotsky's ZPD (Cole et al., 1980), I suggest that the computational practices presented in the Scratch projects induce shifts that maximise the ZPD and learning potentials, as ESOL learners are able to acquire information and knowledge via the Scratch computational environments and multimodal projects. For example, GFL1's involvement with Scratch provides additional opportunities for learning that have the potential to maximise the ZPD because, for instance, she is working on projects that are related to her interests and background, as she is experimenting with Scratch using the different languages she speaks. Also, the construction of projects, including the intra-project progress, allows for more interaction and meaningful expression, as shown in the development of Project 3 through a remixing of Project 2. However, I argue that using digital and computational technologies in the service of a sociocultural constructivist view, such as that of Vygotsky, is not a straightforward process, and needs a fresh perspective. I discuss this perspective further in Chapter 7, Section 7.4, entitled "Computational Perspectives", and illustrate the potential for a synergistic relationship between constructivist and computational practices that serve notions of Vygotsky's ZPD.

6.2.5.3 Gains in GFL1's Case Study

Drawing from the projects and discourses addressed in this case study, different gains are achieved at the linguistic, computational and learning attitude levels. I discuss these gains from the three perspectives of Bloom's taxonomy of learning domains (Anderson et al., 1996; Bloom, 1956). I draw similarities between the cognitive learning domain, which is linguistic; the skills learning domain, which is computational; and the affective learning domain, which is behavioural.

Based on the Scratch projects illustrated in the case study of GFL1, we can conclude that three broad gains emerged from this case study:

First, linguistic gains: the discussed projects provided explicit evidence of progress and linguistic gain. There is explicit evidence for written and spoken sentences and words within the discussed Scratch projects themselves, and further evidence is provided within the discourse that took place during the interactions with the student. These interactions were illustrated in the dialogues, which show progress in generating sentences and words that were informed by those generated within the project itself. As such, these illustrations provide explicit evidence of the learning of new words and of written and spoken sentences.

The linguistic gains can be seen from the perspective of a revised taxonomy of the cognitive domain that classifies levels of learning, as discussed by Anderson et al., (2001). The authors provide a classification of the cognitive model and suggest a hierarchical progression through the following stages: Remembering, Understanding, Applying, Analysing, Evaluating and Creating.

In the above context, GFL1 was able to recall linguistic and computational knowledge in order to construct meaningful understandings through a multimodal environment as evidenced, for example, by her use of new computational concepts and words such as “sprite”, “object”, “script” and “sequence”. She was able to illustrate and describe ideas around Scratch projects. The student discussed the process of constructing the projects through listening, responding, and asking questions and follow-up questions. The debugging process of a Scratch project in the case of GFL1 entails recurring evaluation, and predicting and modifying activities. From a linguistic point of view, this can be portrayed in the recorded and written sentences within the Scratch project as well as in the discourses that took place around the construction of these projects.

One additional important outcome of applying computational procedures in order to model meaningful projects can be illustrated through conceptual qualities, such as the development of Metacognitive Knowledge, which “involves knowledge about cognition in general as well as awareness of and knowledge about one's own cognition” (Krathwohl, 2002, p214).

Second, computational gains: the student demonstrated that she was able to engage with the computer and use, create and remix Scratch project. This engagement incorporated several computational thinking skills, as illustrated in the Scratch projects in this case study. In particular, according to Resnick and Brennan (2012) computational gains in this case study can be articulated through computational concepts, such as iterations and parallelism; computational practices including remixing and debugging; and computational perspectives that illustrate the learning and personal context of the students as well as modelling their learning practices computationally using Scratch.

The computational gains can be seen from the perspective of the Psycho-Motor domain of the Bloom taxonomy of learning domains, as developed by Dave (1975). The author suggests the following five stages of the development of skills: Imitation, Manipulation, Precision, Articulation and Naturalisation.

The Scratch projects developed in this case study incorporate imitation and manipulation as essential practices, especially in the phase of introducing the project to the students. For example, Project 1 shows that the student was imitating the Scratch examples demonstrated in the classroom. In addition, Project 1 shows a progression after the student added her recorded voice to the imitated Scratch project, which can be described as a manipulation. In short, the computational skills can be seen from the perspective of the Psycho-Motor domain of learning. Lastly, the computational gains can be beneficial for the students in other subjects she is learning at the college, such as mathematics and numeracy skills.

Third, gains in attitudes: there are several qualities and attitudes that the student have developed as a result of her engagement in the study. The non-linguistic outputs of each project discussed in this case study are an illustration of these. For instance, working with others (e.g. the researcher or other students) contributed to developing a sense of collaboration in the classroom. The level of the student's engagement, as demonstrated in the discussions and dialogues, is an indication of a developed attitude of willingness to receive as well as of increased attention over the course of the study.

These developed attitudes towards learning can be viewed through the Affective domain that consists of the five stages of: Receiving, Responding, Valuing, Organisation and Conceptualisation, and Value Concept (Krathwohl, 2002). The development of an independent and autonomous learning environment is an illustration of the Affective gains in this case study. Other developed learning attitudes and behaviours include incorporating the social and cultural contexts, an illustration of which is the cross-language translation project.

Furthermore, student engagement with the Scratch team induces other attitudes towards learning. For instance, by being engaged with the Scratch team, GFL1 developed a sense of ownership and of belonging to the project and the Scratch team. This helped the student to be more persistent in getting the work done, as observed and evidenced in the projects and the discussions with the student. These are all attitudes, added values and qualities developed as a result of the student's engagement with the Scratch projects and which can be seen from the perspective of the Affective domain of learning. The discussions around the non-linguistic outcomes of each of the projects in this case study illustrate perspectives on these Affective gains.

Finally, we can conclude that the above are illustrations of similarities between elements of Bloom's taxonomy of learning domains and the computational, linguistic and attitudinal gains in the GFL1 case study. However, it should also be noted that there is no clear distinction between the development of one gain and another; as it appears that the student was developing these gains simultaneously, not separately.

6.2.5.4 Intra-project Progression

The following examples of Scratch projects, which were developed by GFL1, illustrate intra-project progression. GFL1 developed Scratch Project 1, entitled "Greetings sentences" during the second week of the study. The project used simple computational skills, which were taught to the students in the introduction to the study, such as writing and animating greetings sentences and words. This constitutes an early adoption of the basic competencies offered through the use of Scratch.

Scratch Project 2, entitled “the job interview”, was developed in the seventh week of the term. This project incorporated more computational and linguistic elements than Project 1. The linguistic outcomes of the project show that the student was able to record and discuss a sequence of full compound sentences, something she was not able to do in the first or second week of the term. The computational outcomes show the utilisation of additional computational concepts, such as “Events” in Project 2. Therefore, Project 2 incorporated more computational understanding and linguistic elements than Project 1.

Similarly, Project 3, entitled “a cross-language and cross-cultural Scratch project” was developed in week twelve of the term. This was an advanced computational project, which incorporated a compound and complex recording of sentences as well as cross-language translation. The student remixed her previous project to develop this advanced project. During this project, there is explicit evidence that the student was able to ask more questions and follow-up questions, and engage in longer conversations with the researcher than in the first three weeks of the study. While the student demonstrated her literacy in the different languages she speaks, she was able to utilise various computational concepts and practices, such as “parallelism”, “events” and “sequence”. As such, Project 3 incorporated higher levels of computational and linguistic skills than Project 2.

On the basis of the above, we can conclude that this particular student, who according to her tutor is an average performer, improved her English language skills as a result of her engagement with Scratch activities. This student started with simple greetings sentences and words in the second week of the term. In the seventh week, she moved on to constructing Scratch projects that recorded her conversations, as illustrated by Project 2. Also, by the twelfth week, she was able to construct advanced Scratch projects that incorporated complex and advanced sentences as well as discourses.

In addition, therefore, there is an intra-project progression. The Scratch projects developed in this case study demonstrate computational progression in parallel with the linguistic gains. As such, I suggest that the projects can be seen through three different phases as follows:

a. *Introductory phase*: In this stage, Scratch was introduced to the student, and she became able to use simple projects that required basic computational skills and techniques, such as animating greetings words and sentences and creating simple interactive projects. In this phase, the discussion with the student was limited to short sentences and basic vocabulary.

b. *Intermediate phase*: In this stage, the student was able to analyse computational concepts, and she constructed more advanced and complex projects than in the introductory phase. The Scratch projects developed in this phase utilised a combination of comprehensive computational skills regarding programming blocks and scripts in Scratch, such as "Motion", "Events", "Looks", "Control" and "Sound".

   From the linguistic perspective, the student was able to engage in longer conversations, ask questions and follow-up questions, and construct more compound sentences, which illustrated comprehension. She was able to employ integrated written and spoken English skills through recording sentences and conversation. The Scratch projects in this phase enabled GFL1 to learn new English words, both through her engagement with Scratch activities and through the discourse that took place during the construction of the projects.

c. *Advanced phase:* In this stage the student was able to remix complex Scratch projects. She was able to show progression in the construction of Scratch projects. For example, students may remix a project by adding new words and/or sentences over several days or weeks. The student was able to construct a Scratch project gradually by adding more script and more components to her project while engaging with her peers in the ESOL class. The attributes of Scratch programming authoring environments are visible in this phase, as the student was able to design, manipulate and construct projects.

   From a linguistic perspective, the advanced phase showed that the student was able to synthesize a variety of complex English sentences within the Scratch projects, as well as in the discourse that arose around the projects. Also, the student was able to demonstrate a proper usage of a varied vocabulary. This phase entailed complex and prolonged discussions around the discourse of Scratch projects. For example, a simple computational Scratch enquiry incorporated a complex set of instructions and required careful listening and responding. Furthermore, peer-teaching and more interaction between students took place in this phase.

6.2.5.5 Serving the Principles of the Pedagogy of Multiliteracies

Features of intra-project progression serve the design elements proposed by the pedagogy of multiliteracies (Cope and Kalantzis, 2000) in four ways. First, according to the pedagogy of multiliteracies, meaning-making is perceived as an active process of design that is not governed by static rules. Therefore, the Scratch projects developed in the case of GFL1 involve active processes that are contextual and which are socially constructed according to GFL1's interests and sociocultural background.

Second, the fact that the Scratch projects allow for remixing promotes an iterative process that is in line with the three elements of design in the pedagogy of multiliteracies: (1) available design, (2) designing, and (3) the redesigned (Cope and Kalantzis, 2000). This is apparent in GFL1's case study, as elements of intra-project progression are evident in the constructed projects.

Third, GFL1's projects exemplify the multimodal representation and modes of meaning-making proposed by the pedagogy of multiliteracies. For example, the use of images, recorded sentences and text in the Scratch programming environment constitutes a rich environment for multimodal representation and meaning-making. This, in effect, suggests a view to multimodality in practice using computational environments.

Fourth, the complementary approach employed in the construction of the Scratch projects in this case study signifies a complementary approach to ESOL teaching and learning using multimodal computational practices. This approach can be seen as a way to serve the pedagogy of multiliteracies' aim of supplementing the traditional phonetic, textual and alphabetical approach to literacy (Cazden et al., 1996).

6.2.5.6 Evidence from the Tutor for Improvement in this Case Study

As a result of the student's engagement in this study, she can now generate compound sentences, all meaningful and coherent. The case study has shown that the student learned new vocabulary. Therefore, after beginning to engage with Scratch, this particular student, who was an average student, started to ask a limited number of questions and learned some new English vocabulary, as discussed in Project 1. Furthermore, unlike non-core participant students, the student is now able to engage in discussions, ask questions and follow-up questions and employ more words in a context. The student has a better command of the English language, and better than that of students who did not use Scratch in the ESOL class.

In order to further validate this conclusion, I shared what I observed and documented with the ESOL tutor who acknowledged the progress with the students in term of level of engagement and number of questions asked. Indeed, he said, “there are different sides to Scratch, talk about it… not even just Scratch itself, but what’s behind Scratch, you know, the whole way of thinking”. On the basis of this, we can conclude that the student has continued to make progress in the use of language, as demonstrated in the linguistic outputs and gains in this case study.

It is worth mentioning that I consider further evidence from researcher observation that compares the performance of non-core participant students with that of participant students, in Chapter 7, Section 7.1, entitled “Performance of Core and Non-Core Participant Students”. Analysing the dialogue and observing non-core participant ESOL classes were the only ways in which I could evidence this because I am not the tutor, and therefore not allowed to give the students assignments. Consequently, it is not surprising that a written text is not enough, coming, as it does, from the Scratch projects and the discourse around the construction of those projects.

6.2.5.7 Difficulties Faced in this Case Study

GFL1’s engagement with Scratch projects was limited to her free time at the college, and it was not possible for her to use Scratch at home. The student reported that she was disappointed because she was not able to operate Scratch on the Apple devices available to her at home because these devices do not support the “Flash Player” software used by Scratch. This situation limited her home usage of Scratch to word spelling and cross-language translation projects.

Another element that limited the ability of GFL1 to develop a variety of Scratch projects was her interest in constructing physical art projects. She reported:

> “I like making things with my hands. I like moving a lot. I just don’t like sitting for three hours. That’s why I also choose to make 3D, because I like a lot moving around the room. I just don’t like to stay in one area. And I also like feeling things, feeling materials”.

These findings document the existence of some subjective parameters that may determine students' degree of engagement with Scratch computational activities. The case of GFL1 is one illustration of this conclusion.

6.2.6 SUMMARY OF THE CASE STUDY

This case study has discussed four Scratch projects developed and used by GFL1, a student in an ESOL Level 1 class. The first Scratch project, which took place at an early stage in this study, is about writing and animating greetings sentences. The second Scratch project discusses the construction of recorded conversation through the Scratch computational environment, while the third, which was based on the second, demonstrates the development of cross-linguistic and cross-cultural ESOL skills. The fourth project is about using Scratch spelling words to improve the learner's spelling and writing skills.

The Scratch projects are discussed on the basis of their linguistic and computational outcomes. Evidence of improvements in language learning and computational domains was established. Also, the discourse that arose around the construction of these projects provided significant evidence for the levels of improvements, as well as being an indication of progress in this case study.

Finally, the Scratch projects illustrated a convergence with notions of multimodal literacies (Jewitt, 2008), Vygotsky's ZPD (Cole et al., 1980) and the design principles of the Pedagogy of multiliteracies (Cope and Kalantzis, 2000). The discussed projects demonstrated a process of deploying visual and phonic ESOL learning strategies (Steeds, 2001), the utilisation of learners' transferable skills, and the encouragement of cross-cultural and cross-language activities in the ESOL classroom. Therefore, these projects, in this case study, exemplify the potential for computational interventions, such as Scratch, to complement ESOL teaching and learning.

6.3 Case Study 2: SFL1

SFL1 is an 18-year-old female student in the ESOL Level 1 class. SFL1 and her family moved to the UK four years ago from the Middle East. This case study portrays a number of qualities and skills that the student gained as a member of the Scratch team at the research site. These qualities include developing new abilities, and, therefore, learning attitudes and opening up the imagination by using and creating interactive Scratch projects, which contributed to the development of her English skills, especially her writing.

According to the ESOL tutor, and borne out by my observations, SFL1 could speak clearly, and her pronunciation was good. However, she had a problem with her writing skills. The tutor reported that this was the reason she was in the ESOL class. SFL1 was preparing for a GCSE qualification in order to apply to a university programme in Health. Therefore, the ESOL qualification was an important step in the development of her English skills.

In this context, I discuss three Scratch projects that demonstrate how SFL1's engagement with the Scratch team contributed to enhancements in her ESOL learning practices. The first of these projects shows how the student's cultural background and beliefs affected her writing skills. The second demonstrates how a Scratch storytelling project helped the student to open up her imagination and enhance her literacy skills, and the third illustrates how Scratch spelling projects enhanced her spelling and extended her English vocabulary.

6.3.1 Project 1: Storytelling Scratch Project

During the introduction of Scratch to the students, and as part of the ESOL writing exercises, the tutor and I agreed to encourage the students to write about a favourite musician, song or story. The plan was that this theme would be useful for SFL1, and for other students, as it encouraged writing, and allowed students to animate what they wrote using Scratch.

In addition, we expected that writing about meaningful subjects would extend the students' learning activities beyond the usual teaching hours and enable them to work with and use Scratch at home. It is for this reason that we suggested the music, lyrics and storytelling themes for the ESOL writing activities. The tutor and I invited the ESOL learners to write an essay about their favourite stories, songs or musicians, and the participant students, including SFL1, were expected to animate the story or the lyrics they prepared using the Scratch tool.

Consequently, in the process of introducing this activity to the students, the tutor and I stimulated their interest and encouraged them to think about their favourite song or story, something they were interested in or passionate about. Indeed, as a classroom demonstration of a favourite song, we played part of a YouTube song (Peace Train by Yusuf Islam) after a brief talk about our own favourite songs and lyrics. In this demonstration, the tutor dimmed the lights and put the volume of the speakers up. We discussed this example by showing the lyrics of the song as well as by providing hints that would be helpful in finding information online to write about this particular song.

6.3.1.1 Background to the Project

The suggested activity, which encouraged writing about meaningful stories and lyrics, revealed several of SFL1's cultural dimensions. Surprisingly, SFL1 rejected projects related to music. After discussing this with the ESOL tutor, we figured out that her reaction to the topics offered was due to her cultural beliefs. The following is an excerpt from a message from the ESOL tutor regarding SFL1's refusal to write about music topics:

> "[SFL1] mentioned that she didn't want to write about that subject. I'm not 100% sure but she may be saying that she's not at all interested in the subject - perhaps it's against her cultural beliefs …Maybe you could talk to her about it? I did mention that I thought it would be fine to write about another art form or entertainment, e.g. actor/actress you like...." (Yacoub 2015, Personal Communications, 3 February 2015).

Therefore, I had a conversation with SFL1 about her views, particularly about her Scratch project and theme preferences. From this conversation, I learned that not only did SFL1 not want to use music projects due to her cultural beliefs but that she was also unable to use her imagination in writing and animating Scratch projects. She believed that imagining or writing stories that did not actually happen was lying or being dishonest, like not telling the "truth". Indeed, she said, "telling things that we imagine is, like, lying" and "imagination is not real and it's not true".

This unveiled a reason for the problems that were limiting her written expression and narrowing her writing skills. In the context of the case of SFL1, using the imagination was an essential practice for the development of writing, speaking and communication skills. I think that many, if not all, writing exercises entail a sort of imagination. Therefore, it was important to address this issue and to help the student to unlock her learning potential and progress in her ESOL studies. I discussed with SFL1 the benefits of the imagination, particularly in writing, and I managed to help her to overcome this problem. We discussed several differences between imagination and dishonesty. For instance, I suggested that she could indicate that her story or piece of writing was an imagined one, sparked from her imagination, that the reader could be made aware of that, and it would not, therefore, be considered a sort of dishonesty. Also, we discussed how the imagination is helpful not only in writing and telling stories but also in thinking. For instance, I shared and discussed with the student some quotes and reflections about the imagination such as, "many great adventures and thinkers begin with great imagination" and the importance of the imagination in almost all aspects of our thinking.

The student was thoughtful, and she was willing to listen and to think positively. In fact, with some encouragement and challenging, it was apparent that SFL1 was interested in our conversation about the imagination. As a result of two short discussions with the student, I was able to convince and encourage her to use her imagination, in both the writing assignments and in constructing Scratch projects

6.3.1.2 Teens at the Castle Scratch Storytelling Project

I subsequently worked with SFL1 and helped her to start developing a story of her choice by remixing a project entitled "Teens at the Castle". The original template for this project was created by a Scratch user called "S20Tester60". The Scratch project remixed by SFL1 narrates an adventure story about two girls trapped inside a deserted castle who then escape and save their lives from a danger they face there. Figure 6.4 below illustrates a snapshot of this project.

Figure 6.4: a snapshot of a Scratch project story template entitled “Teens at the Castle”, remixed by SFL1.

Using this project, the student was introduced to the storytelling and storyboarding element of scenes, and the concept that a story consists of a sequence of scenes. I discussed with her the characters, location and event in each scene and encouraged her to add more scenes and come up with an ending to the story. As a result, SFL1’s developed story in this project consisted of four scenes. Scenes 1 and 2 were provided with the project template, and scenes 3 and 4 were added by SFL1 while experimenting with the template. See Table 6.2 below for a list of the story scenes as well as the dialogue between the main characters in the story, as imagined by SFL1.

Table 6.2: a summary of the conversations between the two characters in the Scratch project story entitled “Teens at the Castle” remixed by SFL1.

Scene 1	In front of the castle
girl 1	There's the castle!
girl 2	I see a light in the window!
Scene 2	At the gate of the castle.
girl 1	The gate is open...
girl 2	Let's see if anyone is home.
Scene 3	Inside the castle
girl 1	Anybody here?
girl 2	Look, a scary man [a wizard] coming down the stairs
girl 1	Run, it is not safe.

Scene 4	Running away
girl 1	The door is closed.
girl 2	What will we do?
girl 1	Let’s find another exit…
girl 2	We are trapped.
Scene 5	The escape scene
girl 1	Run towards that window.
girl 2	Let’s jump, ready
girl 1	Jump.

The student employed her imagination to remix a Scratch storytelling template and added additional scenes to the story. This example provides explicit evidence of the progress the student made in opening up her imagination as well as in starting to use it in her writing.

My intention was not limited to just the outputs from the project itself. I also wanted to see the impact of what the student had learned in the project through the discourse that took place around the construction of this project. The following excerpt from my discussion with the student shows the discourse that took place around remixing this Scratch project and provides additional evidence for the student’s engagement in the imaginary storytelling project:

Researcher: Now, what ending would you like to happen in this story?

SFL1: Something good, I think.

Researcher: What do you suggest?

SFL1: Maybe they can jump from the window, what you think?

Researcher: It’s your story, it’s up to you.

SFL1: They will jump from the window and escape.

Researcher: So, what is the conversation in this scene?

SFL1: The first girl will see a window, and they will jump and escape.

Researcher: Sounds good, but what exactly will the first girl say to the second girl?

SFL1: She will say: run to that window; the other girl will say: ready, jump, and they jump together.

The above excerpt provides an indication of the progress made in terms of thinking about storytelling and using imagination in speaking and writing. This dialogue also indicates the progress that was made regarding asking questions and providing answers to questions. A further example of progress achieved is demonstrated by the employment of the storytelling and storyboarding elements of scenes, characters, events and locations.

The student reflected on this experience in an interview and reported that using Scratch was helpful to her in developing stories:

> "The Scratch actually helped me a lot. And, you know, when I went first, and I logged on, it actually gives you great start animation as well, and stories to yourself…it helps you create any story you want, any project you want. So it's really good and helpful".

As a final step, I provided the student with further suggestions for improving her storytelling project. I encouraged her to give each of the characters a name and to write a description or a summary of the story. Also, she was encouraged to add a narrator by recording her voice, and to introduce the story as well.

6.3.1.3 Results from Project 1: Storytelling Scratch Project

In this project, SFL1 showed how her involvement with the Scratch team activities contributed to her overcoming a problem she had with using her imagination in writing. SFL1 utilised her imagination to improve her writing skills. She was able to remix and add additional scenes to a storytelling project that animated two story characters who were trying to escape from danger inside a deserted castle.

By adding scenes and writing sentences about them, the student showed how Scratch could be used to animate a story using her imagination. This enabled the student to tackle the problem of her imagination as well as to rehearse and develop her writing skills, as demonstrated in the sentences she added in the scenes.

Before the student became engaged in this project, she was not able to use her imagination in writing or in stories. However, once she had started to use Scratch to develop and create stories, she was able to unlock her imagination as well as learn about essential conceptual storytelling and storyboarding elements, including scenes, characters, locations and events. Furthermore, the student was able to use the Scratch tool to employ the conceptual storytelling and storyboarding concepts that she had developed, as can be seen in the added scenes in this Scratch project.

When I asked SFL1, in an interview, about her involvement with the Scratch team and how this could help her to develop new understandings about the imagination, she said:

> "when you wanna express your feelings or something, or when you are thinking about something, you actually imagining. And you can imagine dreams, that is the thing. You are not going to lie, that it's not real and that's not true at the same time. It depends, and, [student thinking] yeah".

She also reported that her engagement with the Scratch team had helped her to open up and use her imagination: "especially when creating stories, it is actually helped me imagine, it actually helped me create a story".

In my attempt to learn more about the student and about how she developed a new understanding of the imagination, I specifically asked about her current perception and what made her change her response:

SFL1: When you create a story, you actually imagine the things.

Researcher: Yes.

SFL1: When you create anything, you can use any word, you can use anything, you can use anything you wanna create, you can do engagement, voice…That's how we can imagine things…

Researcher: So, did you change your mind about imagination?

SFL1: [student laughing]

SFL1: Yeah, yeah.

Researcher: This is my question, exactly.

SFL1: Yeah.

Researcher: So, why did you change your mind?

SFL1: Because, because there, because there is no right or wrong kind of imagination. It may be right, it may be wrong, so, you'll never know".

As evidenced in the above excerpt and the developed Scratch storytelling project, the student can now use her imagination in writing. The student was able to utilise storytelling elements to add additional scenes and conversation to the story template. The Scratch digital storytelling project illustrated an effective approach for engaging SFL1 in writing in an authentic and genuine fashion and I think that the student has continued to make progress in her use of language, particularly in her writing.

6.3.1.4 Evidence from the Tutor that the Student Made Progress

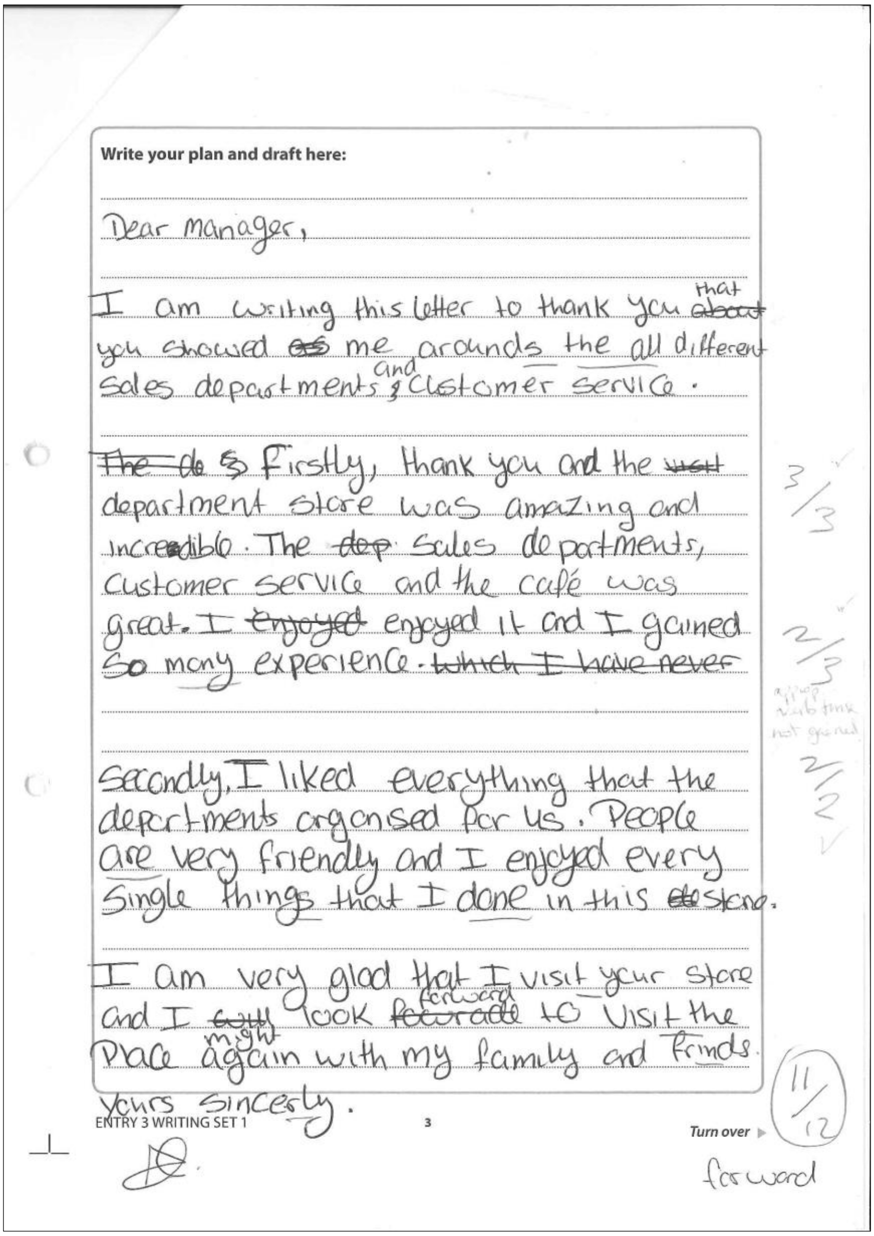
The above discussion displays evidence from both the project and from my interaction with the student that she unlocked her imagination and improved her writing skills. However, I wanted to investigate the student's further improvement. Therefore, I had a discussion with the tutor, who confirmed that she was progressing in her writing. In fact, SFL1 was able to pass her final ESOL writing test by producing a short essay in class on provided themes. She wrote a formal letter to thank a store manager for hosting her on a tour of the store. It is interesting to go through the short essay, read her description of the food and the coffee served, and observe how she imagined and described the events, as seen in Figure 6.5.

I also shared and discussed my findings with the tutor during an interview at the end of the study. The tutor acknowledged that SFL1 had progressed as a result of her engagement with the Scratch activities:

> "I think it's interesting with her attitude, I think she has certain attitudes about certain things. So, for example, about her English and about her writing, and she was just recently able to take GCSE English exams, which is great, because, at some point, none of us was sure whether she would be able to do that this year, one reason she was in our class. And, I think things like this, SFL1 might have been concerned about, were perhaps stopping her from, one thing, to take part in something new….but I think it's great if, you know, we have been able to reach her in a way and to be

open with her to try something new and to change her attitude" (The ESOL tutor, 2015).

Figure 6.5: a snapshot of an essay by SFL1 for the final ESOL writing test.


Write your plan and draft here:

Dear manager,

I am writing this letter to thank you that you showed me arounds the all different sales departments and customer service.

Firstly, thank you and the department store was amazing and incredible. The sales departments, customer service and the café was great. I enjoyed it and I gained so many experience.

Secondly, I liked everything that the departments organised for us. People are very friendly and I enjoyed every single things that I done in this store.

I am very glad that I visit your store and I might look forward to visit the place again with my family and friends.

Yours sincerely.

ENTRY 3 WRITING SET 1 3 Turn over

6.3.1.5 Incorporation of the Cultural Background of the Student

This project demonstrates that the student's cultural background and her social context constitute an important dimension of her ESOL learning activities. The results show that the complementary Scratch activities are not necessarily solely focused on technical and computing topics. Rather, these activities can tackle and incorporate the cultural and social dimensions that can encourage a student's self-expression. As such, the student's social and cultural contexts cannot be ignored in her ESOL learning practices.

The empirical findings in this Scratch project are supported by the views of the pedagogy of multiliteracies that embrace literacy as social practices and discourses (Gee, 2012; Cope and Kalantzis, 2009), especially within highly diverse ESOL classrooms. From another perspective, the Adult ESOL Core Curriculum (Steeds, 2001) recommends writing about topics that are meaningful to the students and incorporate their cultural background, as this will enhance their literacy skills. These two views suggest a need to incorporate the individual context and cultural background of ESOL learners in the learning activities. As such, the Scratch storytelling project is an illustration of this need being fulfilled.

6.3.1.6 Improved Time Management

An additional result of this Scratch storytelling project is that it enabled SFL1 to extend her work on the ESOL learning activities beyond the usual teaching hours of the college and, in particular, to work at home. The student reported that she worked at home using Scratch storytelling projects, word spelling games and word root projects. I asked SFL1 whether she thought that Scratch was more helpful in class or at home; she reported that working on Scratch "was really helpful at home more [than working in class]". Being able to working at home was especially helpful to the student because of the crowded class timetable and because all the core participant ESOL students were full-time and enrolled in other main courses at the college.

In this respect, the story of SFL1, supported by the student's own reflections and those of the ESOL tutor, is an illustration of ESOL learning activities being extended to the home using the Scratch computational environment, leading to improved time management. Therefore, the students who used Scratch reported more homework activities.

Prior to this study, doing homework for the ESOL course was not generally feasible. Based on my correspondence with the ESOL tutor regarding this activity, he commented: "[a]s I think you know, they've [the students] never really had to do homework for these lessons, but you can ask!" (Yacoub 2015, personal communications, 27 January 2015). Encouraging the students, as illustrated by SFL1, to extend their ESOL work to the home contributed to improving their English skills.

The ESOL tutor explains this further in an interview and notes that the students are enrolled on other main courses in addition to ESOL. These main courses usually demand a large amount of course work and assignments and, therefore, the students "never really wanted to do [ESOL] homework at all". He also observed that the students:

> "don't see working on Scratch as homework because it is not just filling in a worksheet or writing an essay, but it is actually interactive, it is on the computer, so I think that would be an excellent way of engaging them to take an interest and make efforts in their own time" (The ESOL tutor, 2015).

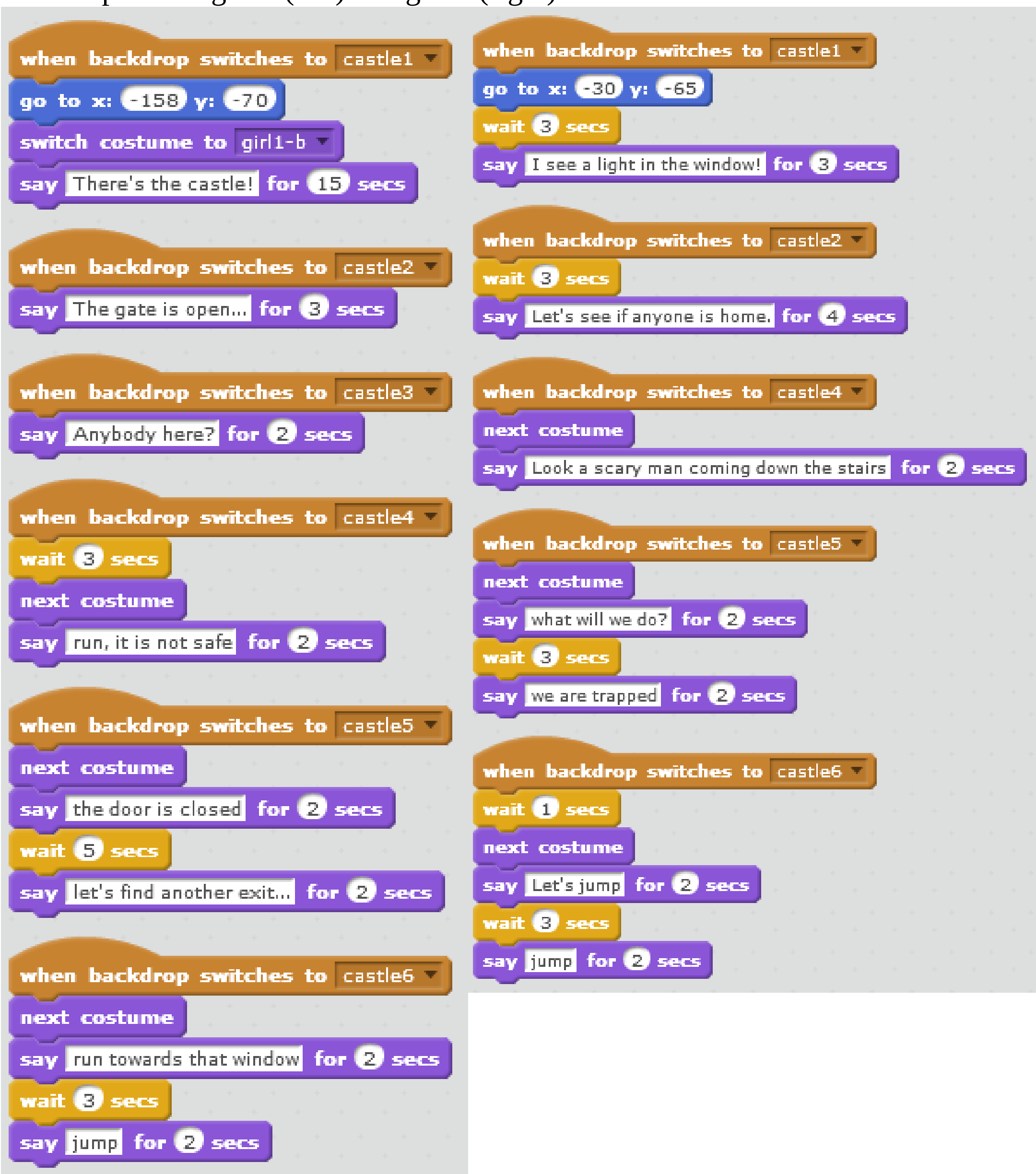
Before using Scratch, SFL1 did not carry out homework activities but, after her engagement in Scratch project activities, she was able to continue her ESOL learning activities at home using Scratch.

6.3.1.7 Computational Outcomes of Project 1

When SFL1 constructed Project 1, she had to navigate and use different sections of the Scratch script blocks, which helped to improve her computational thinking skills. The development of this Scratch project took place in different phases. First, SFL1 was able to read the script in the selected Scratch storytelling template. This template allows the students to animate a sequence of scenes by changing the background image. This main background image is called "Backdrop" in Scratch editor. Second, the student added more Backdrops suitable for each scene. Third, SFL1 had to add the dialogue between the two characters in this project for each scene. Third, the student experimented with the project to adjust the timing of the dialogue for each character in each scene. Figure 6.6 illustrates two snapshots of the Scratch script for the sprites of girl 1 (left) and girl 2 (right).

It was essential to briefly discuss storyboarding with the student before starting to build the story using Scratch. After the student suggested and wrote down the scenes and what would happen in each, she was able to construct the Scratch project with some guidance from the researcher. As such, the construction of this project employed computational thinking skills that were facilitated by the conceptual storyboarding exercise that took place prior to the construction of this project.

Figure 6.6: two snapshots of the Scratch script, in the "Teens at the Castle" project, for the sprites of girl 1 (left) and girl 2 (right).



Through constructing this Scratch project, the student developed several computational concepts, including "sequence", through which the student has to understand the sequence of the scene and arrange it in a way that follows the conceptual storyboarding design. The most used script block was the "Looks" one, which allows the characters (the two girls) to engage in a conversation that follows the timing in each scene. The initial template was designed to allow the user to add new scenes simply by adding a new "Backdrop" in the Scratch main stage. When the "Backdrop" changes, this provides the stage for the next scene and the characters engage in conversation according to the new scene.

Other computational concepts developed in this project include loops, parallelism, events and conditionals (Brennan and Resnick, 2012). For instance, the computational concept of "events" is illustrated in the process of clicking on the arrow to move to the next scene (see Figure 6.6 above). That is, when a user clicks on the arrow, the "Backdrop" image changes, and the next scene is displayed along with the written dialogue for that scene. Therefore, the initial task was to change the "Backdrop" of the Scratch project as an indication of a new scene. Then, I explored with the student how she could arrange the sequence of the conversation between "girl 1" and "girl 2" according to each scene.

6.3.2 Project 2: English Vocabulary and Spelling Skills

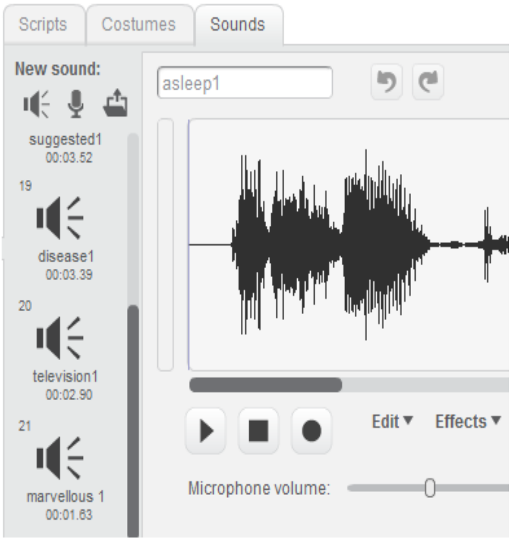
Increasing English vocabulary and enhancing the spelling of English words was an essential activity for SFL1 and, in fact, for most, if not all, of the ESOL learners. In response to this need, SFL1 was encouraged to experiment with word root and spelling Scratch projects both at college and at home. The project discussed in this example illustrates the use and remixing of the Scratch spelling and word root project. The project assisted SFL1 in increasing her English vocabulary and enhancing her spelling and writing skills. The student used and remixed a Scratch project designed by a Scratch user called "srearley", which was given the title 'Spelling Game – SFL1'. See Figure 6.7a below for a snapshot of this project.

Figure 6.7a: an illustration of SFL1's remixed Scratch project on the spelling of English words - a vocabulary drill and a gap-filling project.

This project functions as a word drill and a gap-filling exercise. It can also be seen as a form of game, because it has an element of competition. The project is built around a list of English words that are pronounced one at a time. The project user is then invited to try to type the correct spelling of the word s/he has heard. The project provides hints about the number of characters in the word and reveals selected characters. Consequently, the user hears the pronunciation of the word followed by a sentence that explains the word. For example, the word in question in Figure 6.7a is "suggested". The user hears the following sentence: "Suggested. Eric suggested that Jane gets a new car". Then, the user has to type the correct spelling of the word in the text box provided.

SFL1 have used, through the online Scratch forum, more projects than she created herself. Students' interaction with Scratch projects would first start with their experimenting with projects already shared through the Scratch online forum. In essence, there are three different levels through which students interacted with Scratch during this study: (1) using already created projects, as in the case of SFL1 using games and projects built around spelling and English word roots; (2) experimenting with and remixing Scratch projects – Figures 6.7b and 6.7c are illustrations of a remixed Scratch project; (3) sharing projects online and discussing projects with peers in the Scratch online forum.

Figure 6.7b: a snapshot of the list of words in the spelling project in which the student can add as many new words as she wants.	Figure 6.7c: a snapshot of the sound functions of Scratch, and a list of recordings for the pronunciation of words in Figure 6.7b.



6.3.2.1 Outputs from Project 2: Enhanced Spelling and Increased Vocabulary

By practising the spelling of about two dozen English words in this Scratch spelling project (Figure 6.7a), SFL1 has shown how Scratch can help to develop the spelling skills of ESOL students. When SFL1 practised the spelling of English words using the Scratch project, she had to listen to the pronunciation of the word in question, which helped to enhance her listening skills as well. For example, one word in the list is ‘needed’; SFL1 had to listen to the pronunciation of this word followed by the sentence, “All he needed was a nap”, which put the word in a context.

In this project, SFL1 utilised her computational skills to remix and customise the Scratch project by adding more words that she wanted to practise, along with their pronunciation. As a result, she was able to extend the list of words in the project and, therefore, further increase her vocabulary and spelling skills. By using and remixing the project, SFL1 learned some new words and sentences. The words “marvellous” and “telecommunication”, along with the recordings of their pronunciation, are just two of the newly added and learned words in this project. See Figures 6.7b and 6.7c for others.

I wanted to verify that the student has benefited from the project and had learned new words, so I asked SFL1 about her experience of using the spelling project, in my interview with her at the end of the project. She confirmed that Scratch had been beneficial in developing her English skills:

> “It actually helped me a lot in my speaking to do my project and to talk, and to say what I want to say as well …and it helped in my writing as well. My writing is bad, and it actually helped me….when I start using it, it is actually helpful in term reading and writing. You have a lot of vocabulary, and you remember it”.

I asked her for specific examples of how this was helpful and she responded that the Scratch activities had helped her in learning new words and with the spelling of many others:

> “for example, if you say ‘marvellous’, what does this mean? And so you have to create word with Scratch…so it help you remember the word. So it actually helping me to remember the word. So it helped me in remembering as well”.

Having the student practise many English words (see Appendix 4), and remix the Scratch project by adding other words, contributed to enhancing her spelling skills and increasing her English vocabulary.

From another perspective, this spelling project incorporates writing and speaking skills as well. When adding a new word to the project, the student can also record her pronunciation of it; this resulted in increasing the student's confidence. In my interview with her, SFL1 reflected on how Scratch was helpful in increasing her confidence:

> "in terms of write what you need, if you wanna write something in new way, in terms of, if you wanna build your confidence when you speak and you record your voice. And there is many ways as well, there is a lot of different terms".

The above discussion and quotes from the student are explicit evidence that the student learned some new English vocabulary and enhanced her spelling, writing and speaking skills.

6.3.2.2 Increased Student's Interaction

The Scratch project in this example, including other remixes of the project, was popular with the students in the two targeted ESOL classes, perhaps because of its competitive elements. For instance, I observed increased interaction between SFL1 and GFL1, who are both in the same ESOL level 1 class. The two students exchanged several questions about the Scratch spelling project (or game) such as, "How did you get this word here?", which is what GFL1 asked SFL1 about how she remixed a new word into the project.

In addition, during their work on this project, the two students had frequent talks, especially about the number of incorrectly spelled words. The Scratch spelling project lists the incorrectly spelled words in a box on the right of the screen (see Figure 6.7a), and the students have to provide the correct spelling of all words in order to finish the project. This process continues as students add more words to the project. In other words, the remixing function makes the project dynamic and computational. This is another illustration of how the project helped the student to practise her spelling of selected English words and/or increase her vocabulary by practising the spelling of and listening to unfamiliar words.

6.3.2.3 Feeding into the Learning Strategies in the Adult ESOL Learning Curriculum

The Scratch project in Figure 6.7a was in line with, and fed into, the following three ESOL learning strategies (Steeds, 2001):

1- Visual learning strategies. SFL1 was able to recognise the combination and sequence of letters in words. The word "suggested" in Figure 6.7a is an illustration of this visual learning strategy. Another illustration is the hints provided about the number of characters in each word and the revealed characters.

2- Contextual strategies. SFL1 was able to understand the meaning of the words from the general context provided by the example sentences. For example, the word "disease" is explained in the context of the phrase "we should always try to prevent disease". The context of the Scratch project is not limited to the sentences and words within the project itself, but is extended throughout the discourse around using or constructing the project. For example, "preventing disease" can have several meaning and contexts (e.g. could be through avoiding obesity or bullying) and the context and meaning are explored further through the discourse around the project. More concrete examples can be explored through interaction with the students.

3- Phonic strategies. SFL1 was able to pronounce and record the newly added words (Figure 6.7b). As such, the activities in this example increased the learner's phonemic awareness, through hearing, spelling and interacting playfully with words and sentences, as illustrated in the Scratch project in this example as well as in other remixes (or versions). The ESOL curriculum discusses spelling extensively and suggests that:

> "It is important for adult ESOL learners to be able to recognise the sound-symbol relationship and common letter patterns in words that are of real interest to them as individuals, working from a context. The order in which these sounds and patterns will be taught will depend on the words learners want and need to write" (Steeds, 2001, p163).

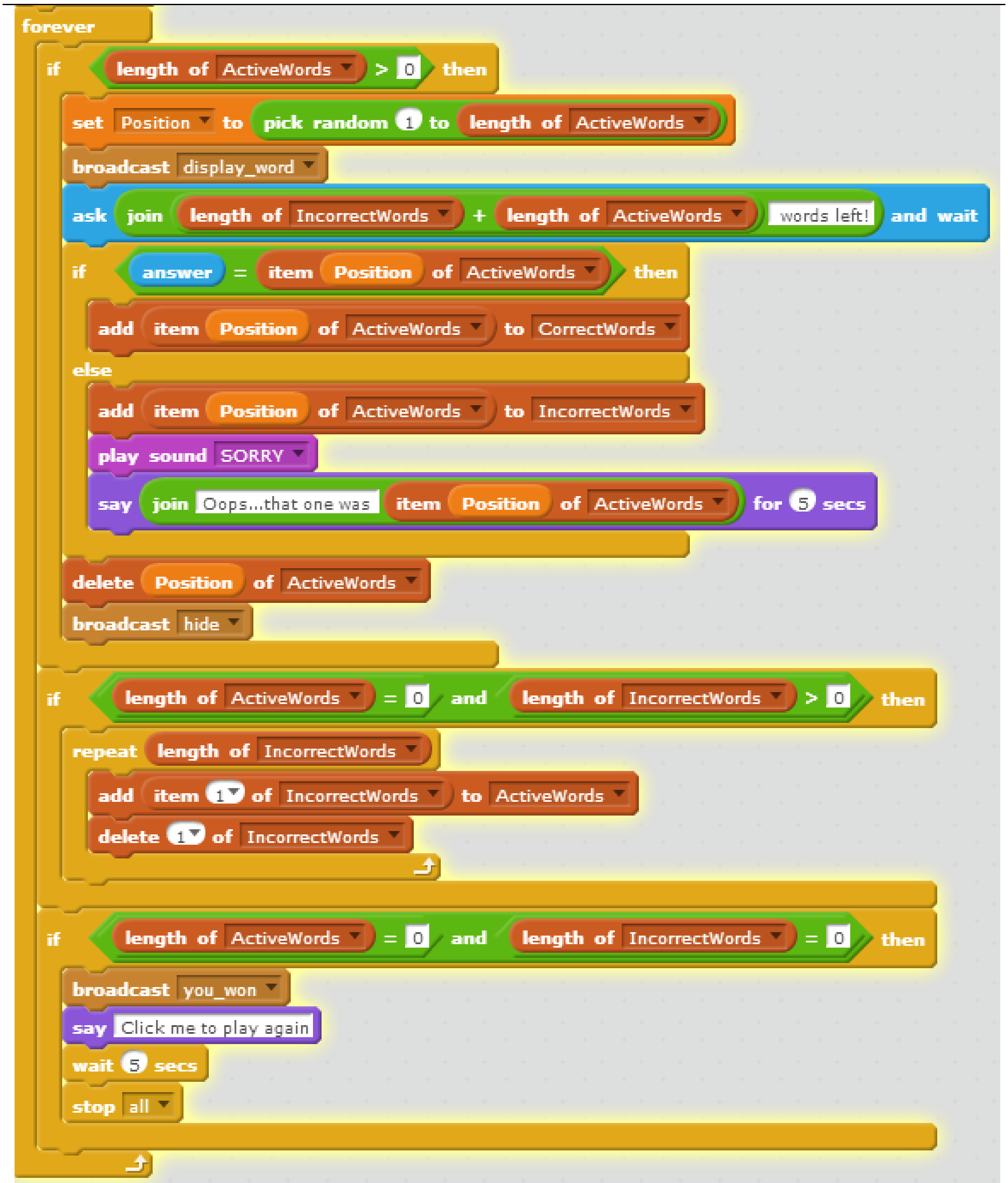
In this context, the spelling project was observed to absorb the interest of SFL1, and other students as well. Usually, students are more engaged with the project when there are competitive elements, such as checking to see which user gets the most spellings correct.

6.3.2.4 Computational Outcomes of Project 2

In this project, it was evident that the student did not need to understand all the parts of the script, particularly the complex ones, to be able to remix, customise or personalise the list of words and pronunciations. An illustration of the complex block of Scratch script in Project 2 is provided in Figure 6.7d on the next page.

The reason for this is that this complex block of script could work independently of the number of words and recorded pronunciations added to the lists. What was required of the student though was that she identify the block of the script where she could add the new word (Figure 6.7b), and where she could record the pronunciation of the newly added word (Figure 6.7c). As such, with a little help and guidance, she was able to remix the project by adding new words to the list as well as recording their pronunciation.

Figure 6.7d: a snapshot of a complex block of script in the English words spelling Scratch project.



Drawing on Resnick and Brennan (2012), this illustration of SFL1's engagement with the Scratch project describes computational thinking concepts, such as "iteration" and "parallelism" as well as computational practices, such as debugging and remixing projects (p1). When SFL1 runs the Scratch project, the script randomly selects a word from the list, and the student hears the selected word before being prompted to type the correct spelling in the text box provided, as shown in Figure 6.7a. This explains how it is possible for a learner with few programming skills to re-use, or remix, a Scratch project that may contain complex blocks of script.

It is important to mention that other studies corroborate and explain the practice of using or remixing projects created by others while not fully understanding the script. For example, Brennan and Resnick (2012) note that:

> "As we discussed the project and how it works, one of the interviewers wanted to know more about a particular code excerpt …The interviewer asked, "How does this work?" The Scratcher was unable to explain any part of it. The Scratcher explained that they had seen a project like it on the website, downloaded the project to view its code, and had pulled out matching blocks until it somewhat worked the same" (p17).

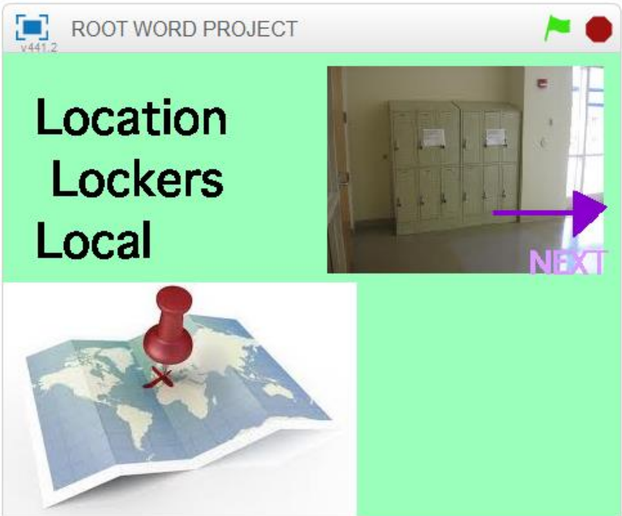
The main block containing the complex code (see Figure 6.7d) was not changed or altered when SFL1 added new words to the Scratch project. The ability to think in an abstract way provides an explanation for how students can remix Scratch projects that contain a complex script, which demonstrates the feasibility of remixing and personalising Scratch projects. This example may also explain how more than 20 Scratchers were able to remix and share this project in the Scratch online forum.

6.3.3 Project 3: English Word Roots

SFL1 explored and used several Scratch projects based on English word roots. The Scratch project entitled "Root Word Project" by a Scratch user called "JNLASCRATCH" is one example. In this project, SFL1 explored and learned some new word roots, which assisted her in increasing her vocabulary and improving her writing. The project provides a visual illustration of English word roots as well as examples of each. Figure 6.8 shows a snapshot of this project, with illustrated examples of the word root "loc", as in the words "location", "lockers" and "local".

In this project, SFL1 not only learned some new words but also learned how to identify a variety of English words by decoding their roots, for example, through learning about Greek and Latin roots. This project is a good example of other English word roots projects used by SFL1 and other students. There are at least a few hundred such Scratch projects available in the Scratch online forum, including projects on the Greek and Latin roots of English words. Sheets of common Greek and Latin roots and common prefixes and suffixes were handed to the student, including SFL1, so that they could practise the English word roots at college and at home. See Appendix 10 for copies of these handouts.

Figure 6.8: a snapshot of the English word roots Scratch project used by SFL1. Project demonstrate the root "spec" which means to see or look visually.



In this project, the visual and interactive elements helped the student to learn English word roots, suffixes and prefixes more effectively. When the student used the project, she not only saw photos and examples of the English word root but also heard a sound related to the root, such as the sound of water streaming for the word root "agua". This helped the student to remember the English words and roots more easily than solely reading them from a list on a sheet.

6.3.3.1 Linguistic Outputs from Project 3

In this project, the student explored and learned some new word roots and, therefore, some new words. Table 6.3 below summarises the English word roots, their meaning and the examples provided for each root in this Scratch project.

Table 6.3: a summary of the English word roots, their meaning and the examples provided for each root in the Scratch project entitled “Root Word Project” used by SFL1.

word root	Meaning	Examples provided
aqua	water	aquatic, aquarium, aqueduct
gen	generation	generation, general, gender
bio	life	biography, biology
spec	to see or look	spectators, specialist
sign	an object, quality or event	signature, signed, sign language
loc	place	location, lockers, local
mater	having to do with motherhood	material, maternal
cog	to know, to learn	cognition, cognizant
photo	image or picture	photography, photogram, photosynthesis
aud	sound	audition, audio, audi
cap	to take, seize control	captain, capture, capable

SFL1 reported that using Scratch projects based on English word roots and spelling increased her English vocabulary and enhanced her word spelling as well. I investigated this with her further at the end of the project and asked her about the ways in which she thought Scratch projects were helpful in extending her English vocabulary. She responded that using English word roots projects helped her to understand and remember English vocabulary through practising the word roots. I asked her for examples, and she said:

> “say for example, if you said a ‘tele’, which mean different meaning, but if you get the ‘tele’, which is T.E.L.E, you can get ‘telephone’, how you remember what the voice mean. You can actually read as well. Scratch how good it is, make people can read, I remember”.

Furthermore, SFL1 perceived English word root projects, including this project, as a “smart” way to learn English words:

> “That was actually good one, and it was really smart way to learn about the vocabulary, yeah. And, is really good, is really helpful, is actually smart way to learn. I did not know that in the beginning, and no one told us, this is so good, it’s really good”.

This project is an additional demonstration of how SFL1 has progressed in learning new English words and extending her English vocabulary, using the English word roots Scratch.

6.3.3.2 Computational Outcomes of Project 3

Although the student did not create or remix this project, she was able to explore the sprites and read the inside Scratch script. Therefore, she was able to enhance her computational skills and learn more about how other Scratchers employed computational skills and concepts. For example, the project provided a demonstration of the "Events" concept, as illustrated in the script block, "when this sprite clicked". A second illustration is the "Sequence" computational concept as illustrated in the sequence of broadcasting messages inside the script using the "broadcast [message]" block. Lastly, various functions are employed in this project to animate photographs through the "Looks" section, such as the employment of "show", "hide" and "say [message]" blocks.

6.3.4 Discussion of SFL1's Case Study

The projects developed in this case study illustrate a student-centred approach, in which the ESOL tutor and the researcher had a facilitative and collaborative role that valued relationships, inquiry and invention (Cohen et al., 2011). Encouraging SFL1 to use her imagination was essential to unlocking her potential and developing her English skills, especially in writing. The case study also shows how this computational complementary approach feeds into the learning strategies in the adult ESOL core curriculum (Steeds, 2001), facilitating higher levels of student interaction and incorporating SFL1's cultural background into the learning activities. Additional perspectives on how the student's engagement in this study contributed to her gaining a number of qualities and competencies are discussed in the subsequent sections.

6.3.4.1 Convergence with the Principles of the Pedagogy of Multiliteracies

The projects and activities in SFL1's case study are in line with the pedagogy of multiliteracies' approach to literacy practices, which promotes the incorporation of situated practices, overt instruction, critical framing and transformed practices (Cope and Kalantzis, 2000). For example, Projects 1 and 2 illustrate situated and highly contextualised sociocultural practices that were beneficial to SFL1 in developing fundamental learning skills. This case study exemplifies the critical role of cultural background and personal context in enhancing ESOL literacy skills. In other words, the situated practices in this case study have the potential to promote "new contexts for teaching and learning" that facilitate the development of SFL1's learning practices with digital technologies (Sharpe et al., 2010, p9).

The overt instruction dimension tailored towards scaffolding learning activities is manifested in the projects in this case study. In this respect, the overt instruction can be seen as guiding and mentoring principles that facilitate the construction of SFL1's own metalanguage of design, rather than the passive transmission of information from teacher to students. This process is illustrated in the remixing of the Scratch storytelling project as a response to challenges the student encountered as a result of cultural beliefs.

The critical framing dimension is presented in the student's remixing of the Scratch storytelling project (Project 1) and the English vocabulary and spelling skills project (Project 2). These remixed projects offered SFL1 diverse modalities of meaning-making, which recognised her personal context and cultural background. This critical framing can be contrasted with the traditional one-size-fits-all approach that does not usually recognise differences among learners.

The case study illustrates how SFL1 transformed the practices she developed through the storytelling and storyboarding Scratch project into an ESOL essay, as described in Figure 6.5 in this case study. The transformed practices dimension (Cope and Kalantzis, 2000) can also be seen in the change in SFL1's attitudes as a result of her engagement with multimodal Scratch projects, as acknowledged by her ESOL tutor.

6.3.4.2 Imagination and Storytelling Assist in Improving Literacy and Language Skills

Although the storytelling Scratch Project 1 was not carried out within a digital storytelling activity or workshop, it still incorporated the main elements of a digital storytelling project and involved activities that developed the English skills of SFL1, especially writing, through her engagement in developing scenes and dialogue. In order to investigate further the activities in Project 1 as well as the context of SFL1 that led to this project being undertaken, it is important to discuss the role of the imagination in learning and how storytelling projects can feed into the development of individual learning practices.

Some studies show the effective role that digital storytelling activities play in literacy development. For example, Ohler (2007) establishes a robust correlation between digital storytelling and the development of literacy skills. The author notes that digital storytelling helped not only to enhance the digital and artistic skills of students but also improved their writing and speaking as well:

> "I have found no better vehicle for blending traditional and emerging literacy development than DST [digital storytelling]. With DST, good old-fashioned, clear, expository writing is key…Many teachers have told me that media projects are a great way to sneak writing in under the radar. Students who have no taste for the planning and execution of an essay attack the planning and narration of a digital story with gusto" (p11).

From another perspective, according to Parkinson (2011), there is enough evidence for the imagination, including storytelling, having a major role in learning and literacy development. He notes that a story "is vital to teaching, as it is to many other sides of life and the way we live it". In fact, he suggests a "storytelling culture" that "links to and feeds literacy and also reaches out beyond, making teaching of many other areas of the curriculum more effective and imaginative in general" (p3). With SFL1, it was helpful to consider the role of digital storytelling. Based on my own research on a digital storytelling project that targeted marginalised and impoverished youth (Sawhney et al., 2012), I recognise the effective role of storytelling activities in empowering young people and assisting them in overcoming difficulties.

The above illustrations validate the approach the tutor and the researcher took in response to SFL1, through their use of Scratch storytelling projects to help and encourage her to use her imagination, especially in writing, as discussed in Project 1. There is also additional evidence for improvements in her literacy level. In conclusion, the student was able to use her imagination both in writing and in developing Scratch projects. As a result, her confidence increased, and her writing skills improved, as is evident in the "Teens at the Castle" Scratch project, as well as in the text she submitted for her final exam, which, according to her tutor, she passed successfully.

6.3.4.3 SFL1's Scratch Projects from the Perspectives of Bloom's Digital Taxonomy

SFL1's Scratch projects can be discussed from the perspective of Bloom's digital taxonomy (Churches, 2011), which is based on Bloom's taxonomy of learning domains. As discussed in the literature review chapter, Bloom's digital taxonomy offers a conceptualisation of the following digital skills (listed in order, from highest to lowest): creation and production, evaluation, analysing, understanding and remembering. Most of these skills are manifested in the projects constructed in this case study. For example, it can be seen in the dialogue excerpts that remembering and understanding were emphasised several times by SFL1 during her engagement in the projects. The review of SFL1's interview transcript at the end of the project shows that the student emphasised that using Scratch enhanced her ability to remember words, vocabulary and stories. There were seven occasions on which SFL1 emphasised that Scratch had helped her in this way. The following excerpt is an illustration of this:

> Researcher: Do you have any specific theme, idea or comment that you'd like to share with us?
>
> SFL1: My experience was… when I first used the Scratch, I was like, what is that and what is to do with ESOL. Then, when I start using it, it is actually helpful in term reading and writing. You have a lot of vocabulary, and you remember it. And what I actually I do, is making stories, and I remember what does that mean.

I wanted to verify this with the ESOL tutor, who recognised that Scratch provided a new way for the students to learn and to remember what they had learned. He said:

> "As for the games and different kind of interactive activities, I think that's really useful because it engages feelings and enjoyment. Their interest is more engaged because it's fun, whether there is a competitive element or it's just actually enjoyable to use the game or the activity. And, I think it really helps to consolidate their understanding, and help them to remember things as well, because there is a fun element. And also, because, if it is a multi-sensory, a kind of multi-media thing, with sound and visuals, I think that's the word. I think the multi-sensory approach helps the learning as well, helpful for deeper learning which will be remembered for longer than just superficial, or [such as a student saying] well, I remember it for two minutes, and then it's forgotten again next time". (The ESOL tutor, 2015)

The above illustrations provide additional evidence that using Scratch helped the student to remember what she had learned. This demonstrates the project's contribution to helping the ESOL student to enhance her learning and develop her English language skills.

The remixing of Scratch Projects 1 and 2 involves analysis and evaluation skills that can be mapped to computational and linguistic practices. Furthermore, Figure 6.6 illustrates Scratch's visual programming blocks, which were synchronised and arranged in a sequence that necessitated experimenting with, analysing and evaluating the Scratch script block. The remixing of Scratch Project 2 can be seen as the creation of SFL1's version of the original project. Recording the pronunciation of new English words, adding them to the existing list of words and typing their correct spelling are all remixing processes that can be seen as the student creating her own project.

The computational gains (Brennan and Resnick, 2012) achieved in this case study can be seen from the perspectives of Bloom's digital taxonomy (Churches, 2011). For example, gains in computational concepts include concepts of "sequence", as SFL1 had to understand the sequence of the scenes and to arrange them in a way that followed the conceptual storyboarding design. There were also gains in computational practices, such as testing and debugging and being iterative and incremental, as discussed in the Scratch projects. The construction of the synchronous dialogue, between the two characters in the storytelling project (Project 1), indicates computational concepts of iteration and parallelism.

6.3.4.4 Feasibility of the Scratch Computational Environment as a Medium for Expression

The findings from the case of SFL1 show that Scratch was easy to learn, and that it was not a complex technical or computing tool. The remixing of Scratch Project 2, which contains complex script, is one illustration of the feasibility of utilising Scratch projects in ESOL programmes. This result corroborates those of the previously discussed case study, which showed how the ESOL students in the team considered Scratch an easy tool. In an interview with SFL1, I asked her whether she thought using Scratch was complicated or difficult, and she reflected on her experience in this way:

> "I don't know because in my own experience, in the beginning, I found it difficult how to use it, but then, in the end, I found it completely easy to use it. And, there is instructions as well how to use it, as you gave me booklet for it, which actually helped me a lot. So, I think it's really easy for people who go into Scratch".

In addition, the visual drag and drop blocks of script made it easy for the students to experiment with Scratch projects. SFL1 reported that "…it's really easy to use as well, you can just drag this one to this, you can write words, you can make anything". Therefore, the visual and interactive elements of the Scratch programming environment made it easy for SFL1 to use the software and to practise authoring Scratch projects, as illustrated in the projects in this case study.

SFL1 asserts that using Scratch was easy and not complex, despite the technical computing elements offered through the programming environment. This assertion can be discussed and explained from several perspectives, including multimodality (Jewitt, 2013; Kress, 2000) and computational thinking (Wing, 2008). The multimodal perspective suggests that not only is multimodality ubiquitous in contemporary practices, but knowledge is fundamentally multimodal (Kress, 2005). As such, I argue that these ubiquitous multimodal practices were conceived as easy and meaningful, especially when they were relevant to the context and cultural background of SFL1. In other words, and drawing on Ajayi (2009), SFL1's Scratch programming environment can be regarded as a medium for new meanings reflected in the contexts and the sociocultural-specific views and experiences of SFL1.

From a computational thinking perspective (Wing, 2008), elements of abstraction and encapsulation provide an explanation for SFL1's deep engagement in using and remixing her Scratch projects. For example, as illustrated in Figure 3.2 in Chapter 3, Section 3.13.1, entitled "Computational Thinking", the higher the levels of abstraction, the greater the participation and usability. This concept is also signified in the participatory culture that creates a low barrier to entry (Jenkins, 2006). Britsch (2009) comes to a similar conclusion and suggests that "visual thinking" elements create "communicative comfort zones", and I argue that SFL1 could have experienced these in her engagement with the Scratch projects.

In this context, SFL1 did not perceive Scratch as a computing or technical programming tool. Based on my observation, SFL1, similarly to other ESOL learners, thought about Scratch as a tool for expression. I wanted to verify this with the student, and when I asked her in an interview about her perceptions concerning computing and computational concepts, she did not recognise the technical terms. The following is an excerpt from this conversation:

Researcher: So, what are the main, let's say, concepts about computing or computation, what do you think about these?

SFL1: I am not really fan of computing, because I don't use it a lot, and I don't have that good experience, I was in the beginning, gradually in the beginning of things.

Researcher: Did you expect before using Scratch, did you expect that it would be, like this way?

SFL1: I was not expecting that this will help me a lot. I just thought that is just a normal thing. And I went to the website, and it actually was good thing and it helped me a lot, to develop my writing and reading, which is a good thing. But I did not expect to be helpful that much.

We can draw a contrast in this conversation between the two questions: a technical question about computing, with the response, "I am not really fan of computing", and the next question about her expectations before and after using Scratch, with the answer, "I was not expecting that this will help me a lot. I just thought that is just a normal thing". The above excerpt provides explicit evidence that the student did not like the technical terms of computing and programming. However, she was very attracted to animating projects, recording her voice, checking and developing spelling projects and creating stories using Scratch. It is in this context that this particular student perceived Scratch as a tool for expression rather than as a computing or technical tool for programming. Computational thinking skills were, nevertheless, embedded in the Scratch projects used or developed by SFL1. This is evident in the discussions in the computational outcome sections above. This view of Scratch as a tool for expression with embedded computational thinking skills, and how this is aligned with the concept of abstraction, is debated further in Section 6.3, which contains reflections on case studies.

6.3.4.5 An Indication of the Continued Usage of Scratch after the End of the Project

SFL1 was able to succeed in her ESOL writing tests and to obtain the GCSE qualification, and she consequently enrolled on an undergraduate programme at a university in London. There was an indication that she continued her work on Scratch after she graduated from the college. It could be argued that this was because she used Scratch at home more than in college. She said, "It was really helpful at home more. When I do my English, it actually helped me".

I asked her if she would continue using Scratch at the college or elsewhere. She responded: "Yeah, I'll recommend it to people and I'll join it as well, and I'll do some presentations as well, and I'll actually share this one with other people, to help them as well". This indicates that the student is willing, and planning, not only to continue to use the programme but also to encourage other people to use it.

6.3.4.6 Difficulties Faced in this Case Study

SFL1's case study exemplifies the diversity among the ESOL students which imposed difficulties in targeting students with different cultural and mother tongue languages. This constituted a challenge for the researcher as well as for the ESOL tutor. This case study has shown that every ESOL student might need particular attention paying to her or his cultural background. Time was another constraint for SFL1, who was preparing to take the GCSE exam at the end of the project. This limited her engagement in the Scratch team activities, especially in the second half of the summer term.

6.3.5 SUMMARY OF THE CASE STUDY

This case study has demonstrated how the individual context and the cultural background of SFL1 were addressed through her engagement with the Scratch team. ProvidingSFL1 with the opportunity to join the Scratch team, and interact with Scratch activities, served as a new platform to develop her English language skills in a more meaningful way. Also, this case study has demonstrated how a Scratch storytelling project helped the student to open up her imagination and enhance her literacy skills, especially in writing.

The storytelling and storyboarding Scratch projects in this case study represent a novel approach to tackling SFL1's individual context and enabling her to overcome the constraints that were limiting her progress in writing. Therefore, this case study has exemplified how the Scratch computational environment contributed to enhancing her ESOL skills, especially in writing. It has also demonstrated how Scratch spelling projects and games can be utilised in ESOL learning activities, and can, therefore, help to enhance the spelling skills and extend the vocabulary of ESOL learners.

In conclusion, the Scratch projects discussed in this case study illustrate how the project contributed to enhancing SFL1's learning practices and enabling her to overcome difficulties triggered by her cultural background and personal context, as well as improving her English skills, in particular her writing skills and her vocabulary.

6.4 CASE STUDY 3: JFE2

JFE2 is an 18-year-old female student on an ESOL Entry Level 2/3 programme. Her mother tongue is Mandarin, and she moved to the UK two years ago. In my communications with JFE2, she frequently constructed her English sentences in the wrong order, perhaps reflecting the sequence of thinking and speaking in her mother tongue. Various studies have shown significant differences between English and Mandarin. For example, Boroditsky (2001) suggests that fundamental differences in their alphabets and phonology shape both thoughts and the process of thinking. One commonly observed flaw in students studying at entry level, including JFE2, is that they tend to think more in their mother tongue, and, therefore, structure their English sentences accordingly.

In this context, and given the English Entry Level 2/3 skills of JFE1, one response was to encourage her to enhance her pronunciation and extend her English vocabulary through recording her pronunciation of English words and sentences, and constructing cross-language Scratch projects. At the start of this study, she was directed to explore and use several Scratch projects in the Scratch online forum. In this regard, she was encouraged to improve her English phonetic awareness through the use of English phonics Scratch projects. What follows is a discussion of JFE2's engagement with four of these projects.

6.4.1 Project 1: Music Project and Animated Lyrics

Scratch music projects were, perhaps, what encouraged JFE2 to join the Scratch team. When introducing the study, I asked the students, including JFE2, to search the Scratch online forum for something that interested them. JFE2 was delighted to find a project that animated one of her favourite songs. The project was entitled "Listen to mum words" and had been created by a Scratch user called "Andysuen94". The project enabled the user to listen to the song while watching an animation of the lyrics in both Mandarin and English. This was the first Scratch project the student explored and used. See Figure 6.9 below for a snapshot of this project.

Encouraging JFE2 to search the Scratch online forum for projects that interested her, or topics that she was passionate about, was a very helpful way to engage the student in Scratch activities and to encourage her to get started with using Scratch meaningfully. It is in this context that JFE2 explored Scratch projects and used Project 1.

Figure 6.9: a snapshot of a Scratch project on a Chinese song entitled "Listen to mum words" with animation of the lyrics.

6.4.1.1 Outputs of Project 1: Music Project and Animated Lyrics

For JFE2, this was her first experience of using a Scratch project. As her starting point for exploring and using Scratch, she was able to look inside the project and navigate various blocks and costumes that contained the lyrics in both English and Mandarin. The costumes, and the main stage photo, inside the project, were labelled in both languages. The student's personal interest in the song and the provision of the lyrics meant that the project served as a kick-starter project through which she could learn about the Scratch environment and the translation of the lyrics of one of her favourite songs.

6.4.1.2 Linguistic Outputs of Project 1

Project 1 provides an illustration of using language meaningfully and purposefully. In this project, the student read the provided animation of the lyrics in both Mandarin and English. This was helpful in that JFE2 rehearsed her English vocabulary using the provided translation of the animated lyrics. The translation of the lyrics entailed more than a dozen sentences in English as seen in Table 6.4 below.

Table 6.4: the English translation of the lyrics of the Chinese song "Listen to mum" as it appeared in the Scratch Project 1.

1	Friend, do you have a lot of question marks?

2	Why other kids are reading comics?
3	I am her having art lesson and talk to piano.
4	And when other kids are playing games.
5	ABC, I am learning on the wall memorizing my ABC.
6	I said I want a big aeroplane.
7	But I got an old recorder.
8	Why listen to mum words?
9	You will understand it when you grow up.
10	When I grow up, I start to understand.
11	Why I can run faster than the others?
12	Fly higher than the others?
13	In the future, people are reading comics drawn by me.
14	And they are singing songs written by me.

I observed JFE2 listening to the song and reading the animated lyrics carefully. I wanted to learn more about her interaction with this Scratch project, so I intervened and asked her:

Researcher: Is this the translation from Mandarin to English?

JFE2: Yes…you can read the English say here [the English translation of the lyrics]

Researcher: Can you show me please?

JFE2: This English animate, say the Chinese one of it, like this [pointing to the computer screen].

Researcher: Is the animation or the translation in English is good?

JFE2: Yeah.

Researcher: Can you read the English animation of the words of this song?

JFE2: Yes, it is easy, no? I can read it [the student asking with a tone and she means: isn't it?].

This dialogue provides explicit evidence that the student could read, at least parts of, the translated lyrics of a favourite song. As such, she practised and, perhaps learned, some English words and sentences meaningfully and purposefully. As illustrated in the dialogue, the student participated in a conversation. She was listening and understanding, responding to questions and engaging in the discussion by asking her own questions.

This activity represents an exercise in reading the English translation of lyrics that the student is passionate about. It seems from the above dialogue with the student that she had to compare the words and sentences in her mother tongue and in English. This helped her to develop awareness of the differences, and perhaps of some similarities, between Mandarin and English.

From another perspective, the Adult ESOL Core Curriculum acknowledges the use of cross-language activities that include translation between the students' mother tongue language and English. This is considered a highly desirable skill as the "[l]earners translate a few sentences into their language of literacy and compare the word order of this language and English" (Steeds, 2001, p147).

6.4.1.3 Non-Linguistic Outcomes of Project 1

Using the English lyrics of a favourite song resulted in a number of affective and social gains for this student. The student demonstrated an openness to developing a new experience in the classroom. This supported her in developing attitudes towards learning, such as team working, actively participating in discussions and willingness to learn. Also, talking about a familiar topic that the student understood very well increased her confidence in speaking about and discussing the topic. The above dialogue with the student is an illustration of this enthusiasm and willingness to communicate and talk about a favourite topic.

6.4.1.4 Computational Outcomes of Project 1

Although JFE2 did not create this project, she was able to look inside the script, and explore various blocks of the sound script that played the song file as well as experiment with several animation scripts. This exploration and experimentation enabled the student to familiarise herself with the visual computational blocks and sections of the Scratch programming environment. Because of this, and also the guidance she was given about basic Scratch blocks and scripts, she was able to construct simple projects and add recordings, animations and text, as discussed in the subsequent projects.

6.4.2 Project 2: Simple Conversation

The animation of a simple conversation between two sprites is an activity that was used when introducing Scratch to JFE2 in order to support her in constructing her first Scratch projects. Project 2 animates a simple conversation between two characters – a cat and a butterfly. In this project, JFE2 created the two sprites, and animated a simple conversation between the two characters, as illustrated in Figure 6.10. The first sprite asks, “Hi, how are you?” and the second sprite responds, “I am good thank you”.

Figure 6.10: a snapshot of a Scratch project that animates greeting sentences produced by JFE2.

6.4.2.1 Linguistic Outputs from Project 2

In this project, JFE2 was able to write a simple conversation between the two sprites and animate the written text. The student was able to describe her project to the researcher. She was able to pronounce the names of the sprites, the “cat” and the “butterfly”, and to explain both the greeting question asked and the response. Another illustration of the project’s linguistic outputs is in the discourse that took place around the construction of the project. The following excerpt from my dialogue with the student shows the conversation that occurred while I was demonstrating the concepts of sequence and timing to the student and helping her to synchronise the conversation between the two sprites:

Researcher: Can you please show me what you did?

JFE2: The project animate[s] the saying: “hello, how are you?” and “I am good thank you”, like that.

Researcher: Do you mean the question of “How are you?”…

JFE2: Yeah, the question of “How are you?”

Researcher: I see; that’s good.

Researcher: Why are the cat and the butterfly talking at the same time?

JFE2: Ha? [she did not fully understand the question]

Researcher: Can you make the cat ask the question “how are you?” first; then the butterfly will say “good thank you?”

JFE2: Not really know this.

Researcher: I can show you.

Researcher: Click, here, on the butterfly [pointing to the Scratch screen].

Researcher: Now click on “Control”, and drag “wait (1) secs” block here [pointing at the butterfly script.

JFE2: Aha

Researcher: Drop it [the “wait (1) secs” block] here.

JFE2: Then what?

Researcher: That’s it. Try to run the project now and the cat will first ask “How are you?”; then, the butterfly will answer “I am good, thank you”.

As illustrated in the above dialogue, the student was able to engage in a discussion about modifying the Scratch script. This helped her to acquire and employ some new English words, and listen and respond to questions. For example, the student learned to employ the word "question" instead of "saying" (referring to the question "how are you?"). Also, this dialogue exemplifies a conversation that does not normally take place in ESOL Entry classrooms, as will be discussed further in Section 6.4 of this chapter.

The utilisation of the simple words and greeting sentences in this project, or in any other classroom activity, is one of the sample activities recommended in the ESOL Entry Level curriculum. The ESOL Entry levels curriculum (Steeds, 2001, p119) indicates that a simple conversation such as "Hi, how are you?" is one of the "sample activities" recommended for students at the Entry levels. In this regard, an initial exploration and experimentation with the Scratch environment can be seen to feed into a number of Entry levels activities and strategies.

6.4.2.2 Non-Linguistic Outputs from Project 2

This Scratch project is an illustration of additional methods of communication, interaction and expression that JFE2, and other novice ESOL learners, utilised in their learning practices. The student's engagement in the project supported the development of her attitudes towards learning, as illustrated in her teamwork and active participation in discussions. The discourse that took place around the project showed a willingness to learn, hear, respond and react. Additional attitudes that were enhanced include an openness to developing a new experience in the classroom and to valuing such learning activities. This is illustrated both in Project 2 itself and in the discourse around the project.

6.4.2.3 Computational Outcomes from Project 2

In this project, the student learned the computational concept of "events", as she used the basic event block (the green flag) to run the scripts as demonstrated in the cat and the butterfly sprites. She was also introduced to the computational concepts of "sequence" and "parallelism", as she learned about the timing of the conversation between the two sprites. She also experimented with the "looks" section in the Scratch editor to write and animate the sentences. This helped in that it integrated her writing and speaking skills in one Scratch activity while encouraging her to engage in a conversation about the project.

6.4.3 Project 3: A Cross-lingual Translation Scratch Project

In this project, JFE2 created a cross-language Scratch project that animates some greeting words in English, Mandarin and Malay, with the collaboration of her Malaysian friend. JFE2 involved her friend in the project, and they were able to demonstrate some greeting words and sentences in both English and their mother tongues. A number of linguistic, non-linguistic and computational outcomes emerged from the project, as discussed in the subsequent sections.

6.4.3.1 Linguistic Outputs from Project 3

By constructing this project, JFE2 was able to practise her pronunciation of some greeting words in English, as evidenced in the recorded and written words within the project, and the discussion she engaged in with her Malaysian friend while constructing the project and recording her. The greeting words portrayed both similarities and differences between English, Mandarin and Malay.

Similarly to previous discussions about Scratch projects, some evidence for progress comes from the project itself, and other evidence from the discourse during the interaction with the student. The following dialogue shows that the student can generate sentences informed by the content generated in the Scratch project. The dialogue arose from my asking JFE2 to explain part of the project that she had constructed in collaboration with her Malaysian friend.

JFE2: Because I am a Chinese say [I speak Chinese], we say the difference about English and Chinese [she created a cross-languages project using English and Chinese languages].

Researcher: Yeah, Aha.

JFE2: Just like that.

Researcher: Can you please tell us a little bit more about this project?

JFE2: Hmm, I made two animates, one is Malaysian, one is Chinese. Then, we say Malaysian language and English, just like that.

I asked JFE2 to provide more details about her experience in creating this project, and whether she aimed to translate words from Malay and Chinese to English. She responded:

> "Not translation, just he say, he say Chinese in 'hello', and he say English in 'hello', and he say Malaysian in 'hello', just like that" [She means recording and playing the word 'hello' in English, Chinese and Malay languages].

The above excerpt from my dialogue with JFE2 shows part of her efforts to use Entry Level English skills to construct a simple project that animates some greeting words using translations from her own and her friend's mother tongues. I think that the discussion with JFE2 demonstrates her engagement in a conversation about the construction of her project. Despite some speaking flaws, due to her level of English, the conversation involved a variety of simple, compound and complex sentences.

6.4.3.2 Computational Outcomes of Project 3

JFE2 constructed this project by creating three sprites to represent English, Mandarin and Malay. Each of the sprites had a similar block of script that played the recorded greeting sentences in the three different languages. This design shows several computational concepts, including (1) "sequence", as when joining two or more script blocks together; (2) "events", as when a sprite is clicked a corresponding recorded file is played; (3) and "parallelism", as some scripts operate the three sprites together, while others apply only to a particular sprite.

It is worth mentioning that JFE2 perceived Scratch as an easy tool with which to create animation and express herself, rather than to develop computing or computational competencies. To illustrate, when I asked JFE2 how she designed and created the project, and how she knew about the scripts for recording her voice in English and the other languages she responded:

> "just go to click, and then go to time, if I want to animate thing, I put animate, and then you put a 'move', like that, and then animate, and the animate can working… Then put a sound. You cut the sound and animate, so can record yourself. Just like that".

When I asked whether she faced any difficulties while creating the project, she responded, with confidence, that it is "very easy…this is not difficult; it is not difficult". She explained her response further:

> "Just drag a button, and then press the thing you want: if you want sound, or if you want time… or if you want to write something, if you want animate to tell you something, you can write down the word in this button, I think it is easy".

6.4.3.3 Non-Linguistic Outputs of Project 3

The involvement of JFE2's Malay friend is explicit evidence of the social elements and the team-working attitude that were developed as a result of new abilities that gained during the construction of the project. Other illustrations of increased interactions can be seen in JFE2's interaction with the researcher, as shown in the above dialogue. These examples provide explicit evidence for increased classroom interaction in the case of this particular student.

In this context, the student perceived Scratch as a tool for animation or expression, as opposed to a tool for computing, programming or coding. This perception shows that Scratch activities can be socially constructed in conjunction with the interest of the learners to foster self-expression. Other studies explain and corroborate the finding that learners usually do not aim to learn technical computing or computational skills while developing Scratch projects. For example, Kafai and Burke (2014) note that "[a]s our own research suggests, often children are not even aware they were in fact programming with Scratch until we actually tell them" (p4). This establishes the fact that the often frightening abstract concepts of coding, computing and programming are not explicitly the sole end goal in Scratch activities.

6.4.4 Project 4: Using Scratch to Develop English Phonics

In this project, JFE2 used and experimented with a Scratch project build around the phonics of the English alphabet. JFE2 selected a project entitled "Phonics Shooter" by a Scratch group member called "msappy00". This project helps with the phonics and pronunciation of the English alphabet, in what might be classified "a fun way". The student perceived this project as a game and used it as such. See Figure 6.11 below for a snapshot of this project.

Figure 6.11: an overview of the Scratch project entitled "Phonics Shooter".

At the heart of this project are the phonic representations of the English alphabet as well as the pronunciation of a word that begins with selected letters. For example, the user of the project hears the phonic of the letter "J", and then the Scratch project plays the pronunciation of the word "Jam" as a demonstration of this. In return, the learner has to select the correct letter, by shooting at it. The user's choice of the appropriate letter is informed by the sound she picks up from the pronunciation.

6.4.4.1 Linguistic Outputs from Project 4

JFE2 was observed using this project and trying out the available recordings of the English phonics and word pronunciations. She was able to listen to, and practise, the phonics of selected English letters using examples of word pronunciation. For example, the phonic of the letter "T" was pronounced several times while an example of the phonic as in the word "tennis" was provided. See Appendix 11 for a list of all the phonics and word examples in this project.

On three occasions, JFE2 was observed to take longer when shooting at the right letter and on one occasion, she missed the letter "Y". It appears that she was not able to pick up the phonic of the letter "Y", which has the sound "Ya", as exemplified by the word "Yoghurt".

Therefore, one response was to show her how she could repeat selected phonics and examples by checking the recordings in the sound section inside the script.

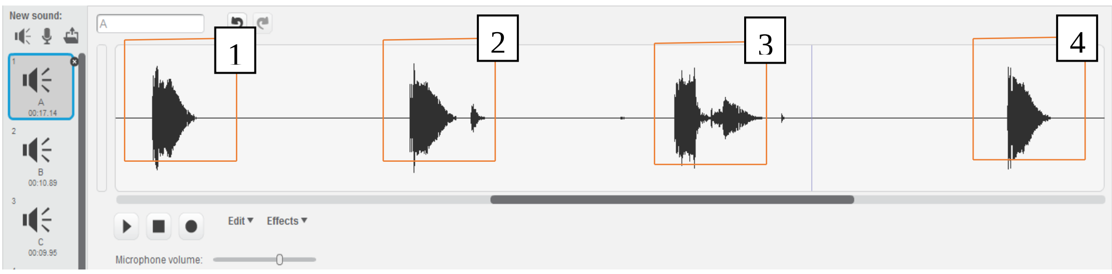
This activity can be seen to contribute to the achievement of, and feed into, the ESOL phonic and visual strategies (Steeds, 2001). It therefore has the potential to enhance the curriculum activities through its utilisation of phonic and graphic knowledge to decode words in an interactive and meaningful ways. As such, JFE2's engagement in this project is an illustration of Scratch activities being in line with the ESOL visual and phonic elements and strategies.

6.4.4.2 Computational Sound Editing

The audio files inside the Scratch script could be remixed in a similar way to other media content in the Scratch editor. This allowed the researcher to navigate the sound files, visually identify a point on the soundtrack in order to add more examples, and record additional word/s or sentences. Figure 6.12 is a snapshot of the sound file of the phonic of the letter "A" in this project. This figure illustrates my addition of the word "apple", as shown in the square labelled with the number three in this figure. As a result of this sound editing function, JFE2 could listen to the following when she selected the phonic of the letter "A":

1- A recording of the phonic of the letter "A" (/ə/)
2- A recording of the pronunciation of the word "ant" (example 1)
3- A recording of the pronunciation of the word "apple", added by the researcher (example 2)
4- A recording of the phonic of the letter A (/ə/)

Figure 6.12: a snapshot of the sound editor in the Scratch programme, showing the recording of an additional word that exemplifies the phonic of the letter "A".



Therefore, while JFE2 was encouraged to remix the project or any phonics she chose, I provided an additional example for her by remixing the sound file of the phonic of the letter

"A" by recording my pronunciation of the word "apple" through editing the sound file using the Scratch editor.

This demonstration of computational sound editing enables ESOL learners and tutors to compare pronunciation and phonics. I argue that this illustrates a dimension of the personalised computational learning environment, in which convergence and synergism take place between language development and computational environments.

This example provides explicit evidence that, by using this Scratch project, including the remixed version, JFE2 improved both her phonic awareness and her pronunciation. Indeed, JFE2 reported that this was helpful to her and that she also accessed the recordings on several occasions at home.

6.4.4.3 Non-Linguistic Outputs from Project 4

Encouraging "fun" activities using Scratch is another demonstration of how the computational Scratch environment can be incorporated into ESOL learning settings, especially when these activities have a competitive dimension. The opportunities for repetition and review provided by this project were also found to be useful for progression in the student's learning practices. For example, the student could run the project at a time that was convenient for her. In addition to the sound remixes provided by the researcher, JFE2 was encouraged to remix selected phonics to rehearse her listening and phonics awareness of the selected letters. This process of repetition on demand demonstrates one aspect of personalising learning practices using a computational environment. Consequently, this supported the student to develop new attitudes such as a willingness to learn and to work at home and openness to trying something new.

6.4.5 Discussion of JFE2's Case Study

The projects in this case study provide insights into this student's engagement with the Scratch team, and demonstrate how this engagement helped her in developing her English language skills. The projects and the excerpts in JFE2's case study are in line with the social constructivist approach, which stands in opposition to the technological determinist approach regarding the role of technology in education. Therefore, JFE2's Scratch projects are illustrations of the constructionist approach to learning. This approach is similar to the social constructivist approach that promotes the active construction of knowledge rather than its being passively transmitted and received (Edwards, 2012). However, the digital computational artefacts in this case study provide empirical evidence for the effectiveness of the constructionist approach in enhancing JFE2's ESOL literacy skills through the meaningful employment of these artefacts.

The projects and dialogue excerpts in this case study represent a computational culture (Papert, 1993) that transcends the didactic dissemination of traditional technical computing skills. Perhaps this emerging culture is an explanation for JFE2's confidence and ease in using Scratch. However, this should not be confused with the technological determinist approach that perceives young adult learners as, for example, digital natives (Prensky, 2001) or net generation (Oblinger and Oblinger, 2005), because although JFE2 was comfortable using the Scratch computational tool, the pedagogy of digital technology is an essential component in enhancing creative self-expression using this tool (Edwards, 2012).

In this context, the Scratch projects in this case study illustrate linguistic, computational and attitudinal gains. As discussed in the subsequent sections, these gains can be further examined from the perspectives of learner experience research (Sharpe et al., 2010; Sharpe and Beetham, 2010), of using popular culture in ESOL teaching and learning (Cheung, 2001; Oxford, 2002) and of the enhancement of the phonetic awareness of ESOL learners (Gibbons, 2002).

6.4.5.1 Serving Learner Experience Research

In JFE2's case study, the description of the Scratch projects and the discourse elicited around the construction of them are in line with learner experience research (Sharpe et al., 2010), which suggests prioritising the learners' perceptions and their descriptive accounts regarding the use of new technology in the classroom. This view can also be applied to the other case studies in this research. This was essential in order to include the students' perspectives in the discussion and analysis of the project. This, in effect, enables the focus to be at the level of the learners and not of the technology, as discussed in Chapter 3, Section 3.8.2, entitled "The Learner Experience Approach".

In this respect, engagement in this research provides a descriptive account of her viewpoint regarding Scratch as the new technology introduced into her ESOL class. As such, JFE2's

Scratch projects can be discussed from the following two perspectives of learner experience research.

First are the strategies, behaviours and attitudes (Sharpe and Beetham, 2010) that JFE2 developed in her engagement with the Scratch team at her college. The strategies developed, as seen from JFE2's perspective, can be understood through the computational gains, which include computational concepts, practices and perspectives (Brennan and Resnick, 2012). For example, the excerpts from the dialogues with JFE2 demonstrate that she developed computational strategies and perspectives that facilitated her self-expression, using Scratch within a social classroom context. Also, JFE2's exploration and experimentation with the Scratch projects enabled her to familiarise herself with visual programming concepts, such as "sequence" and "parallelism" (Brennan and Resnick, 2012). These computational strategies and perspectives enabled JFE2 to experiment with Scratch projects, remixing and constructing other projects of her choice.

With regard to JFE2's description of the attitudes developed, she expressed an openness to new experiences in the classroom. I argue that this experience constitutes added value, which supported her in developing attitudes towards learning, such as team working, actively participating in discussions and a willingness to learn. Also, talking about a familiar topic that she understood very well increased her confidence in subsequently speaking about and discussing the same theme. The excerpts from the dialogues between her and the researcher illustrate her enthusiasm and her willingness to communicate and to talk about a favourite topic. This description of JFE2's personal experience in developing strategies and attitudes for learning in her ESOL class serves learner experience research (Sharpe et al., 2010) and aids the inclusion of JFE2's perspectives rather than just the technology itself.

Second, according to Sharpe and Beetham (2010), factors concerning the effectiveness of new technology in post-compulsory education are better understood through students' descriptive dialogue. As such, they suggest a categorisation that divides the students' experience into four sequential development stages, which can be applied to JFE2's case study:

1. Access to the Scratch programming environment, resources and services as essential for JFE2, and other case study students, in their getting started using Scratch. The investigation of students' access to the Internet, and, therefore, to the Scratch tool, was

discussed earlier in Chapter 5, Section 5.2.1, entitled, “Measurement of the Usage of the Internet and Knowledge of Scratch”.

2. The technical skills required for using Scratch that enable JFE2 to develop her confidence in learning to use a new digital technology. Similarly to the other case studies in this research, JFE2’s case study provides empirical evidence that the Scratch technical skills are not necessarily a higher priority than practices and creative expression using digital technologies. In other words, Scratch technical and computational skills can be acquired during, or as a result of, the process of experimentation and practising using the Scratch computational tool. Therefore, Sharpe and Beetham’s (2010) ranking of technical skills above experimentation and practices can be refuted in the context of the use of the visual computational practices offered by Scratch in this case study. That is why JFE2, similarly to the students in the other case studies in this research, was able to develop meaningful projects after she had had a basic orientation that explained Scratch’s technical and computational skills.

   An explanation for the argument that technical skills, within a computational context, can be developed through meaningful experimentation and practices is drawn from the social constructivist approach that suggests that it is the social environment that promotes learning, rather than the technology itself, as exemplified in computational culture (Papert, 1993; Brennan and Resnick, 2012) and Vygotsky’s ZPD (Cole et al., 1980). JFE2’s interaction with the Chinese song in Project 1 and the cross-lingual translation Scratch project (Project 3) are examples of meaningful computational practices within a relevant social context that does not require technical skills from the outset. Also, perhaps the “enculturation” (Gee, 2001, p527) of computational practices (Brenan and Resnick, 2012) within social discourse induces a comprehension of technical and computing skills through experimentation and expression.

3. Digital and computational practices that facilitate the process of making informed choices about the use of digital and computational technologies in a context. JFE2’s Scratch projects illustrate how a learner can use and remix Scratch projects of his or her choice and within a relevant context. I argue that this is essential in serving the social constructivist and constructionist approaches to learning through new digital technology. For example, the cross-lingual Scratch project demonstrates JFE2’s informed choice of a

project that animates greetings in English, Mandarin and Malay, with the collaboration of her Malaysian friend.

4. Creative appropriation, which involves learners constructing their personal learning environments through the meaningful use of the skills practices developed in earlier stages. JFE2's English phonics project (Project 4) illustrates a creative use of Scratch, using "computational sound editing" techniques in which the student is guided to remix the sound recordings of examples of the phonics of English letters of her choice.

6.4.5.2 Using Popular Culture in ESOL Learning Activities

Using the lyrics of a favourite song to practise, enhance and learn new English words and sentences follows the theme of utilising popular culture in developing English language skills. JFE2's Scratch Project 1 is an illustration of this theme. Various studies corroborate the effectiveness of popular culture in language learning strategies. For instance, Cheung (2001) recommends using popular culture in learning English as a second language. He argues that "English teachers' use of popular culture is a key to effective teaching and learning" (Cheung, 2001, p55).

JFE2's Project 1 can be discussed from the perspective of Oxford (2002) on using popular culture. Oxford (2002) suggests a language learning strategy for novice ESL students that includes affective and social language learning strategies, using popular culture such as lyrics or a favourite newspaper. She notes that the social and emotional side of learning is not receiving as much attention as other language learning strategies. According to her, while cognitive and behavioural language learning strategies are considered effective, some affective and social learning strategies are very useful in increasing the motivation of and cooperation between novice learners of English as a second language. These remarks about using popular culture in learning English as a second language show how, for example, Project 1 was relevant and meaningful to JFE2 in developing her English language skills.

6.4.5.3 Phonetic Awareness and English Language Development

The Scratch projects in this case study provided an indication of integration between computational thinking and language development. This view can be articulated as a synergism between the two fields of computational thinking and language development. In this context, some studies suggest an integrated view of language learning. For example, Gibbons (2002) illustrates an integrated view of language learning that includes phonics, spelling and grammar. She calls this an “integrated meaning-focused approach” (p132). In this approach, she notes the three principles of: (1) move from whole to part; (2) move from meaning to form; (3) move from familiar to unfamiliar (p133). Furthermore, Gibbons (2002) suggests that “letters and sound in isolation are very abstract concepts” (p135). Therefore, given the visual and interactive elements of the Scratch project, the words that exemplify the phonic (letter-sound relationship), and sound editing, can make the activity less abstract as well as more interactive.

From another viewpoint, the increased English phonetic awareness can have various positive implications for the ESOL learners, including JFE2. An increased phonetic awareness is helpful not only in speaking and pronunciation but also in reading and writing. For example, some research shows a robust relationship between awareness of phonemic patterns and the learners’ ability to rhyme (Goswani and Bryant, 1990).

6.4.5.4 Difficulties Faced in this Case Study

Similar to most of the students studying at ESOL Entry levels, JFE2 has a basic level of English language skills. This presented some difficulties in communicating with the student at the beginning of the study. Possibly, due to interference from her mother tongue language, I had to pay extra attention to her expressions. For example, on several occasions, instead of ending her sentences with the expression “right?”, to seek confirmation of what she had said, she used the expression “no?”, as in asking a question. Consequently, communication with JFE2 required more attention, careful listening and the selection of simple words and sentences. There was a need for frequent repetition of questions as well as to speak slowly and clearly in conversations.

Furthermore, time was a constraint for JFE2. She reported that her coursework was preventing her from engaging further in Scratch activities. She wanted to achieve a distinction and was trying to do her best in submitting several assignments for her other courses at the college.

Lastly, monitoring the set of phonics and words that JFE2 was able to identify correctly or incorrectly is not a straightforward process, particularly given the complementary nature of this project. In other words, the focus will not only be on the student working on her project and practising phonics, but also on the researcher observing the student closely to monitor the phonics she selected correctly or missed.

6.4.6 Summary of the Case Study

This case study has discussed the engagement of an Entry-level ESOL student in Scratch activities. The case study exemplifies how simple conversation, words or sentences can contribute to enhancing ESOL learning practices at this level. The case study illustrated four Scratch examples: the first project is about using animation of lyrics in English and Mandarin of a favourite Chinese song. The second and third projects are about a cross-language project and animating simple conversation. The student, through these two projects, was able to practise her pronunciation of some greeting words and sentences in English. The fourth project describes the engagement of the student in English phonics exercises, through which she was able to practise English phonics and the pronunciation of English words. These Scratch project were discussed from the perspectives of using popular culture in ESOL teaching and learning (Cheung, 2001; Oxford, 2002), the enhancement of phonetic awareness of ESOL learners (Gibbons, 2002) and the learners' experience research (Sharpe et al., 2010; Sharpe and Beetham, 2010) that shows the importance of including the students' perspective in the introduction of new technology into the classroom.

6.5 CASE STUDY 4: KME2

KME2 is a 17-year-old male student in the ESOL Entry Level 2/3 class. KME2 moved to the UK about one year ago from Greece. Similarly to other students studying at the ESOL Entry Level, the main obstacle for his education in general and for his favourite courses at the college was his level of English. Along with many ESOL students, KME2 speaks two other languages – Greek and Albanian. He studied public service Level 1 as his main course, and wanted to apply for Business Studies at Level 2 at the beginning of the following academic year.

KME2 had difficulties extending his English vocabulary and found it a huge challenge to build a rich English vocabulary within the relatively limited time of his ESOL programme. This is especially because he had a timeframe for his ESOL programme and this constituted a challenge for a newcomer to the country, whose main goal was to work hard at his ESOL studies in order to unlock other possibilities and proceed in his academic and professional career. According to the ESOL tutor, KME2 had never sent an email before joining his sixth form college, despite accessing and using the internet.

6.5.1 Project 1: Animating Greeting Sentences in English

In the orientation I gave about project-starter ideas, I introduced the greeting words Scratch projects that animate both text and recording of greeting sentences. KME2 copied my demonstration and promptly created a Scratch project that animated the sentence, "Hello ESOL class", by writing the sentence as well as by recording his voice. This was his first experience of using a Scratch project. As his starting point for exploring and using Scratch projects, he was able to use the provided default sprite of the "cat" in this project and navigate the script blocks to write and record the greeting sentences.

6.5.1.1 Linguistic Outputs of Project 1

In this project, the student practised a simple English conversation in both writing and speaking. Although the project might not incorporate significant linguistic gains, it allowed the student to write, speak, read and repeat the project output several times. The combinations of these simple activities show a process of integration between elements of the ESOL skill areas. This was one aspect in which this project was useful to JME2 as an Entry Level student.

In order to verify what the student had learned in the project, I reminded him about his first Scratch project and asked him in an interview about his experience of constructing it. He reported that using Scratch for animating sentences was interesting to him. By constructing such animations, he was able to write and animate some greeting words, record them, and replay them. The following is an excerpt from his response:

KME2:	Yes, it was nice. I remember, you put ‘dogs’ and ‘cats’ to speak your voice.
Researcher:	Yes. Aha.
KME2:	Yeah, was nice, you can create full sentences,
Researcher:	Yes.
KME2:	And put them loud [record and play the recorded sentences].

6.5.1.2 Computational Outcomes of Project 1

The student learned about several sections and blocks in the Scratch editor. He learned the computational concept of “events” as he had to drag the “green flag” block into the script area. He also learned to add a sound block and to record his voice. In addition, he experimented with changing the “looks” of the “cat” sprite by dragging and dropping the “change colour effect” script into the script area. By doing this, the student learned logical computational concepts such as “sequence”, as he experienced different orders of the “looks” and “event” blocks.

6.5.1.3 Non-Linguistic Outputs from Project 1

The student ran this project several times, as a demonstration of his work. He repeatedly played the recording of his voice out loud in the classroom. I observed that there was a “fun” element to this project, as other students and the tutor paused for a moment while listening to KME2’s recording, and there was a smile on everybody’s face, including mine. This activity encouraged the student to express himself in a classroom activity and increased his interaction with other students in the class, as they were engaged in constructing similar Scratch projects. In addition, by constructing this project, KME2 developed a little sense of accomplishment, as illustrated in his demonstration to the class. In this context, using Scratch to record simple sentences can incorporate social elements.

6.5.2 Project 2: The English Word Roots

This Scratch project was designed with the need to develop the English vocabulary of students. The Scratch project is built around employing the word roots of English, particularly the Greek and Latin ones.

KME2 found the English word roots, particularly the Greek and Latin ones, a stimulating technique to increase his English vocabulary. There are many Scratch projects about the Greek and Latin roots of English already available through the Scratch online forum. Some of these projects were remixed and customised by KME2, by adding more roots and recording the pronunciation of words that exemplified the word roots.

KME2 used a Scratch project entitled “Greek & Latin Roots 1” by a Scratch user called “alfiaw”. This project provides about a dozen Greek and Latin roots of English words as illustrated in Figure 6.13a. When a user clicks on any of these roots, the English meaning of the roots is pronounced and displayed on the screen. Figure 6.13b shows a snapshot of when a user selects the Latin root “scrib”. The user listens to the pronunciation, and to the meaning of this root form in Latin: “Scrib means to write in Latin”. The user also sees the English meaning of the root on the screen, side by side with a descriptive photo of the root.

Figure 6.13a: a snapshot of the Greek and Latin roots Scratch project.

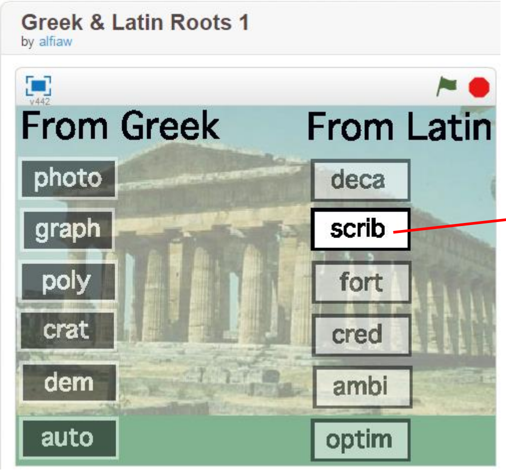
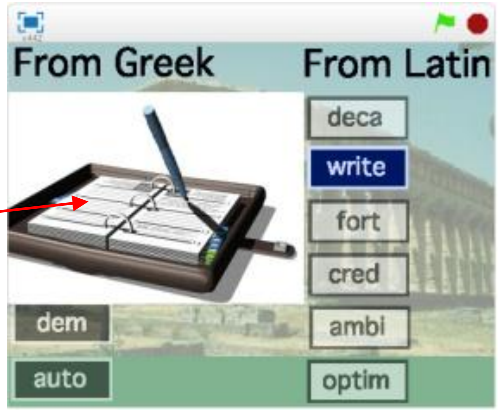


Figure 6.13b: a snapshot demonstrating the result of a selection of a root “scrib”



The introduction of English word root activities requires careful planning and detailed explanations. It was important to introduce the topic gradually to the students in the classroom and demonstrate Scratch examples of the topic. The students were provided with handouts that listed common English word roots, prefixes and suffixes to review at home and to keep as a reference for future activities. See Appendix 10 for a complete list of these handouts.

6.5.2.1 Linguistic Outputs from Project 1: Identifying the English Word Roots

KME2 explored, used and then remixed the Greek and Latin roots in this project. The student had comprehended many English words in his use of this project. As illustrated in Figure 6.13a, when KME2 engaged with this project he reviewed the roots of the English words. These roots helped him to deconstruct several words in English that are derived from these roots. Table 6.5 below illustrates the word roots and the English words discussed during KME2's interactions on this project.

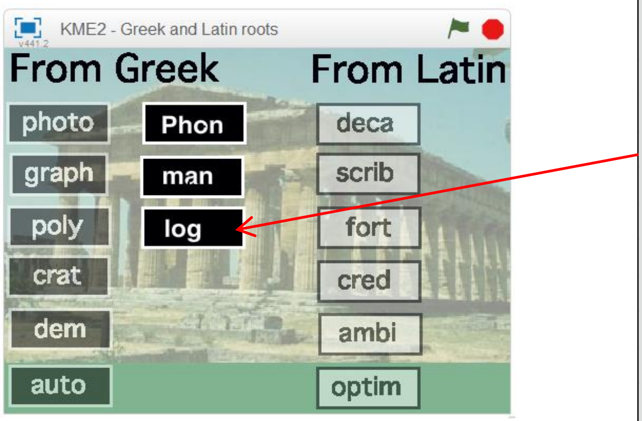
Table 6.5: a list of the words reviewed in the Greek and Latin roots Scratch project

#	Root	Meaning	English Words derived from this root that the learner has reviewed
1	photo	light	photograph, photon
2	graph	picture	Photograph, graphic
3	poly	many	polygon, polygamy
4	craft	power	aircraft, spacecraft
5	auto	self	automatic, autopilot
6	dem	people	demography, democracy
7	deca	ten	decade
8	scrib	write	script
9	fort	strong	effort
10	cred	believe	credit, creditable
11	ambi	around, about, both	ambiguity,
12	optim	best	optimal, optimum

Moreover, with a little help and guidance, KME2 remixed the project and added some new Greek word roots and the English descriptions of these roots, and recorded the pronunciation of the roots and the examples of English words as well.

Figures 6.14a and 6.14b show snapshots of the remixed project entitled “KME2 – Greek and Latin roots”. In this remixed project, the student added some new Greek roots. The roots “man” and “log” are an illustration of the newly added roots, as seen in the column in the middle in Figure 6.14a.

Figure 6.14a: a snapshot of the remixed Greek and Latin roots Scratch project.	Figure 6.14b: a snapshot of a remixed Scratch script of the added root “log”.



Furthermore, the student added some new words and sentences in English that described these newly added roots. He recorded examples of the English words that were derived from each added root. For instance, one root of the English words the student added was “man” which means “by hand” in English. Another example of an added root was “log” which means “word” in English. Therefore, there are several English words generated from the roots that the student had reviewed or added to the Scratch project, for example, “manual”, “logic” and “logbook”.

In this context, I had an initial indication that this student, and other students who had experimented with and remixed Scratch word roots projects, was making more progress than students who were not taking part in the study. I wanted to explore this indication further with the student and, therefore, I asked him in an interview about his experience of using the Greek and Latin roots Scratch projects. He reported that the Greek and Latin roots projects were helpful in extending his English vocabulary. The following excerpt illustrates his response:

KME2: The Greek and Latin roots.

Researcher: Yes.

KME2: The Greek language is the same the English. It little bit the same, yeah. The words are the same. And the Latin is the same as English.

Researcher: So, did you make one Scratch project about Greek and Latin roots?

KME2: Yeah, about the Greek and Latin words. Yeah.

Researcher: How? Can you give me an example, which words did you use, and how it was helpful?

KME2: Amm [student thinking] “Auto”.

Researcher: “Auto”?

KME2: “Auto”, in Greek means “this”.

Researcher: Yes…

KME2: “Log”… It’s a Greek word. Is {student thinking}, “logging”, for example, “log” or “login”.

In order to further validate this assumption, I then discussed my observation with the tutor, and presented what I had gathered from the students together with the artefacts produced. The tutor acknowledged the progress made by both this student and others who had engaged in word roots Scratch projects:

> “I think it’s very useful for them to be able to access different techniques, techniques on knowledge, so looking at the roots of words and different word endings, that kind of grammatical and vocabulary thing is an interesting way which they probably don’t get otherwise in functional skills English courses or qualifications, because it’s kind of going behind the scenes to look at sorts of linguistic roots of English and it gives them new tools to use in their spelling and writing” (The ESOL tutor, 2015).

Based on this, the English word roots, and the English words and sentences that exemplify them, provide explicit evidence that the student learned some new English word roots and extended his English vocabulary as well.

6.5.2.2 Computational Outcomes of Project 2

As seen in Figure 6.14b, KME2 remixed this project in spite of containing a relatively complex block of script. The student was able to remix it, and add new Greek roots, by copying the script from one of the available roots' buttons (the Phon/Photo button). He then customised the new button by updating the text and recorded sentences in English that described the new roots. Similarly to with some of the projects discussed in the previous case studies, remixing this Scratch project provides evidence that the student did not need to fully understand all the blocks of the remixed Scratch script.

KME2's engagement in this project can be described through several computational thinking concepts and practices. To illustrate, the computational concepts employed include "events", "sequence", "iteration" and "parallelism" (Brennan and Resnick, 2012). The student could read the script, the event's block of "when this sprite clicked" and navigate the sequence of the script. Understanding the sequence of the script was essential, for example, to add the sound block of "play sound (log) until done" as well as the sound block of "play sound (log2)".

Furthermore, the student engaged in this project using computational thinking practices such as "debugging" and "remixing" (Brennan and Resnick, 2012). KME2 had to debug the script by identifying the location where he needed to add or update the recorded files – "log" and "log2". This resulted in allowing the student to remix this project as shown in Figures 6.14a and 6.14b.

6.5.2.3 Non-Linguistic Outputs from Project 2

As a consequence of the student's engagement in this project, he felt confident about learning more English vocabulary using English word roots, especially using the Greek roots of the English words, as illustrated in Table 6.5 and Figure 6.13a. For example, KME2 noted that Scratch was helping him. When I asked the student, "What does it help?", He said, "It is helping you for writing. You can improve your writing, [and] your reading skills".

A second non-linguistic output that emerged was the student's readiness to extend his work on the ESOL learning materials at home. The student reported that working on Scratch was an easy task and more convenient at home. Given the student's crowded timetable at the college, working on Scratch projects at home is an indicator of a deeper engagement with the Scratch activities. KME2 confirmed that he found working on Scratch projects at home more convenient than working on them at the college. Indeed, he said, “Because I know how to do it, and I did it in my home, it was okay, it was not so hard to do”. As such, enabling the students to work at home is a major outcome of this study. The students did not do homework before taking part in this study, and they were able to extend their work at home using the Scratch tool, except in the case of GFL1 (Case Study 1), who had a technical problem with operating Scratch using Apple devices.

A third non-linguistic output that emerged from Project 2 was a willingness to try a new approach and a new tool for learning English while working in a team. This attitude is essential for developing learning skills in ESOL as well as in other subjects. In addition, it provides an indication of personal growth and development.

6.5.2.4 Serving the Adult ESOL Learning Curriculum

This project exemplifies a technique for learning, extending vocabulary and memorising the English words. It served visual and phonic learning strategies (Steeds, 2001) through which KME2 interacted with this project visually and listened to the pronunciation of the root followed by an example of an English word. In addition, the most commonly used English prefixes and suffixes were provided to the student along other common English word roots. Similarly to the word roots, the prefixes and suffixes fed into the Adult ESOL Core Curriculum.

In this context, English words roots, prefixes and suffixes are discussed at various levels of the ESOL curriculum. The curriculum recommends that students learn to “develop knowledge of word families, shared roots and prefixes to help read and understand some key specialist words…understand that knowledge of prefixes and suffixes can be generalised to another vocabulary” (Steeds, 2001, p228). In particular, the ESOL curriculum directs learners to “use context and range of phonic and graphic knowledge to decode words” and demonstrate the benefits of “how words can be broken down into parts, e.g. common prefixes and suffixes” (Steeds, 2001, p152).

The Scratch projects discussed in this case study, demonstrate the ESOL learning practice of interacting with English word roots, as well as common prefixes and suffixes, through the constructionist and the computational environment of Scratch. As illustrated in Project 2, these computational practices can be useful for ESOL students because they help them to achieve their goals through the use of the “structural strategies” and “visual strategies” recommended in the ESOL curriculum (Steeds, 2001, p230-1).

In fact, the student’s engagement with word roots, common prefixes and suffixes can be a means to employ the structural learning strategies. Likewise, the Scratch interactive projects that demonstrate visual modes of interactive text and pronunciation can be a means to utilise the visual learning strategies. Furthermore, the Scratch examples of Greek and Latin roots incorporate elements for maintaining an “integrated curriculum” (Steeds, 200, p5) that shows an integration of speaking, reading and writing skills.

6.5.3 Discussion of KME2’s Case Study

Learning English word roots as well as common suffixes and prefixes was stimulating for KME2 and the Scratch team. In this case study, the student learned new English word roots, which helped him to improve his understanding of English words and, therefore, to extend his English vocabulary, as evident in both the content of the Scratch projects and my dialogues with him. Also, KME2’s engagement in this study helped him to develop new abilities which have contributed to enhancing his attitudes towards learning. For example, the student became more confident in extending his English vocabulary using English word roots, especially Greek ones. The student’s willingness to experiment with a new learning technique constitutes another attitude developed in this case study.

In this context, KME2’s Scratch projects can be seen as an illustration of an individual’s conversation and representations using computational artefacts and programmable objects-to-think-with (Ackermann, 2004), which embrace “pluralistic outcomes” and “open-ended pedagogical approaches” (Cunningham and Allen, 2010, pp5-6). The subsequent sections discuss the computational and programmable artefacts employed in this case study and demonstrate their convergence with notions of digital literacy (Hague and Williamson, 2009; Buckingham, 2006).

6.5.3.1 Serving the Social Constructivist View of Digital Literacy

KME2’s Scratch projects can be seen from the social constructivist view of digital literacy, which incorporates awareness, critical thinking and understanding of a broader context of new digital technologies (e.g. Hague and Williamson, 2009; Newman, 2008; Merchant, 2007). This view stands in opposition to the functional definition, which embraces digital literacy as a set of functional skills (Buckingham, 2006). In particular, KME2's projects are in line with Newman's (2008) five-stage model, which utilises a critical thinking framework in promoting digital literacy learning. The five stages are: (1) defining the need; (2) accessing information; (3) understanding and evaluating the information; (4) creating; and (5) communicating information.

Based on KME2's projects, defining the need to critically engage in digital literacy is mainly driven by the student's interests and created based on his own choices. Although KME2, along with the other case study students, was encouraged to use general themes such as common prefixes and suffixes and Greek and Latin roots of English words, this served to provide him with a set of themes from which he could choose a project based on his own interests. Therefore, this activity was not perceived as an instructional task. In this context, because KME2's first spoken language was Greek, he quickly identified the Greek roots Scratch project as a relevant theme that he could experiment with and build upon. This student-centred view is in line with the social constructivist view of digital technology (Hague and Williamson, 2009; Buckingham, 2006) and it enabled KME2 to develop digital and computational practices based on his personal context.

In terms of the second stage, that of accessing information (Newman, 2008), this can be conceptualised from a multimodal perspective (Jewitt, 2013; Kress, 2000) of information and knowledge, such as having KME2 access computational and linguistic information within the same Scratch project: for example, KME2's experimentation with Project 2 involved learning new words using digital text, images, and the recorded pronunciation of words and sentences using the Scratch visual programming environment.

Stage three involves understanding and evaluating the information through the understanding and identification of common Greek roots of English words, as well as the underlying computational practices, concepts and perspectives (Brennan and Resnick, 2012) that are required to understand how this Scratch project works. KME2 indicated that he had reviewed and comprehended many English words while using and remixing Project 2, as illustrated in Table 6.5.

Stage four includes creating, remixing and debugging the project by adding new Greek roots of English words, including their description, as shown in Figures 6.14a and 6.14b. The multimodal dimension is well presented in these digital and computational practices as KME2 had, for example, to record the pronunciation of the newly added words and the sentences that described them.

Communicating information can be seen as reflecting on the practices, and KME2 shared, and reflected on, his experience with other case study students, the tutor and the researcher. The practices in this stage stimulated several attitudinal gains, such as increased classroom interaction and a developed attitude to team-working, especially as KME2 frequently interacted with his Greek classmate. In this context, English words roots, and the Greek and Latin roots of English, were absorbing examples for the Scratch team, especially the two Greek students.

6.5.3.2 Linguistic Gains and Improved Pronunciation and Identification of Syllables

Similarly to in the other case studies, recording sentences in English and listening to his own or others' recordings served as a way to introduce the concept of syllables and pronunciation to the student. The student was directed to wrong pronunciations, usually where he had used short instead of long syllables. The English words "thought", "hand", or "man", are examples of words that were pronounced incorrectly in this way.

Recording the student's examples of words using his remixed Scratch project helped in the identification of the wrong pronunciation of these words as well as serving as a way for the student to hear his pronunciation and compare it with the correct pronunciation. For example, the word "thought" was pronounced as short syllables as in \ˈthät\ instead of the normal pronunciation \ˈthȯt\. Similarly, KME2 pronounced the word "man" in short syllabes as in \ˈmən\ instead of the normal pronunciation of \ˈman\. In response, the student was directed to these pronunciations. A recording of the normal pronunciation was provided for his Scratch project. As a result of this, the student could listen to and compare his pronunciation with the researcher's pronunciation of the words "thought" and "man".

Regarding speaking skills, when the student was asked whether he thought that the Scratch activities were helpful in improving his skills, he responded:

> "it's helpful, the Scratch is helpful. I remember in the ESOL class, when we are doing the Scratch, we are testing the Scratch, it was helpful. Because you

> can create the sentences, you can learn about, you can learn, you can improve your English, I think".

In this context, while various studies conclude that digital and multimedia forms are crucial for language, literacy and intellectual development (Gilmore, 2007; Kern, 2003; Abraham, 2008), computational forms have the potential to foster participation and to benefit language learning in unprecedented ways that are different from the traditional multimedia forms. This is evident in the various linguistic gains that are illustrated in the Scratch projects used or created by KME2, particularly Project 2. The student learned not only some new words, but also a new technique for extending his English vocabulary using word roots. This contributed to improvements in the student's pronunciation of these new words, such as those derived from the roots "log" and "man" that were discussed in this case study.

Therefore, although digital and multimedia forms can aid second language learning, KME2's case study shows that computational participation can offer considerable levels of engagement and classroom interaction. While some studies show that digital applications such as blogging and emailing can be beneficial to second language learners (Li et al., 2015), I argue that the levels of participation in blogging and emailing are lower than in computational practices, which enable students to not only provide and share digital texts and images, but also customise, carry out visual programming and remix these computational artefacts.

6.5.3.3 Difficulties Faced in this Case Study

As in previous case studies, time constituted a constraint for exploring deeply and investigating, and personalising, discussing and sharing Scratch projects with the rest of the students. While the students had more time during the spring term (from January to May 2015) to supplement their ESOL learning activities using Scratch, the summer term was busy for some ESOL students studying at Entry Level, including KME2. Some of them had to reconsider their main course at the college; others had to start looking for another college and hope to be admitted to their preferred course. KME2 was one of the students who were applying to another college in an attempt to secure admission to the Business Level 2 course. This situation limited the time the student was able to devote to Scratch activities towards the end of the project. One implication of this is that personal circumstance can be a significant factor in learners' engagement with Scratch.

6.5.4 Summary of the Case Study

This case study has illustrated new ways to gain knowledge and extend the English vocabulary of the ESOL learners. It has discussed examples of using and remixing a Scratch English word roots project. KME2, a student at the ESOL Entry Level, was able to learn and employ the word roots techniques to extend his vocabulary and enhance his pronunciation. The English word roots project in this case study has exemplified remixing Scratch word roots project in a way that demonstrated a personalisation of the learning environment using Scratch computational projects.

6.6 Case Study 5: SME2

SME2 is an 18-year-old male student studying at the ESOL Entry Level. He moved to the UK around one year ago from Greece. SME2 and KME2 (KME2 was discussed in Case Study 4) are both ESOL learners whose mother tongue is Greek. They share similar cultural backgrounds and were both studying the same Public Service Level 1 course at the college.

I discuss three projects in this case study. The first is an English word roots Scratch project, similar to Project 2 in Case Study 4, and the second and third projects are based on algorithm activities and on how these types of computational activity contribute to the development of language learning. The two algorithm projects highlight perspectives regarding the student's engagement with computational practices and discuss how these practices helped to enhance SME2's English language skills.

The main concept regarding algorithms is that the learners can think purposefully about solving a problem or achieving a particular output. Levitin (2003) notes that an algorithm "is a sequence of unambiguous instructions for solving a problem, i.e., for obtaining a required output for any legitimate input in a finite amount of time" (p3). Therefore, the discussion of the concept of algorithm contributes to developing the learners' computational thinking skills which are essential for problem-solving as well as for designing strategies that apply to non-programming domains (Resnick et al., 2008).

6.6.1 Project 1: Greek and Latin Roots of English Words

Similar to KME2 in Case Study 4, SME2 found that the Scratch projects on Greek and Latin word roots motivated him to increase his English vocabulary and improve his spelling and writing skills. SME2 explored and used several English word root projects, including “Greek & Latin Roots 1”, illustrated in Figures 6.13a and 6.13b in Case Study 4, and “Poseidon Teaches Greek Roots” by a Scratch user called “alfiaw”. He interacted with these projects, which provide a visual interface for a list of Greek and Latin roots of common English words and play audio recordings of the pronunciation of selected English words derived from these roots.

SME2 interchangeably used Scratch projects and handouts of common Greek and Latin roots and prefixes and suffixes of English words in order to learn new English words, and, therefore, to extend his English vocabulary and enhance his spelling and writing skills. Therefore, the handouts (Appendix 10) provided an additional resource for the student to utilise during and/or after his interaction with the English word root Scratch projects.

6.6.1.1 Linguistic Outcomes from Project 1

SME2 explored, reviewed and learned various English word roots, as well as English words derived from these roots. Because SME2 used a similar Scratch project to his fellow student KME2, some of the linguistic outcomes are provided in Table 6.5, in Case Study 4. The table lists the word roots and the English words derived from these roots which were reviewed and discussed by SME2 and other students. The student learned some new words, such as “decade”, which is derived from the root “deca”, and “optimal” and “optimum”, derived from the root “optim”.

Based on the student interaction with this project as well as the discourse aroused with KME2, there was an indication that this student made progress in learning new words. However, this was not sufficient for me and, therefore, I sought to engage in a dialogue with him, for two reasons: first, because I wanted to discuss the meaning of English words derived from the word roots provided in the Scratch projects; and, second, I wanted to see whether he could apply what he had learned in a general discourse and develop other sentences. The following is an excerpt of the discussion I had with him about English words derived from the roots “hydr” and “aqua”, which mean “water”, and “optim”, which means “best”:

[First excerpt]

Researcher: Can you use this in a sentence?

SME2: Umm … I didn’t drink water, then I have dehydration.

Researcher: That's good; you did not drink water and became dehydrated.

[Second excerpt]

Researcher: Has anyone visited the London aquarium?

SME2: Where?

Researcher: There is a famous aquarium just near the London Eye. In that aquarium you can see various sea life such as fish, sharks and penguins.

[Third excerpt]

Researcher: What other roots have you learned from this project?

KME2: "Optim" means the best.

Researcher: Can you give us an example for the root "optim"?

KME2: [student is thinking]

SME2: [interrupting] It's optimal to finish college [graduate] before do work.

Based on the above transcript, it is evident that this student started making progress and learned not only some new English words but also a technique to extend his vocabulary and improve his spelling and writing skills, as demonstrated in his generation of simple, complex and compound sentences. In addition, the meanings of the English words were explained and discussed with the student.

The second English word root Scratch projects that SME2 interacted with during the Scratch team activities was "Poseidon Teaches Greek Roots". SME2 used this project and learned some new English words with Greek roots, including "anthropology", "hypodermic" and "xenophobia". SME2 learned the meaning of these new words, as the project provided explanations of the meaning of selected Greek roots, as well as of the English words derived from these roots.

To demonstrate this, while the student watched animations that described English words derived from Greek roots, he also listened to an explanation of the meaning of both the word root and the English word derived from it. For example, as shown in Figure 6.15 below, the meaning of the English word “anthropology” was explained to the student via a recording. The following is a transcription of this recording:

> “Anthropo: means human. Logy: means study. Anthropology is the study of human beings, where they came from, their languages, how they behave in groups and more. You can study anthropology in college. You can Google the word anthropology and learn more. Anthropology.”

Figure 6.15: snapshots of a Scratch project entitled “Poseidon Teaches Greek Roots”, by a Scratch user called “alfiaw”, illustrating the Greek roots of “anthropology”.

The discussion about the linguistic outcomes provides explicit evidence that the student is making progress. The student can now use and generate some new words and sentences from the English word root project and the handouts. The dialogue excerpts show that the student learned some new English words, and could employ them in a classroom discussion. Another important linguistic gain is that the student learned a technique for using word roots and common prefixes and suffixes to extend his English vocabulary and enhance his spelling and writing skills.

6.6.1.2 Non-Linguistic Outputs from Project 1

SME2 frequently collaborated with KME2 while working on Greek and Latin word root Scratch projects, especially as they both have Greek as their mother tongue. This resulted in increased classroom interaction. The increased interaction between the two Greek students was observed as they discussed the meaning of selected words and their Greek or Latin roots in English. Also they dealt with questions from other students regarding the Greek roots of English words. This was beneficial for the two Greek students, as it encouraged them to learn and increased their confidence in developing their English vocabulary and in participating in classroom discussion.

6.6.1.3 Computational Outcomes of Project 1

SME2 was able to look inside the script of the word root projects and explore the different blocks of the sound script that play the recordings of the word pronunciations and the descriptions of the meaning of the English words, as illustrated earlier in the "anthropology" example. The student was also able to explore and experiment with several scripts, which enabled him to familiarise himself with the visual scripts and blocks in the Scratch environment. This resulted in the student learning about basic computational thinking concepts such as "sequence", "events" and "parallelism" (Brennan and Resnick, 2012). Consequently, this allowed the student to alter the recorded sound files within the Scratch script by recording his own voice or adding random words or sentences that were perceived by the other students in the class as "fun".

6.6.2 Project 2: The Algorithm

This project involving SME2 illustrates how Scratch projects and exercises can help to facilitate the learning of computational thinking concepts. The goal was to introduce students gradually to computing and computational concepts. As a starting point, a handout of a list of computing keywords and concepts (Appendix 12) was discussed in the classroom. The handout contained basic images and illustrations of computing keywords that the students could utilise in their Scratch activities. The students were then introduced to computational thinking concepts through further activities, such as the Algorithm.

In this context, the students conducted an exercise that explained the concept of algorithm, or sequence, in computational thinking. This shows how "a particular activity or task can be expressed as a series of individual steps or instructions that can be executed by the computer" (Brennan and Resnick, 2012, p3). SME2 volunteered for this exercise, to play the role of a computer robot and receive instructions from the other students in the class to accomplish a task that they agreed on. The approved task was to "enter the classroom and write his name in the middle of the board".

6.6.2.1 Outputs from Project 2

In the course of the exercise, the other students in the class issued a detailed sequence of instructions for SME2 to follow. According to the agreed task, the series of instructions aimed at guiding SME2 to enter the classroom and write his name in the middle of the board. The students, therefore, had to experiment with the required number of steps SME2 had to take to accomplish the task and the directions of these steps.

On the first attempt, the instruction to SME2 was "enter the room and write your name on the board" but SME2 and the other participants progressively learned the process of breaking down instructions to accomplish their goals. Ultimately, the desired goal was achieved by giving instructions on direction (left, right, forward and backward) and on the exact number of steps required to situate the student in a position facing the board, and then getting him to take the marker, point it at the middle of the board and, finally, write his name.

6.6.2.2 Linguistic Outputs from Project 2

In this project, the student learned and practised some new formal words and phrases, including "locate", "identify", "situate", "proceed until…" and "position". In addition, he practised several words about directions, including left, right, forward and backward. These words and phrases helped to extend the formal English vocabulary of SME2 and other students. The ESOL curriculum suggests that the ability to construct simple sentences and use appropriate words at the Entry levels is an expectation. For instance, several learning activities for ESOL students at the Entry levels involve asking for directions and receiving and giving instructions, such as "turn left, then turn right". Through this project, the students learned basic English words and sentences, which were used in giving directions and instructions. Furthermore, this exercise was useful in enhancing the speaking and listening skills of the students and enriching their English vocabulary. For example, the students used vocabulary such as "walk", "stop", "forward" and "backwards", and sentences such as "point the marker at the middle of the board". The following is an excerpt from my dialogue with the students, while they were providing instructions to SME2 to guide him in writing his name in the middle of the board:

DFE2: Come inside the room and write your name on the board.

KME2: Enter the classroom, go right and write you name.

[SME2 attempt number one to accomplish the task]

Researcher: We need a detailed instruction. Think about the number of steps he needs to take, and the directions of the steps. For example, walk forward, for example, five steps, and then, turn right, then walk for some steps, and so on.

KME2: Walk four steps forward. Turn right, walk three steps and write your name.

[SME2 attempt number two to accomplish the task]

Researcher: What about the marker? You need to direct him to locate the board, the marker. Remember he is a robot following instructions.

[SME2 attempt number three to accomplish the task]

DFE2: Walk four steps forward…

KME2: … Turn right, walk three steps, locate the board…

DFE2: …locate the board, and write your name.

Researcher: Well, where exactly should he write his name on the board, what about if he starts writing at the end of the board…? [The researcher is demonstrating whereabouts on the board the student should point the marker and start writing his name]

Researcher: The robot must receive instructions to identify the middle of the board, point the marker there and then write his name …

6.6.2.3 Computational Outcomes of Project 2

There are several computational thinking concepts promoted through this project. One significant computational concept the students learned was that of breaking a task down into subtasks that help to understand the task in depth. The project in this case study demonstrated the concept of "sequence" through which the students learned about breaking down instructions and providing the correct sequence for SME2 to accomplish the requested task. The computational concepts of "events", "loops" and "conditionals" can also apply to this exercise (Brennan and Resnick, 2012). These computational thinking concepts are manifested in the segment of the project in which the students explored and provided instructions such as: "Start moving when you hear the word "start", and "Keep walking until you reach the table", and "If you touch a chair, then stop".

6.6.2.4 Non-Linguistic Outputs from Project 2

Apart from the language-related outputs of the engagement with this project, there were other positive outcomes relating to soft skills. Drawing on the researcher's observation and the tutor's comments, it was evident that the project helped to increase motivation and improve the focus and attention span of these learners. A specific effect in this context was that engagement with this project led to fewer incidences of students chatting unproductively among themselves. Before the introduction of the Scratch projects, the ESOL tutor had on several occasions separated KME2 and SME2 in the classroom because they frequently distracted each other. However, during the six months that they were engaged in the Scratch project, the tutor did not have to do this during Scratch sessions, as they were focused on the Scratch activities.

Perhaps another explanation for the improved level of concentration is that working on some of the Scratch projects involves interacting with other students; the interaction is triggered by the learning activity. Therefore, this is not a distraction from the learning activity and it reinforces the argument of Papert (1980) that a constructionist approach promotes the social dimension of learning through interaction with other learners.

It is worth mentioning that the two Greek students (SME2 and KME2) had the advantage of understanding the concept of "algorithm" more easily and quickly than the other students participating in this activity. When I told the students that algorithm was a Greek word, SME2 immediately confirmed this, but KME2 was not sure about the meaning. Perhaps he had not encountered or used the word in his mother tongue. SME2 then explained the meaning of the word to KME2 by pronouncing it in Greek.

6.6.3 Project 3: The Coffee-Making Robot

In this project, the students were asked to imagine that they had a robot at home, and that they wanted to provide detailed instructions for the robot to make them a cup of coffee. I facilitated a short discussion with the students about the instructions that they needed to provide for the robot to successfully make a cup of coffee. The following dialogue arose after I introduced the project and asked the students to suggest detailed instructions for the robot:

SME2: I will say, find the coffee, and put water, and bring it to me.

Researcher: We need a more detailed set of instructions; what about the hot water, the coffee itself, and the location of the coffee…the location of the cup?

SME2: I will say, go to the kitchen, put the coffee, the hot water and the milk in the cup, and make the coffee…

KME2: …take the coffee cup, put two spoons of coffee, water, milk

SME2: One spoon is all right.

Researcher: JFE2, what do you think?

JFE2: I think, just go to kitchen, and then put the coffee and water, then put milk.

After a short discussion about the project, I provided a handout with a suggested set of instructions for the robot. Using the handout, the students read and discussed a detailed set of instructions that the robot needed to follow in order to accomplish the task. The suggested instructions showed the breakdowns for finding the coffee, table, spoon and hot water and then preparing the coffee. Figure 6.16 below shows these instructions, which are based on a blog post by Rwxweb (2012) that provides simple examples around the concept of algorithm.

Figure 6.16: a handout that shows the concept of computational algorithms by providing a list of instructions for a robot to make a cup of coffee.

Instructions for the computer robot: how to make a coffee

1. Find coffee on the shelf.
2. See if the item is coffee, if it is coffee, then I am ok.
3. If it is not coffee, put it back and look at the next item.
4. Once you locate the coffee, find the table, if found: put coffee on table;

   - Else: keep looking for the table.
5. Get a cup from the kitchen (medium sized and white), if found bring it on the table;

   - Else: keep looking.
6. Get a jug of water from the fridge, if found put it on the table.
7. Fill the cup with hot (at least 55 C) water (it is full when the water is 1cm down from the top edge).
8. Find a spoon from the kitchen, if found, go back to the table;

   - Else: keep looking
9. Fill the spoon with coffee and pour in the cup.
10. Mix the coffee and water for 0.5 minute.
11. Add some milk and continue mixing.
12. Done.

As a result of the discussion, SME2 was able to identify and discuss with other students several breakdowns and instructions that they needed to provide for the robot. This breaking-down of the process of making a cup of coffee, which might be a routine daily task, incorporates several computational concepts related to, for example, sequence and systematic thinking about very well defined and clear steps for accomplishing a particular task.

6.6.3.1 Linguistic Outputs from Project 3

In this project, SME2 used and learned some new formal words in a meaningful and purposeful context, for instance, “instructions”, “locate” and “item”. My observation and the tutor’s notes show that it was necessary to engage SME2, and the other students, in a conversation that included formal words and phrases. The students frequently used informal words and only occasionally used formal words in their discussions and writing assignments.

During my interview with SME2, he reflected on his experience of taking part in the algorithm exercise. He thought that the project was interesting, as he had practised an activity that required simple, specific and purposeful steps yet has elements of “fun”. He stated that this was a helpful way of thinking about activities, narratives and stories because the project demonstrated a concept that he could employ in his writing and speaking exercises. To illustrate this, SME2 provided an example of an ESOL writing assignment about planning and organising a trip, after which he was supposed to discuss the planning of the trip with other students in his class:

SME2: If I think to write or talk about going to [a] museum or the zoo maybe, you know, I may just think that animals is nice, is cool. But if I want to give details about the trip, I can have a lot of complete sentences … I can have a good discussion, yeah.

Researcher: Can you please give us an example of the detail of the trip and the complete sentences?

SME2: For example, the bus from school to the “airport”, then the “aeroplane”, then the food that we bring from home to save money.

The student’s engagement in this activity provides evidence that he has learned some new words, mostly formal ones. In addition, his engagement in the project rehearsed his way of thinking about breaking tasks down into subtasks, which can be reflected in writing or speaking activities, as illustrated in the above example.

6.6.3.2 Non-Linguistic Outputs from Project 3

SME2’s engagement of in this activity stimulated interaction and discussion in the class. SME2, and other students, actively participated in the discussion, made suggestions and comments and asked questions about the discussed topic. In addition, the activity produced different affective and social gains for the student. For example, teamwork, openness to new ideas and willingness to learn using new techniques are all illustrations of attitudes developed as a result of the student’s engagement in the project.

6.6.3.3 Computational Outcomes of Project 3

The project provided SME2, and other students, with an understanding of computer algorithms and computational thinking. For example, the student practised the computational concepts of “sequence” and “events” (Brennan and Resnick, 2012). He also learned about conditionals and conditional statements, for example: “Get a cup from the kitchen, if found put it on the table; Else: keep looking”.

This activity was not focused on technical terms; rather, it used the normal everyday routine of making a cup of coffee or tea. The main aim was not to discuss and develop a pseudo-code for the robot or to gain a technical sense of the computer algorithm, but to exhibit a concept of thinking purposefully, systematically and clearly in short steps. Brennan and Resnick (2012) provide insight into this description. They note that “abstraction and modularizing” are computational thinking practices, and they define these practices “as building something large by putting together collections of smaller parts” (p9).

6.6.4 Discussion of SME2’s Case Study

SME2’s projects and activities are illustrations of computational and constructionist interventions that are relevant for students at ESOL Level 2/3. These projects provide empirical examples of a synergy between constructionist learning theory (Papert, 1980) and new literacy studies (Cazden et al., 1996). This synergy is manifested in SME2’s design-based activities as well as in his engagement in the computational learning activities. This illustrates how constructionism embraces learning activities as a reflective dynamic process (Resnick, 2007), and that there is no meaning-making outside of practices (Knobel and Lankshear, 2007).

The Scratch project and computational activities in this case study are in line with the multimodal view of teaching and learning (Jewitt, 2013; Kress, 2000; 2005) that promotes learning and meaning-making through modes of communication other than spoken and written language. For example, these computational projects illustrate a convergence with Britsch’s (2009) conceptualisation of ESOL language learning, which includes multimodal elements such as visual thinking and visual literacy. As such, SME2’s engagement in this study illustrates a “communicative zone”, which provided him with a sense of freedom to exercise visual thinking and expression, skills not typically practised in formal didactic learning (Britsch, 2009, p716).

Drawing on learner experience research (Sharpe et al., 2010; Sharpe and Beetham, 2010), the dialogue excerpts in this case study illustrate the multimodal and performative practices through which SME2 and the participant students expressed their ideas and thoughts. In this regard, the students were excited about incorporating non-traditional modes of expression, such as in the animated Scratch projects or in acted out activities in the classroom. Equally important factors within this exploratory approach are granting SME2 and other students control and providing them with different techniques for self-expression using computational practices.

Furthermore, the descriptive dialogue provided in this case study reveals practices as experienced by SME2, including his perception of the computational activities, whether programmed or acted out. As such, SME2's multimodal computational learning practices can be described as authentic practices, similar to Gilmore's (2007) and Abraham's (2008) descriptions of the importance of using authentic text and resources in teaching and learning.

In this context, SME2 experienced playful computational learning (Resnick, 2007) activities that can be seen as advantageous to learning in a digital world. Yet, these activities were sometimes seen by the ESOL tutor as worrying, because of his lack of control in such learning settings. Nevertheless, this supported SME2 in developing positive learning attitudes, such as a willingness to experiment with, receive and discuss ideas, as well as to respond to comments and questions in the classroom and to continue his ESOL work at home.

6.6.4.1 Computational Perspectives on Technology-Enhanced Learning

The description of SME2's experience in developing the Scratch project on common Greek and Latin roots of English words, as well as the discourse that took place around the development of this project, suggest one possible way to enhance students' English language skills using computational environments. SME2's Project 1, including the dialogue excerpts provided, illustrates an empirical perspective on the constructivist conviction that advocates that technology enhanced learning transcends the mere technical skills of retrieving and accessing information (Macdonald, 2008; Siemens, 2005). Also, this demonstrates how having a technology-rich environment rather than using only "specialised tools" in the classroom can foster students' production, investigation and collaboration (Sharpe and Beetham, 2010, p91).

Furthermore, the Algorithm and the Coffee-Making Robot projects exemplify playful computational learning practices, of the kind that maintain the fun and joy elements in an ESOL class. The sense of learning in a different, playful way using a technology-rich environment was seen as advantageous to learning in the case of SME2. Therefore, although these computational projects can limit the tutor's control over the students inside the classroom, they were beneficial to SME2 and helped him in developing his learning strategies and his ESOL skills.

6.6.4.2 Gains in this Case Study

As a result of the student's engagement with the computational projects, there were several gains. These can be categorised into linguistic, computational and attitudinal gains. These gains and their classification can be seen from the perspective of Bloom's Taxonomy of the cognitive, psycho-motor and affective learning domains:

First, Linguistic gains: SME2 learned some new formal words as a result of participating in the computational projects and exercises. He rehearsed some conditional statements and developed new techniques to increase his English vocabulary using common English word roots, prefixes and suffixes. The student also adapted to the logic and the systematic thinking applied in the algorithm exercise, through which he practised breaking down the writing and speaking tasks into clearer and more specific subtasks.

These linguistic gains can be seen from the perspective of the revised Bloom's Taxonomy of the cognitive learning domain. For instance, SME2 was able to remember and understand some new formal words that had come out of the algorithm projects. He was able to apply new techniques in extending his English vocabulary as well as in developing his spelling and writing skills. As such, he applied these techniques, using the concept of the algorithm, to wider writing and speaking activities in the ESOL learning discourses.

Second, Computational gains: Drawing on Brennan and Resnick (2012), the computational gains in this case study fall into three categories:

- Gains in computational concepts: an example of a computational concept acquired in this case study is "sequence", as discussed in the algorithm exercises when the students provided the sequence of instructions for SME2, to guide him to write his name in the middle of the board. A second example is "events", as illustrated in what the student should do in the case of certain events, such as "if touched a table, stop walking".

- Gains in computational practices: examples of computational practices include: being incremental and iterative, testing and debugging, abstraction and modularising. These practices are illustrated in the algorithm and the coffee-making robot exercises, in which the student was able to think incrementally and iteratively, while providing detailed breakdowns of instruction in each iteration.

- Gains in computational perspectives: an example of computational perspectives is using computational thinking for "self-expression" and for expressing ideas within a medium (Brennan and Resnick, 2012, p10), as demonstrated in the projects in this case study. A second illustration of the computational perspectives gained is portrayed in the wider social interactions and discussions that were sparked between the ESOL students and the researcher upon the introduction of the conceptual algorithm exercises. Brennan and Resnick (2012) label this computational perspective as "connecting", because computational activities are "enriched by interactions with others" (p10).

These computational gains can be seen from the perspectives of the psycho-motor domain of Bloom's Taxonomy of learning domains. For example, after practising the algorithm exercises, SME2 was able to imitate the concept of the algorithm by following a precise set of instructions that concluded in his writing his name in the middle of the board. The coffee-making robot project offers another illustration of the manipulation of a pre-defined detailed set of instructions. The student was able to discuss, suggest and imitate conceptual breakdowns aimed at enabling the robot to accomplish the task of making a cup of coffee. This resulted in the student developing greater computing precision, as he learned to break tasks and ideas down into more specific and measurable subtasks.

Third, Gains in attitudes: SME2's engagement in this study has enabled him to gain new abilities that contributed to the development of attitudes that include a willingness to experiment with new ideas and increased classroom interaction. He was willing to receive and discuss ideas and respond to comments and questions. These examples of attitudes can be viewed from the perspective of the affective learning domain of Bloom's Taxonomy of learning domains (Krathwohl, 2002). The student's engagement, and willingness to learn, receive and respond are illustrations of the affective learning domain.

6.6.4.3 Evidence from the Tutor for Improvement in this Case Study

The algorithm projects improved the computational competency of SME2 and other students and contributed to enhancing their interaction with Scratch as well as with other computing and computational environments. SME2 engaged in this learning activity meaningfully and derived a significant level of fun from it. Consequently, the attained English skills and the developed computational practices demonstrate that the activities were beneficial for the students.

With the aim of verifying the student's gains, I had a discussion with the ESOL tutor, and he confirmed that SME2's engagement with these projects had helped to increase his English vocabulary, especially that of formal words. He noted that before the student began to participate in this study, he did not usually use formal language in his conversation and writing, similar to other Entry Level 2/3 students in his class. In my interview with him at the end of the research/project, I asked the tutor to reflect on the algorithm projects and activities. He emphasised the importance of the conceptual and analytical components behind the Scratch tool, and said:

> "introducing the concept of algorithms to the students, you know, it's a big word 'algorithm', and it sounds very mathematical, and to break the term, let's just follow the instructions; something like the game, such as the robot game, with forward, stop, turn to the right, pick up the pen, you know. It is very rich in language, and of course, we'll use English language in the class, so that was helpful to them anyway. But also about thinking skills and logic, and, you know, there are so many different sides to it, have benefited them; and vocabulary as well, of course. And the skills: practising, speaking, reading, writing. I think it has been really useful" (The ESOL tutor, 2015).

The tutor emphasised the concept of using Scratch in a way that goes beyond the technical goals of the tool itself. He acknowledged that Scratch was helpful, noting that "there are so many different sides to Scratch and how we approach Scratch…not even just Scratch itself, but what's behind Scratch, you know, the whole way of thinking".

6.6.4.4 Difficulties Faced in this Case Study

Time was a constraint for SME2. He reported on occasion that most days he had several classes, and this limited his engagement with the Scratch projects. In addition, similarly to KME2, SME2 was applying for another main course of study. This placed more stress on him and, therefore, he was not able to devote himself to Scratch activities during the second half of the summer term. This illustrates the effect that personal circumstances had on learners' engagement in this study.

6.6.5 SUMMARY OF THE CASE STUDY

This case study has shown how language learning can be aided by the development of computational practices through Scratch and computational projects. The algorithm projects helped SME2 to develop some new English vocabulary that was suitable for ESOL Entry level learners, while also helping him to develop his computational thinking skills. The algorithm activities particularly enriched SME2's learning and use of formal words and sentences. This case study demonstrates how the student employed such words purposefully and meaningfully in a context. Finally, the discussed projects show how computational thinking practices and algorithms can be applied to other learning domains, such as ESOL language development.

CHAPTER 7: DISCUSSION AND REFLECTION

This chapter discusses perspectives on the effectiveness of Scratch in terms of ESOL learners' increased performance and enhanced ESOL skills, in line with the ESOL Core Curriculum (Steeds, 2001). It also extends the discussion to a consideration of convergence with Bloom's taxonomy of learning domains. Finally, the chapter discusses the computational themes that emerged from the case studies, providing additional insights into computational practices and computational thinking.

7.1 PERFORMANCE OF CORE AND NON-CORE PARTICIPANT STUDENTS

In this section, I provide and discuss further evidence of progression and improvement among the core participant students in terms of their performance and their level of engagement in classroom discourses, based on my observation of two ESOL sessions for non-core participant students.

Progression and improvement are demonstrated by the new words the students learned and their level of engagement in constructing Scratch projects, as well as by the discourse that arose around the projects. In the dialogues provided in the case studies there is sufficient evidence of an increased number of questions and follow-up questions being asked by the students during their engagement in the Scratch projects and the associated discourse.

It was beneficial to carry out observation sessions of non-core participant students in order to investigate further the claim that the core participant students' involvement in the Scratch activities facilitates their progress in learning, particularly in terms of their level of engagement in discussion, and their asking of questions and follow-up questions. In other words, I wanted to find out whether this was mainly because the students had more time to study or whether their engagement with the Scratch projects was contributing to their progress. I decided, therefore, after an initial discussion with the tutor, to observe two sessions of non-core participant ESOL classes at around the same time. The aim was to investigate whether non-core participant students made similar progress. The following description and discussion of the first observed session give an indication that being involved in the study helped core-participant students to make progress in their learning. Therefore, this provides further evidence that Scratch facilitates progress, particularly in term of students' level of engagement in discussion, and in asking questions and follow-up questions.

In the first observed session, 21 questions were asked: the tutor asked ten questions and the students 11, with only two students asking a total of three follow-up questions. In the second observed session, there were 27 questions: the tutor asked 17 questions and the students ten. Only one follow-up question was recorded.

None of the students in these observed sessions was able to ask more than two consecutive follow-up questions or engage in a conversation with the tutor at a similar level of engagement to that, which I had had with the core participant students. The latter had been involved in in-depth conversations, which had required, at times, more than seven consecutive follow-up questions in a single conversation, as can be seen in the dialogues in the case studies. I present a detailed description of the first observed session in Appendix 13.

Further evidence emerged from the discussions between the students and the tutor. I followed this up with him, and pointed out the difference between the progress of the students in the case studies and that of the students in the observed classes. The tutor acknowledged this and indicated that the non-core participants were not engaging in classroom discussions, asking questions or follow-up questions, or extending their work beyond the normal teaching hours, as was the case with the core participant students:

> "Speaking and listening skills were enhanced by, you know, discussing what we are trying to achieve, what is possible, or even just commenting what we think about projects. And of course, there was the audio recording within Scratch, which is good for the speaking and listening skills as well." (The ESOL tutor, 2015)

These findings give an indication that being involved in the Scratch study helped students to make progress in their learning. I am confident, therefore, that there is evidence that Scratch facilitates progress, particularly in term of students' level of engagement in discussion, and in asking questions and follow-up questions.

The increased level of engagement of the students in the Scratch team warranted further investigation. The question was: what makes these students engage in deeper conversations and ask more questions and follow-up questions than the non-core participant students? In order to provide an explanation for this contrast, it is helpful to consider the socio-linguistic view (Cazden, 1988) of classroom interaction and draw a distinction between the discourse of the observed students in the normal ESOL sessions and the discourse that arose during the construction of the Scratch projects. Cazden (1988) provides insights into classroom discourses as a particular language for teaching and learning. She notes that: "sociolinguist Marilyn Merritt calls the moments when students try to get the teacher's attention 'service-like events,' to suggest similarities with what happens when customers act to get a clerk's attention in banks or stores" (p63).

In this regard, one explanation of the increased number of questions and follow-up questions and the engagement of the students while constructing Scratch projects is that it is a result of an alteration in the classroom discourses, which are usually characterised as "service-like events" (Cazden, 1988, p63). This alteration in the participants' classroom discourse can be viewed as what I label "team-like events", in contrast to Cazden's "service-like-events".

It appears that the students in the Scratch team did not perceive asking questions about their Scratch projects as "service-like events". Rather, the team element perhaps shaped team-like events, through which the students were encouraged naturally and spontaneously to ask questions and follow-up questions that reflected the level of their engagement in the Scratch projects.

From a different perspective, Hellermann (2008) investigated the social actions involved in classroom language learning. He indicates that face-to-face dyadic interaction is an essential action in language learning classrooms. He notes that opening up a conversation is challenging for novice language learners:

> "Such openings are also a fundamental practice for human interaction in general. Getting a face-to-face interaction started is a practice familiar in some way to all socialized adults. But because of their novice status with the language code and language culture, language learners may find it a challenging area to manage" (p41).

Drawing on Hellermann (2008), it seems that the team-like events offered through the Scratch activities and the Scratch classroom discourses provided a low barrier to face-to-face interactions and the engagement of the students, as evidenced in the dialogues that were stimulated around the construction of the Scratch projects. I found that these two perspectives, from Cazden (1988) and Hellermann (2008), provided insights into and suggested explanations for the differences in the level of engagement of, and the number of questions asked by, the core and non-core participant students.

Furthermore, the increased classroom interaction is in line with the student-centred approach fostered by a notion of the tutor as a collaborator and facilitator, which contrasts with the teacher-centred didactic approach to learning, in which teachers are perceived as “fact-givers” (Edwards, 2012, p83). Also, the increased student interaction, which was achieved as a result of using computational Scratch projects in context, constitutes one way in which students could critically engage with digital technology.

As discussed in the literature review, Section 3.1, entitled “Perspectives on Learning Theories”, this is illustrative of a position that challenges the technological determinist view of literacy teaching and learning, wherein learners use technology frequently while lacking the necessary critical engagement with it. In effect, their digital knowledge and experience of using digital tools are usually overestimated (Hague and Williamson, 2009).

Further examination was required in order to capture any significant differences between core and non-core participant students regarding the impact of using computational programmes and animation software on the development of their English skills. As such, a questionnaire was administered to draw a contrast between the perception of the core and non-core students on their improvement in English skills as a result of using computing and computational tools in their learning activities. A total of 27 ESOL students from the research site (65.85%, N=41) responded to this questionnaire (Appendix 14).

Although the findings from this questionnaire suggest that all students indicated improvements in their English language skills, the core participant students indicated that their progress can be firmly linked to their use of the Scratch and computational tools. The participant students provided more concrete examples for employing the computational tools in their personal learning and studying than the non-core participant students. For example, some core participant students noted that they have used Scratch games as well as the Latin and Greek roots projects. In contrast, the non-core participant noted using computer programmes such as Microsoft Word and PowerPoint.

We can conclude, therefore, that using computational tools, such as Scratch, facilitates progress and increases performance among the core participant students. The increased performance is evident in the observed ESOL sessions, as well as in the perception of the core and non-core participant students on their improvement in English skills as a result of using computing and computational tools in their learning activities.

7.2 THE SCRATCH PROJECTS SERVE THE ADULT ESOL CORE CURRICULUM

The projects discussed in the case studies were in line with the Adult ESOL Core Curriculum (Steeds, 2001). Each case study demonstrates how the Scratch projects and activities fed into this curriculum. There is evidence of improvements in the students' skills as a result of their participation in this study. The earlier section on the performance of the core and non-core participant students discusses evidence of improvements in speaking, listening, responding and discussing. In all the case studies, there is evidence of learning new words and improved spelling and writing skills.

In addition, the Scratch projects and activities were in line with various learning strategies in the Adult ESOL Core Curriculum:

1- Projects in Case Study 1 (GFL1) illustrate the utilisation of phonic and visual learning strategies.

2- Projects in Case Study 2 (SFL1) fed into the visual, phonic and contextual learning strategies, as the students learned to recognise the sound-symbol relationship.

3- Projects in Case Study 3 (JFE2) demonstrate cross-language activities in which learners are encouraged to translate sentences into their language of literacy and compare these with the English.

4- Projects and activities in Case Studies 4 and 5 (KME2 and SME2) show learning techniques that use common word roots, prefixes and suffixes as discussed, for example, in Project 2, entitled "Greek & Latin Roots 1", in Sections 6.6.1 and 6.5.2 of Chapter 6.

Therefore, I conclude that the Scratch projects and activities in this study fed into the development of the Adult ESOL Core Curriculum (Steeds, 2001). The case studies demonstrate the potential to enhance curriculum activities through the utilisation of computational frameworks and graphic knowledge to decode words in interactive and meaningful ways.

Furthermore, the ESOL curriculum sets out several features that should be considered when teaching ESOL learners. These features are prevalent in the case studies, and include:

(a) The context of the learning: The case of SFL1 shows how the context and the culture of an ESOL learner is an important element in their educational endeavour and personal development. The outcomes of this case were not only about developing computing capacities but also about personal development, expression and progression, through the computational practices of the Scratch team.

(b) Mixed and diverse groups of learners: The students in the targeted research population ESOL cases have diverse cultural and educational backgrounds and belong to eight different countries in Eastern Europe, Africa, the Middle East and Latin America. The ESOL tutor reported, in an interview, that the ESOL classes were "extremely diverse; the only thing that they have in common is the 'age'. So, they are all between 16 and 19 years old; apart from that, completely different backgrounds". The participant students constituted a subset of this diversity and, therefore, it was necessary to pay attention to what were the appropriate learning techniques and opportunities for each student. The case studies consider a number of aspects of, and similarities and differences between, the techniques introduced and the learning practices developed in this study.

(c) The cross-cultural and cross-language approaches: The ESOL students were literate in their native languages. Consequently, as discussed in the case studies, it was useful to engage students in activities through which they would practise their transferable skills. In this context, the Scratch programming environment provided a new medium for the students to express themselves and to expedite transferable skills.

(d) Independent learners: Several activities and examples illustrate how emerging computational environments, exemplified by Scratch in this study, aim to personalise the learning environment for ESOL learners. Each of the Scratch projects discussed in the case studies can be seen as feeding into the aim of supporting independent and personalised learning activities.

However, the effectiveness of Scratch activities varies across the different ESOL levels, as well as across ESOL skill areas. The case study findings show that the Scratch computational activities did not all have similar effects on the EOSL students or on the skills acquired through these activities. The following two subsections discuss this variation.

7.2.1 Variations in the Effectiveness of Scratch on Different ESOL Levels

Participant observation revealed that students had different experiences of the Scratch projects. These varied from simple animation projects consisting of a sprite with a single block of script to complex projects that have several sprites and blocks of script. Students at distinct ESOL levels focused on different sets of Scratch themes. The pattern of similarities and differences amongst the ESOL learners involved in this project and their perception of Scratch activities can be described as follows:

First, Scratch activities that included writing and recording simple sentences and words were found to be more appealing to students at ESOL Entry levels than to students at ESOL Level 1. An explanation of this may be that learners at ESOL Level 1 usually construct richer language than those at the Entry levels. As such, it can be concluded that the shorter and briefer the conversations and writing activities, the more likely the ESOL learning activity will be assimilated into a Scratch project.

Second, Scratch projects built around English word roots were appealing to ESOL students at both Entry levels and Level 1. Drawing from this observation, it is logical to suggest that Scratch activities that increase English vocabulary, such as those built on Greek and Latin roots, could be the most useful in engaging the greatest number of participant students. This is probably even more so for lower level learners, as their focus is on the use of simple sentences and words. The ESOL Core Curriculum (Steeds, 2001) notes that, at ESOL Entry levels, "written texts …consists of a few simple sentences or a short paragraph, simple signs and forms with [a] clear layout using familiar vocabulary" (p101).

Third, remixing Scratch projects is considered easy and engaging for all students. Remixed projects have the potential to enrich most ESOL learning activities and enhance the English skills of ESOL students. The increasing millions of Scratch projects shared in the Scratch online forum make it possible to get interesting results from almost any search on the Scratch website.

Students at Entry levels were usually engaged in constructing Scratch projects that were less language intensive compared with those of students at ESOL Level 1. Furthermore, more Level 1 Scratch projects focused on recording audio of words and conversations than on heavy text and reading. The ESOL tutor provided an insight into this, noting that if a student project "involved audio conversations, the speaking [skill] would benefit, so the speaking result should be better"; similarly: "have more reading and writing, and then we'll have a result in reading and writing" (The ESOL tutor, 2015). However, there may not be quite such a distinction between the development of the various language skills of reading, speaking and writing. For example, it can be argued that a project that has the potential to increase a student's vocabulary can also help to improve their reading, writing, speaking and listening skills. This echoes the argument about the inter-relatedness of language skills in ESOL learners (Purpura, 1999).

The difference between Entry levels and Level 1 is not driven solely by the level of English language proficiency. Usually, students in higher-level ESOL classes are studying for higher qualifications and are more focused on passing ESOL at a higher level, in order to make progress in their career or education. This is less so for students studying at an Entry level. In my interview with the ESOL tutor, he noted that "the higher the students, the more focused or more kind of driven to be a bit single-minded…Whereas the lower-level students might tend to be a little bit open-minded".

7.2.2 Variations in the Effectiveness of Scratch in the ESOL Skill Areas

According to the Adult ESOL Core Curriculum (Steeds, 2001), of the four ESOL learning skills, speaking is focused on speaking to communicate and engage in discussion, while listening is focused on listening and responding. These two skill areas of speaking and listening involve no breakdowns of text, sentence and word levels similar to with reading and writing skills. These ESOL skills are discussed in Chapter 5, Section 5.3.1, entitled "Description of ESOL programmes and Curriculum".

The Scratch projects discussed here contributed to improvements in most of the ESOL skill areas. However, a review of the case studies shows variations in effectiveness, with more outcomes at the word and sentence levels than at the text level in the writing and reading skill areas, and speaking skills showing more outcomes than the listening skill area.

It is possible, therefore, that the Scratch computational environment is less helpful for reading comprehension and text focus skills, especially when compared with the other skill areas. On the basis of these findings, it seems that the text level skill areas were slightly rehearsed when compared with outcomes at the word and sentence levels. An implication of this result is that Scratch computational practices may improve ESOL reading and writing skills more at the word and sentence levels than at the text level, and speaking skills more than listening skills.

7.3 CONVERGENCE WITH BLOOM'S TAXONOMY OF LEARNING DOMAINS

The gains noted in the case studies are categorised into linguistic gains, computational gains and attitudinal gains. These gains were also analysed from the perspective of Bloom's Taxonomy of learning domains (Anderson et al., 2001) and Bloom's digital taxonomy (Churches, 2011). As presented and discussed in the case studies, the linguistic gains are in line with the knowledge structure of the cognitive learning domain, whereas the computational gains include the skills developed, which are in line with the psycho-motor learning domain (Dave, 1975), and the attitudinal gains are the behavioural and social gains, which are in line with the affective learning domain (Krathwohl, 2002). However, it is useful to contrast and discuss Bloom's cognitive domain and his digital taxonomy of this domain, as developed by Churches (2011), in order to draw out some common themes, advantages and disadvantages.

From the perspective of the cognitive learning domain, the gains include: (a) knowledge, as in learning new words and the spelling of new words; (b) the meaningful and purposeful remembering, comprehension and understanding of English words, sentences, pronunciation and phonics; and (c) analysis of common English word roots, prefixes and suffixes. The cognitive learning domain incorporates processes that involve "self-knowledge" and "knowledge of cognitive tasks" (Krathwohl, 2002). These processes are evident from the discourses around the construction of the Scratch projects. Illustrations of these processes include: first, improvement in listening, speaking and discussion skills, as seen in the dialogues; second, increased feedback during discussions; third, deeper engagement in discussions, as well as the effective formulation and use of questions and follow-up questions; and fourth, developed understandings of new concepts, such as the learning and decoding of new English words, based on their common roots, prefixes and suffixes.

In contrast, from the perspective of Bloom's digital taxonomy (Churches, 2011), the gains can be synthesised as: (a) remembering, including recognising, describing, retrieving and locating digital media and Scratch projects; (b) understanding, including interpreting and comparing the visual Scratch programmable blocks; (c) applying, including remixing, using and executing programmable blocks, and uploading and sharing Scratch projects; (d) analysing, including the deconstruction and breaking down of Scratch visual programmable blocks and the remixing of Scratch projects; (e) evaluating, including commenting on, remixing, testing and debugging programmable blocks; and (f) creating, including collaborating, remixing and the design and publishing Scratch projects.

It appears, therefore that the outcomes of the case studies confirm Bloom's taxonomy of learning domains. They show, in effect, that the case study students are learning cognitively, behaviourally and socially. But, whereas Bloom have argued that this learning is limited to three domains (Anderson et al., 2001; Krathwohl, 2002; Dave, 1975), the findings from the case studies show a mixture of these domains, which is different from what was originally described in the taxonomy. For example, the construction of computational Scratch projects and artefacts in the GFL1 and SFL1 case studies shows that the students can develop skills simultaneously and not necessarily separately. Also, the findings reveal that learning in the psycho-motor domain does not necessarily need to be manifested in the physical world. Rather, the physical and the virtual can be interrelated and manifested within the same computational objects.

Churches' (2011) development of Bloom's taxonomy can be described as a beneficial process of digitisation of Bloom's work, as illustrated earlier in this section. I argue, however, that the computational elements manifested in the case studies extend this digitisation process into a new domain, which I label a *computational domain*. This suggests a fourth dimension that does not necessarily fit within Churches' (2011) development of the digital taxonomy. Put another way, this computational domain is different from the digitised notions of Bloom's taxonomy of learning domains and I argue that it can be seen as a fourth dimension of the taxonomy. This concept is explained further in the following section.

7.4 Computational Perspectives

Computational practices and computational thinking are key concepts in addressing the research question in this study that seeks to evaluate the impact of constructionist computational interventions on the achievement of higher levels of literacies among young adult ESOL learners. Therefore, I provide additional perspectives on these computational practices that serve to complement ESOL literacy teaching and learning. I discuss these computational practices under the following three themes, which emerged from the utilisation of Scratch in the case studies.

7.4.1 Theme 1: Computational Medium for Animation and Expression

The simple greetings projects and the advanced remixed projects discussed in the case studies allowed the students to animate and to express themselves, and, therefore, to learn, employ and analyse words and sentences in a meaningful and purposeful context. As such, using a computational medium does not solely entail incorporating technical terms that describe programming and computing projects. This conceptualisation of a computational medium for animation and expression is manifested in the three illustrations below.

First, GFL1 frequently referred to the construction of Scratch projects as "animation", not as programming or coding. Similarly, SFL1 did not see the Scratch projects, primarily, as technical or computational activities. When I asked her in an interview about her understanding of computational and computing skills, she did not acknowledge these skills as gains, and said, "I am not really a fan of computing". However, in a follow-up question about her expectations about Scratch before and after her participation in the study, she acknowledged that she liked exploring and constructing different kinds of Scratch project, and said, "I was not expecting that this will help me a lot. I just thought that is just a normal thing".

The second illustration of Scratch being perceived as a tool for expression and animation rather than as a computing or technical tool is from JFE2's case study. JFE2 frequently referred to Scratch as a tool for animation and not as a technical tool for computing, despite the fact that computing and programming concepts can be embedded within the computational practices. This was a recurring theme in the case studies. Therefore, the students' perception of Scratch as a tool for expression and animation incorporated the previously discussed linguistic gains that were achieved through various types of Scratch project, as well as through the discourses that were stimulated by the construction of the projects.

The third illustration is drawn from the case of the two Greek students, in which Scratch appeared to serve as a medium through which to discuss topics such as English word roots. The two students perceived and explored the word roots, particularly the Greek ones, in more depth and with more enthusiasm than the other students in the ESOL class. This gave them an advantage in exploring further English word-root projects through the Scratch environment and sharing the meanings of roots and words with each other as well as with other students. Consequently, the Scratch environment served the students, particularly the two Greek students, as a medium through which to discuss words and their meaning.

These three illustrations provide explicit evidence that Scratch was mainly perceived of as a tool for animation and expression within the ESOL classes and that the computing skills and concepts, embedded within the Scratch projects, were not the ultimate outcome. In this context, the computational skills gained in the case studies were not perceived as technical or computing gains, but rather as skills for self-expression and for animating words and sentences.

From a different perspective, the visual elements in the Scratch programming environment provided the students with an easy interface that accelerated the process of interaction with the tool, and, consequently, the process of using and remixing Scratch projects. For instance, the colours that distinguish the programming blocks from one another helped the students to choose the right scripts. If a student wanted to move a sprite s/he navigated the different blocks in the "Motion" blue section, and if s/he wished to add a sound file or record her/his voice, s/he navigated the "Sound" purple section, and so on.

A further positive outcome of engaging the students in computational practices was the development of digital and computational literacies that facilitated and promoted a role for students as active producers, rather than passive consumers, of digital technologies. This is particularly important because most of the ESOL students had hitherto been passive users of technology and the internet. In this context, the ESOL tutor noted:

> "For most of them [the students], their only experience using computers at the centre is writing Word documents. Some of them never email; of course, they use the internet; mostly they use the internet passively to find information, but apart from that, they are just writing Word documents for their assignments, which is a shame. They are not really developing ICT skills; they are not using what is available in an interesting way. So, I think one of the benefits of Scratch is that it shows new ways they can engage with and use different tools with new technology." (2015).

An illustration of this can be drawn from the projects used or developed in all of the case studies, which engaged the students in meaningful and purposeful activities using computers. Based on SME2's case study, there are two ways in which SME2 was actively engaged in experimenting with both the computational and the creative use of technology: firstly, conceptually, as illustrated in the computational thinking skills and the algorithm concept and, secondly, practically or empirically, as illustrated in his use of the Scratch computational tool. The integration of these skills demonstrates that this research has contributed to helping SME2, and other students, to become active producers of new emerging media and technology.

This view of a computational medium for animation and expression can be seen as problematic, especially from the perspective of standardised learning activities, educational outcomes and assessment. However, as discussed in the literature review, I have identified that most of the other work that has been done is this area has been deterministic in presenting this as a skill for all. Therefore, this study has shown that this computational medium and these practices are used in a complementary way. This, in effect, offers a possible answer to the dilemma underpinned by the two contradictory views of literacy, as a social practice and as a standardised set of cognitive skills. As such, it is possible that the findings of this study can be generalised to a larger segment of the population in a complementary fashion, as demonstrated in the study itself.

7.4.2 Theme 2: Repetition and Review

Repetition is a key learning strategy stressed throughout the Adult ESOL Core Curriculum (Steeds, 2001). Scratch computational activities provide a supportive and encouraging environment for repetition, review and progression in ESOL learning activities. ESOL learners are encouraged to practise repetition in their learning of English language skills (listening, speaking and writing). For example, repetition is a useful practice in developing an awareness of stressed vowels, phonics and the spelling of English words. Steeds (2001) notes that "[w]hen listening, learners can expect considerable support in terms of repetition, re-phrasing and prompts" (p39). The Scratch computational environment has the potential to drive repetition and rephrasing to a new level and to make the learning activities more efficient and less time-consuming. Illustrations of this are SFL1 using the word spelling project and KME2 using the English word-root projects. Both learners were able to extend their vocabulary and enhance their reading and writing skills by working both in the college and at home.

Although it can be argued that recording is feasible through a variety of platforms that are not necessarily "computationalised", other recordings for a word, a sentence or a paragraph will not provide functionality similar to that available through computational platforms. Indeed, while not all visual media is computational, all computational media is visual. For example, although a recording of a word or a sentence using traditional visual tools (such as MP3, video or YouTube) could be helpful for repetition, these types of media are not computational because a recorded sentence or word cannot be programmed and manipulated computationally by the average non-computer-programmer person.

As discussed in the case studies, the ESOL learners built on the Scratch projects they, or their peers, had created previously and used English and language media in these projects to develop new Scratch projects. The media that was remixed or used was sometimes recorded in the ESOL class and on other occasions it was remixed through the online Scratch forum. An illustration of this is the Scratch project developed by GFL1, who used her initial Scratch project, which recorded sentences in an exercise that simulates an interview situation, to construct another project through which she recorded more sentences in Spanish and Bambara.

In this context, it is useful to distinguish between the available functions and procedures in computational environments and other computer software such as computer-aided language learning (CALL). Although the repetition and review procedures and techniques could be accomplished through CALL software, computational programming and authoring environments, such as Scratch, facilitate active participatory roles through a broader design and production functions. These authoring computational functions and procedures enable learners to construct personalised and meaningful projects that are relevant to their social context, using the online and offline Scratch editors.

Moreover, there is a plethora of CALL software that provides learners with the opportunity to use a number of different language-learning techniques, such as vocabulary drills and gap-fill and word-order exercises. CALL software may also offer a parsing mechanism and grammar-checking (Panayiotis, 2005; Dagneaux et al., 1998) services for users. Indeed, there are currently standard word processor programmes that provide decent grammar and spell-check functions. Nevertheless, although such programmes are helpful in accomplishing certain editorial tasks, they do not allow learners to design, create and personalise their own projects, and, consequently, their learning environment.

In addition, although CALL programmes may provide multimedia lessons to learners, and perhaps opportunities for repetition and review, I think that the key issue is that these multimedia programmes are not, interactive or dynamic in the same way as the projects developed through computational and programmable environments, such as that in Scratch, are. In other words, what distinguishes Scratch projects from other types of CALL programme is that they are programmable and "computationable". They can be personalised, remixed and changed in a way that is meaningful to the learners.

7.4.3 Theme 3: A Computational Perspective on Abstraction, Remixing and Creativity

Based on the concept of abstraction, layers of abstraction and encapsulation discussed in Chapter 3, Section 3.12.1, entitled "Computational Thinking", it is not surprising that students remixed projects and blocks that they might not have fully understood. A recent statistic shows that as of "September 2015, about 49.21% of all recently shared projects are remixes" under a Creative Commons License (Scratch, 2015). In this context, several media theorists consider remixing a fundamental skill in schools (Jenkins et al., 2006; Kafai and Burke, 2014).

There is no doubt that it is beneficial for students to understand the code and the script of the Scratch programme. However, the concept of abstraction shows that it is not a condition for learners to understand all blocks of the script to be able to remix a project, as illustrated in most of the Scratch projects in the case studies. Nonetheless, as noted by Peppler and Kafai (2007), "youth require some basic understanding of how to construct and design new media in order to become critical participants in today's media culture" (p150). The students in these illustrations deploy a results-oriented strategy (Schmoker, 2001), which is helpful in harvesting the potential of computational frameworks using the Scratch visual programming environment. This eventually leads the students to personalise their learning environment, and, therefore, makes their learning activities more meaningful.

In my discussion with the ESOL tutor, he recognised that personalisation is a tool for moving students into independence. He commented that Scratch "helps them with their independence and gives them some possibilities to explore things for themselves, you know, according to their interests". Drawing from the ongoing, it is reasonable to recognise that learners are not necessarily doing less coding when remixing; rather, it can be argued, that they are becoming more computationally expressive and efficient.

In addition, as noted by Kafai and Burke (2014), "computational participation" is a pivotal emerging form of computational thinking. Accordingly, computational participation is helpful for leveraging "social connectivity", "participation" and "communal practice" (p3).

In this respect, the illustration of abstraction in the process of remixing complex Scratch blocks of script echoes the concept of layers of abstraction (discussed in Chapter 3) as one of the characteristics of the emerging computational thinking practices within the *dynamic computational sociocultural medium*.

From the perspective of computational thinking discussed in the literature review, and as reflected in the case studies, there is evidence that the learners were involved in meaningful projects, which were socially situated and related to their interests and cultural backgrounds. This view is supported by the constructionist approach to education that perceives of creative learning as consisting of four elements: (1) when people are actively engaged in meaningful projects; (2) when learning is perceived as a social activity in which learners collaborate with each other and share ideas; (3) when learners are working on projects related to their interest; (4) when playful learning and experimentation are encouraged and supported.

The incorporation of creativity into learning has become more prominent in educational discourse (Resnick, 2014; Peppler and Kafai, 2007). Buckingham (2003) and Peppler and Kafai (2007) have observed an increasingly central role of media production in classroom settings which echoes the convergence participatory culture (Jenkins, 2006). Also, Resnick (2007) notes that creative thinking entails skills such as being able to "plan systematically", "analyze critically", "work collaboratively", "communicate clearly" and "design iteratively" (p22).

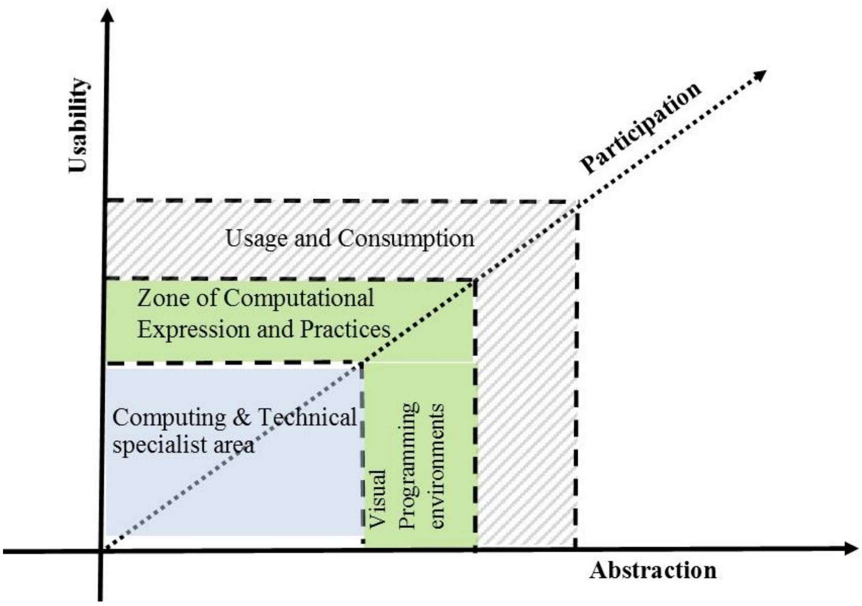
Having ESOL learners engaged in complementary and meaningful computational Scratch activities they care about, exemplifies aspects of creative computational practices. Also, enabling the students and the tutor to be actively engaged in design-based activities brings about elements of creative expression. As demonstrated in the case studies, these activities can range from creating a simple Scratch project that records the pronunciation of a sentence or word to remixing more computationally sophisticated projects about English word roots.

Drawing on these developments, I argue that the case studies illustrate a fresh constructionist perspective on creative and computational thinking, which targets ESOL learners. This novel perspective can be conceptualised through the computational view of the Zone of Proximal Development (ZPD) that I offer in this section. Inspired by Vygotsky's (Cole et al., 1980) notion of the ZPD, which suggests a zone in which learning is maximised, I propose a computational version in which computational practices are maximised in learning contexts. I propose the concept of a *computational zone* that provides a framework for understanding emerging computational practices, including visual programming environments such as Scratch.

The debate in, for example, SFL1's and JFE2's case studies presents aspects of the relationship between abstraction and computational practices in learning contexts. Within such a relationship, the level of computational practices is usually proportionate to the level of abstraction. However, investigating this relationship revealed that participation is a core factor in determining the level of utilisation of computational thinking practices in a learning context. Consequently, I argue that participation is a function of abstraction and usability, and it conceptualises contexts in which computational learning practices are feasible.

If, as suggested above, participation is a core element of computational practices and visual programming, it is logical to argue that emerging computational practices, including visual programming environments such as Scratch, can be perceived from the perspective of participation. Thus, an important question at this point regards the nature of the relationship between computational thinking and participation in the context of literacy learning. I argue that the higher the abstraction and usability, the higher the participation. Figure 7.1 below illustrates the relationship between, on the one hand, computational thinking practices, and abstraction, usability, and, therefore, participation, on the other.

Figure 7.1: the zone of computational practices and expression. Figure developed by the researcher.



The figure suggests that both participation and computational practices are a function of abstraction and usability. However, there is a zone in which expression and learning using computational practices take place. This is what I have labelled the *Zone of Computational Expression and Practices (computational zone).*

As Figure 7.1 indicates, expression within computational practices is maximised in the *computational zone*. However, beyond this zone, expression and learning through computational practices becomes less feasible or declines, despite the increased levels of usability and abstraction. In my view, this is because the area beyond the computational practices is more of a consumption area in which learning is more focused on usage and consumption than on computational practices. By the same token, the area beneath the *computational zone* is likely to be more of a technical specialist area where a specialist in computing and programming operates. Therefore, learning through computational practices that encourage computational thinking is maximised within the computational zone as described in Figure 7.1. It is worth mentioning that the notion of computational practices and expressions is essential to creativity, as discussed earlier in this theme.

In this context, I argue that the *zone of computational practices and expression* offers one explanation of the variation in the effectiveness of computational practices in the case studies discussed in Sections 7.2.1 and 7.2.2 of this chapter. Also, this *computational zone* supports the position adopted in this study that promotes literacy as social and contextual practices, rather than as a set of static cognitive or digital skills.

In conclusion, within the *computational zone* the greater the degree of abstraction, the greater the usability and the more feasible the computational practices. However, if the level of abstraction is higher or lower than in the *computational zone*, this could undermine aspects of computational practices and computational expression in learning contexts. This, in effect, provides an explanation for how learners can best utilise computational activities in theory and practice, and, therefore, how these learners can acquire knowledge through the personalisation of the learning environment using the Scratch computational environment, as exemplified in the remixed English word-roots Scratch projects.

7.5 TECHNICAL DIFFICULTIES IN THE CASE STUDIES

Although the college was well-equipped with different types of computer and accessories, the students frequently complained about the system and the network drives. The following is an excerpt from an observed discussion with the students:

SFL1: The computer; a lot of them does not work.

LFL1: Yeah, yeah, the server of this computer [pointing to the computer terminal in the classroom], I make, I make my perfect animation, perfect animation. Then, I save it, then turn off my computer, and then turn [it] on to show my teacher my work, and it was gone.

SFL1: Oh!

LFL1: My perfect animation.

Tutor: Can I just say: don't trust, you know, what's called the "H Drive", the "my documents" where you save your work. Don't trust it because there are problems sometimes. Always save it twice, you could email it to yourself, save it on the computer, and, maybe, a USB as well. Always make sure there is a backup.

LFL1: Yeah, but when you have to do work on the computer, you just have to wait around half an hour…and you lose time.

SFL1: and then you lose you work …

[The students laugh.]

The above dialogue illustrates some of the technical difficulties the students faced when using or trying to create animation on the networked terminals in the classrooms and the library at the research site. These terminal computers did not function like desktop or laptop computers. The laptop computers that were available were more powerful and could operate Scratch programmes faster than the terminal computers installed in the classrooms. For this reason, the tutor and I would bring the laptop trolley into the classroom so that the students did not need to use the terminal computers. During the Scratch hours, I met the students in the computer laboratory, where there were desktop computers.

7.6 Evidence that Use of Scratch Continued After the End of the Study

There is sufficient evidence that the use of Scratch continued at the research site after it had been introduced. This evidence is from the follow-up activities with the ESOL tutor during autumn 2015 and spring 2016, as well as from communication with two of the core participant students.

I was able to contact two of the participant students who were still studying at the research site. They indicated that they were still using Scratch in their learning activities on different courses, including the ESOL course, as well as in their personal and social activities. Unfortunately, it was not possible to follow up with all of the core participant students because only three out of the six remained students at the research site. SME2 and DFE2 moved to another college and SFL1 took her GCSE and enrolled on a university programme in health.

In addition, the tutor improved his teaching practices and contributed to the development of new teaching strategies as a result of taking part in this study. As such, there is enough evidence provided by the ESOL tutor that the use of Scratch continued at the college after the end of the study. Follow-up on the work of the ESOL tutor at the college in autumn 2015 showed that he was making good progress in terms of using Scratch and computational activities with his students. He reported that he was organising an "hour of code" sessions for the ESOL learners at the college:

> "In an IT lesson last week I briefly introduced Scratch and also Barclays Code Playground to one group of higher-level students. Then yesterday they did 'an hour of coding' on the code.org website, which introduces JavaScript. Very interesting!" (Yacoub, 2015, personal communication with the ESOL tutor on 17 November 2015).

In addition, during a follow-up visit to the research site in January 2016, the ESOL tutor indicated that he had started teaching the ESOL students an IT course in addition to the ESOL course he was already teaching. Inspired by the Scratch study, the tutor started using

Scratch in his IT courses for ESOL students in a way that supported the students' ESOL literacy skill areas.

All these new activities and competencies on the part of the tutor represent a new direction, considering cross-curricula activities as contextualised and complementary learning activities across various subject areas. This provides explicit evidence that the use of Scratch continued after the end of the project at the research site.

7.7 CHAPTER SUMMARY

This chapter has discussed the case studies in the context of additional evidence of progression in terms of the Scratch projects developed, as well as in terms of improvement in ESOL students' performance and level of engagement in classroom discourses. The discussion has provided a perspective on the contrast between the core and non-core participant students. Also, this chapter has identified ESOL skill areas in which the Scratch activities served the Adult ESOL Core Curriculum (Steeds, 2001), and has discussed variations in the effectiveness of Scratch at distinct ESOL levels and in different English skill areas.

Furthermore, this chapter has discussed computational themes that emerged from the case studies by: presenting the Scratch computational medium as, in some of its aspects, a medium of animation and expression; discussing the potential of computational practices to enable students to become active producers of technology and media; and providing perspectives on elements of repetition and review in the discussed Scratch project, as well as abstraction and remixing concepts and a proposed "*computational zone*", which contribute to operationalising computational thinking practices and learning. Finally, some technical difficulties encountered in the case studies, as well as evidence that the use of Scratch continued at the research site after the end of the study, have been presented.

CHAPTER 8: SCRATCH TUTORS' VIEWS ON THE IMPACT OF SCRATCH (SURVEY 4)

This chapter presents and discusses the findings from the survey of Scratch tutors in the UK (Survey 4, Appendix 5), which aimed to capture Scratch tutors' views on the subjects through which Scratch can be used to enhance student achievement and on the skills that can be improved through the use of Scratch. The findings of this survey were used to triangulate the case study findings.

Developing on the earlier discussion of the work of Blenker et al. (2014), and that of Ragin and Becker (1992) in Chapter 4, Section 4.10, "Triangulation of Data Sets and Qualitative Embedded Design", we use the term triangulation in the specific sense presented in the work of these authors, who proposed supporting the findings of data collected from insiders with a set of data collected from outsiders. For example, Blenker et al. (2014) suggest a methodological framework in entrepreneurship education research that uses multiple types of data collected by research teams consisting of insiders such as teachers researching their own teaching and outsiders such as research collaborators. They note that this framework enriches the findings as it "integrates the empirical sensitivity of qualitative techniques and diverse research positions, with the rigour of quantitative measures" (p 697).

Ragin and Becker (1992) echo this position and suggest a type of triangulation that can be seen as a validation of the "insider information" with "perspectives from outsiders" (p198). They define outsiders as people who are informed about the subject under investigation, and who may have views that are different from those of the "primary data sources" (p198). In particular, they suggest that case study researchers should not only examine the data collected from the core participants through primary data sources, but also investigate the context through the inclusion of the views of outsiders.

Blenker et al. (2014) and Ragin and Becker (1992) conceptualisation of triangulation in this context, might not necessarily align with its general understanding in reporting research methods. The data collected from core research participants in the case studies (insiders) is supplemented by the data collected from the Scratch tutors in the UK (outsiders). Although the data is collected from two different sources, the tool remains the same. Consequently, the triangulation is about Scratch rather than the users. As such, the Scratch tutors' views presented in this chapter are an important addition to the case studies because they provide essential perspectives of non-core participants who are informed about the usefulness and the impact of the Scratch tool. This inclusion of non-core participants, or outsiders, can also be seen as an external triangulation of the case study findings, which came about through the engagement of core research participants (the case study students).

Survey 4 is a questionnaire administered to 225 tutors with experience of using Scratch in their teaching and learning in the UK. A total of 77 tutors responded to the survey, which constituted a response rate of 34.22%. The invitations to participate in this survey were sent electronically to individual tutors and were shared in online forums of tutors who used Scratch in their teaching and training. These electronic invitations to fill out the survey offered "advantages of speed, efficiency and novelty" (Wellington, 2000, p103). In this regard, administering the survey electronically was more convenient and efficient than using other means, such as print and post copies, especially as Scratch tutors are by definition Internet users.

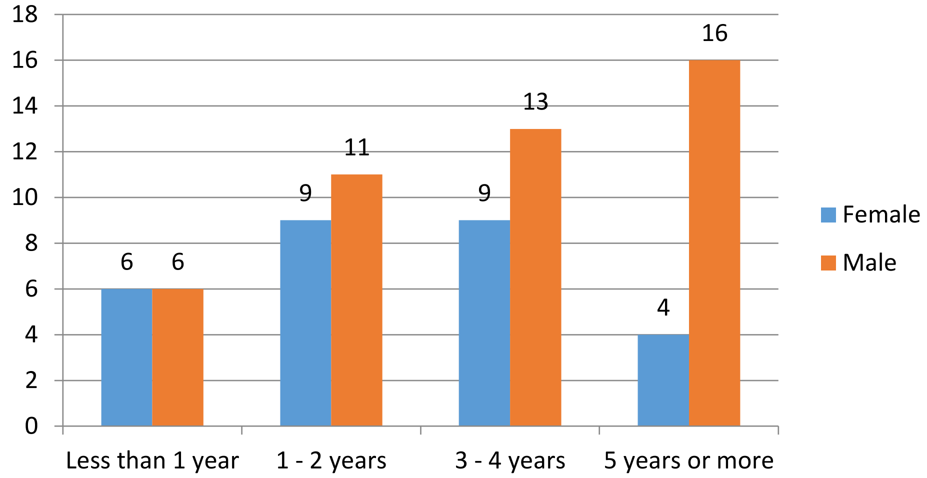
The survey consists of six sections: Section 8.1 is structured to collect demographic information about the tutors; Section 8.2 investigates their views on the subjects through which Scratch can be used for improving learners' achievement; Section 8.3 examines their thoughts about the skills that can be enhanced using Scratch; Section 8.4 explores other computational tools that the Scratch tutors might have been using, in order to draw a contrast between these tools and Scratch; Section 8.5 discusses the tutors' reflections, based on their experience of using Scratch; and Section 8.6 provides a summary of the survey and some conclusions.

8.1 Demographic Distribution

The gender distribution of the 77 respondents (N=225, 34.22% response rate) is 36.4% female and 64.6% male. Figure 8.1 shows the respondents' gender distribution against their Scratch teaching experience (in years).

The bar chart reflects a mixed group of Scratch tutors in terms of their gender as well as in terms of the number of years of their use of Scratch in their teaching over a five-year scale. Around a quarter of the respondents (25.97%) had at least five years of Scratch teaching experience. More than half of them (54.54%) reported having between one and four years' experience. Only 12 respondents (16.2%) indicated that they had less than one year's experience of using Scratch with students. Although Scratch is a relatively new piece of software, this distribution shows that the vast majority of tutors are fairly experienced in using Scratch, and, therefore, we can expect them to contribute significant views and opinions about it.

Figure 8.1: the distribution of the respondents' gender and experience in teaching Scratch (years)



8.1.1 Age Distribution

Table 8.1 shows the age distribution of the respondents and reveals that around two-thirds of the respondents are aged 40 years or over while the rest are aged between 18 and 39.

Table 8.1: the age distribution of the respondents and percentages for each age group

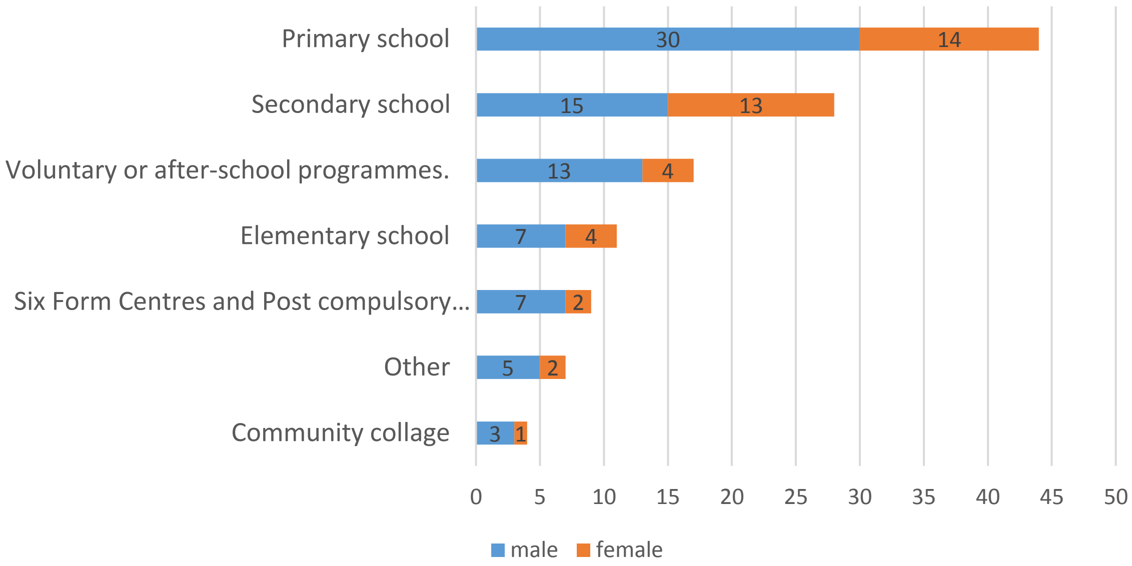
Age (years)	Number of respondents	(%)
18 - 19	2	2.6
20 - 29	8	10.3
30 - 39	10	14.1
40 - 49	25	32.1
50+	32	41.0

8.1.2 Levels at which Respondents Taught Scratch

Figure 8.2 below lists the levels at which the respondents were teaching or had taught Scratch. The figure shows that the vast majority of them teach or have taught Scratch in primary or secondary schools. More than half of them also teach or have taught Scratch in community colleges, voluntary or after-school programmes, or "other" learning settings.

The fact that the vast majority of respondents teach or have taught Scratch in primary or secondary schools can be explained by the recent introduction of the new national curriculum in computing education in England, beginning with Key Stages 1 to 4. According

Figure 8.2: the distribution of the levels at which the respondents (77 tutors) teach or have previously taught Scratch - against the number of times each level was selected and gender



to the Department for Education (2013), the new programme is designed to promote the teaching of computing subjects in all primary and secondary schools. It would appear that Scratch, along with other software, is being utilised as a major tool for teaching these new computing subjects. This is explained in detail in Chapter 2, Section 2.4, entitled, "Computing, ICT and Literacy".

On the one hand, we recognise that the dominance of male in the sample makes it atypical of the teaching force in the UK, particularly at the primary level which is usually dominated by female teachers (Department for Education, 2016). This shows that the sample represents enthusiastic tutors who are therefore not disinterested. On the other hand, the key advantage of this sample is that it represent expert informants and insiders, who provided insight into the subject of using the Scratch tool to facilitate teaching and learning in various subjects including English, as discussed in Chapter 4, Section 4.10.

8.2 Subjects in which Learners' Achievements Can be Improved Through the Use of Scratch

Around two-thirds of the tutors (70.12%) think that Scratch can improve the achievement of learners. These tutors were given a list of subjects and asked to select the subjects in which they believed Scratch could help to improve their learners' achievements. Using the functions available in the online survey tools, the subjects were included in a random order that changed automatically for each respondent. This contributed to the avoidance of leading questions, as the random order of the listed subjects assisted in avoiding a perception of prioritisation of the subjects in the top of the list.

8.2.1 Findings from the Quantitative Analysis: Subjects that can be Improved Using Scratch

Table 8.2 below presents the results of the quantitative analysis of the responses to the question on the subjects in which Scratch can be used to improve learners' achievement.

Table 8.2: the subject areas in which Scratch can be used to improve learners' achievement according to the findings of the Scratch tutors survey

Subjects	**Number of Respondents**	**(%)**
Computing	54	100.0
Mathematics	48	88.9
English Language	35	64.8
Art and Design	34	63.0
Science	27	50.0
Music	23	42.6
Geography	11	20.4
Citizenship	8	14.8
Physical Education	2	3.7
Other	7	13.0

Since Scratch, and other visual programming environments, are widely associated with computing and mathematics subjects, it was not surprising that all respondents (100%) believed that Scratch could be used to improve learners' achievement in computing, and that most of them (88.9%) thought that it could be used to improve achievement in mathematics. It is noteworthy that around two-thirds (64.8%) of tutors believed that Scratch could be used to improve learners' achievement in English language.

English language is ranked third, alongside art and design, among the courses in which learners' achievement could be improved using the Scratch programming environment. This indicates that the most Scratch tutors perceive Scratch as a tool with the potential to improve learners' achievement in English language. These findings support the outcomes and the conclusions of the case studies, which suggest that Scratch is a tool that has the potential to have an impact on English language literacy programmes.

8.2.2 Findings from the Qualitative Analysis: Subjects that Can be Improved Using Scratch

In order to give the respondents the opportunity to explain their selection of the subjects in which they believed Scratch could be used to improve learners' achievement, they were asked Question 11 (Survey 4, Appendix 5): "Please explain how you think Scratch has improved the achievement of your learners in the subject(s) identified above". A total of forty-four tutors (80%) responded by providing rationales for their selections. In order to analyse these, a qualitative analysis was carried out by means of a coding technique, using the qualitative analysis software Nvivo. The analysis aimed to code the respondents' text in order to identify themes around the subjects in question, as well as other emergent themes.

The respondents explained their choices by providing interesting comments and reflections on the selected subjects. The qualitative analysis revealed six themes, which are presented in Table 8.3. The table shows the number of coded references on each theme as well as the percentage of text coverage of these coded themes in the overall tutor responses to this open-ended question.

Table 8.3: the coded themes, including the number of references and the percentage of the overall text coverage in tutors' views on the subjects through which learners' achievement can be improved using Scratch.

Coded themes	Number of references	Text coverage (%)
Computing & Computational Thinking	36	15.52
Capacity to facilitate aspects of literacy and language learning	26	14.26
Features that support mathematical thinking and skills	21	12.83
Features that promote the development of other skills useful for learning	22	8.28
Supportive environment for teaching and learning	9	5.86
Features that stimulate creativity	6	2.33

In this context, I choose to discuss the themes related to literacy and language learning in order to triangulate and, therefore, confirm the findings that emerged from the case studies. As such, the sections that follow discuss the three themes of: (1) Capacity to facilitate the spoken and written aspects of literacy and language learning. (2) Features of Scratch that promote the development of other skills that are useful for improving students' achievement. (3) A supportive environment for teaching and learning.

8.2.2.1 Theme 1: Capacity to Facilitate the Spoken and Written Aspects of Literacy and Language Learning

This theme is discussed through the three foci of storytelling, games and writing.

a) *Storytelling*

Several tutors indicated how storytelling Scratch projects could improve the literacy and English language skills of their students. For example, Respondent 62 noted:

> "Scratch is an easily accessed programming language that I used to teach computational thinking, but it involved students constructing projects that involved them in subject areas above…Because they could also use language for storytelling, they had to develop the progression of the story and think about what they were writing to keep story elements in order."

Other tutors, such as Respondent 42, emphasised the positive role of Scratch in promoting creativity in language learning, particularly through elements of storytelling. He suggested that "[t]here are lots of ways to use Scratch to improve learning, [such as] Storyboards, animations, games or interactive quizzes".

Furthering the theme of facilitating literacy and language learning, other tutors associated this theme with the interface environment and the various functions available in the Scratch programme. One respondent commented that the friendly interface in English increases the learners' "[a]bility to implement their own interactive digital stories" (Respondent 68). This respondent also noted that the remixing functions in Scratch increase the "[a]bility to change [the] code in ready made programs".

These comments from Scratch tutors corroborate the recognition of the storytelling function as a strength in the case studies; for example, in the case study of SFL1 and the construction of the Scratch project on animating lyrics and stories. Also, the comments support the argument about the usefulness of the Scratch remixing function, as discussed in most of the case studies.

b) Games

Another strand of the argument regarding why Scratch is well aligned with the development of literacy and language was built around its games projects. Respondents commented that Scratch games projects represent a “fun way to program and problem solve” which is “good in and out of [the] classroom” (Respondent 61). Another tutor thought that Scratch was useful in “creating games that require pupils to apply an understanding of number concepts and probability to create rules and [a] scoring system for a game” (Respondent 05). He also commented that Scratch can contribute to the development of literacy and language learning through its other features and functions, including the facility to get a student to create his or her “own adventure text based games”.

Another tutor noted that the “fun” elements in the Scratch projects promote improvement in students’ achievement in all subjects. He commented that the “development of logical analytical skills [and] team work [are] [a]ll achieved while having fun/playing games” (Respondent 13). Similarly, Respondent 21 suggested that the “[c]urriculum topics for all…subjects have been used or needed to solve challenges [through] creating games in Scratch”.

In this context, several Scratch projects in the case studies were seen as games because they involved an element of competition. Examples include the English phonics Scratch game in JFE2’s case study and the English word spelling games in GFL1’s and SFL1’s case studies. In addition, using Scratch in and outside of the classroom reiterates the discussions in the case studies about extending the work of ESOL students outside of the normal classroom teaching hours. The respondents’ comments echo the findings discussed in the case studies in respect of the impact of Scratch interactive quizzes, such as the Scratch spelling games that ESOL students utilised to enhance their spelling skills and extend their English vocabulary. These are all examples of Scratch games projects that promote the enhancement of literacy and language learning.

Finally, given that some learners resent the regimental nature of classroom learning, the ability of Scratch to provide these less formal learning opportunities could be a motivation for many literacy and language learners. It is, therefore, not surprising that Scratch is considered engaging for literacy and language learners. Echoing this viewpoint, one respondent noted that Scratch "provides a new way of accessing traditional materials" that are "engaging for pupils who traditionally don't enjoy learning…the Xbox generation" (Respondent 30).

c) *Writing*

Respondents highlighted the fact that Scratch has the potential to facilitate literacy and language learning because of the writing requirements of some of the projects, even though this is in a context characterised by "fun" elements. For example, some respondents commented that Scratch projects are useful in improving writing because "writing clear and concise instructions to the games they have created" is a requirement for many of the projects (Respondent 05).

While some tutors stated that Scratch provides an opportunity for learners to "animate simple conversations between characters" in a straightforward fashion (Respondent 19), others pointed out that developing literacy and language skills through Scratch is feasible because:

> "strict computer language syntax aids in writing clear English…The iterative process of writing and testing code mirrors scientific method. And it encourages problem solving crucial for scientific analysis" (Respondent 31).

To support their claims, respondents provided examples that illustrated aspects of Scratch that could facilitate the learning of English language skills. For instance, Respondent 07 reported that "computer generated poetry, madlibs, consequences - all [seen as] good for reinforcing concepts of verb, noun, adjective etc". Other examples included Scratch projects built around conversations, which suggests that Scratch makes it "[e]asy to animate simple conversations between characters" (Respondent 19). Also, these features make Scratch helpful to ESOL learners and enable "[c]hildren of immigrant parents [to] benefit linguistically" (Respondent 40).

The overriding view, as seen in the responses and illustrations presented above, is that there is some kind of similarity between the process of language learning and computational practices. A final illustration of this similarity is demonstrated by the fact that students "have to think carefully about the syntax of the code to ensure that it works as desired" in computational practices (Respondent 39). Language learning requires a similar process, in order to ensure that what is being written and spoken is logical and can be easily followed and understood. Findings from the case studies appear to provide evidence of this relationship.

8.2.2.2 Theme 2: Features of Scratch that Promote the Development of other Skills that are Useful for Improving Students' Achievement

Respondents suggest that apart from improving literacy and language learning, Scratch has features that are helpful in developing other skills that are useful for the learning process, although these features are not directly related to literacy and language learning. Some of the qualities and attributes identified and discussed in the sections that follow are: increased motivation; enhanced communication, interaction and team working; increased learning independence and confidence; cross-curricular activities; and creativity.

a) Motivation

Several tutors noted that Scratch is "[m]otivating and [provides an] accessible interface" for learners (Respondent 11). The visually friendly interface of the Scratch programming environment was noted as being a "supportive visual environment [that] enables pupils to achieve success" (Respondent 56). It is generally felt that Scratch has the potential to empower and motivate learners. For example, a Scratch tutor noted that Scratch is "fundamentally empowering… [because students] suddenly realise that creating things can change the world...and that is within their grasp" (Respondent 50). According to the same respondent, these qualities, therefore, are expected to "increase their motivation to learn".

b) Enhanced Communication, Interaction and Team Working

Interactions between learners in creating Scratch projects were an element of interest to the tutors, who noted that there is enhancement "in communication skills as they [the students] share and explain what they did" (Respondent 54). In addition, another tutor stated that "[h]elping classmates through difficulties develops abilities for team working" (Respondent 40).

Illustrations of enhanced communication can be seen in all of the case studies. Most of the Scratch projects discussed in the case studies entail some sort of communication with other students, the researcher and the tutor. The case studies discuss a number of projects from the perspective of the discourses that arose around their construction and which contributed to increasing classroom interaction. For example, JFE2's case study, as discussed in Chapter 6, provided evidence of her being able to increase her classroom interaction with her Malay friend. Similarly, the increased level of collaboration between SME2 and KME2 while working on Scratch projects provided evidence of enhanced communication and increased classroom interaction as a result of taking part in the study. This is discussed in more detail in Chapter 7, Section 7.1, entitled, "Performance of Core and Non-Core Participant Students".

c) *Increased Learning Independence and Confidence*

Some of the responses that fed into this theme suggest that "students working through Scratch projects appear to be more independent and better logical thinkers" (Respondent 49). Another respondent noted that "[c]reating and following up ideas for programs develops intellectual confidence that is then felt across the curriculum" (Respondent 40). The concept of independence and personalised learning activities echoes the process of personalisation of the learning context using computational practices that is discussed in the case studies.

d) *Cross-Curricular Activities*

The cross-curricular context was stressed in some of the tutors' comments: "creating and following up ideas for programs develops intellectual confidence that is then felt across the curriculum" (Respondent 40). Another tutor noted:

> "It all depends on the cross curricular context. For example we created a simple habitat scene - for our seaside topic, pupils' thoughts about the animals that live in the scene and also included reference to an eco theme - as we had eco week" (Respondent 27).

Other tutors suggested that students' achievement in any topic, including in English language, can be improved through the employment of Scratch. However, this depends on the cross-curricular context as well as on the creativity of the tutor. The cross-curricular teaching and learning activities are referred to in various previous and subsequent sections. For example, the games and storytelling themes discussed earlier incorporate elements of cross-curricular teaching and learning.

e) *Creativity*

Lastly, in the context of Scratch, creativity is indicated as a key element in improving learners' achievement in various subjects. For example, some respondents described Scratch as a tool that provides a "[n]ew forms of creativity" (Respondent 30), and another argued that elements of creativity in the context of Scratch depend on the tutors themselves::

> "I think learning Scratch in an after-school club, which I tutor, has helped learners with their English Language and maths, and probably their geography but I think it can help in all subjects if the person teaching is creative enough. The pupils have realised they have to spell consistently to make code work and, also, they have improved their skills in co-ordinate maths" (Respondent 64).

Creativity is also discussed later in this chapter, in Section 8.3, entitled "Skills that can be Improved Using Scratch".

8.2.2.3 Theme 3: Supportive Environment for Teaching and Learning

Several tutors noted that Scratch programming is an environment that is of benefit in different subjects, including English. For example: "Scratch provides computing which is a life skill, [and, therefore,] life skills improve achievement in all subjects with no exception" (Respondent 01). Likewise, constructing or using Scratch projects leads to supportive learning environments. Having students engage in learning activities that can be described as "fun" and "playful learning" was mentioned in many tutors' comments.

The social element of Scratch was another facet that was presented as being a supportive environment for learning. For example, Respondent 44 suggested that "the authoring of projects is socialised so that students learn from each other and study advanced designs by their peers". Also, the online Scratch forum was referred to as something that "helps students practise their digital citizenship skills in a low-stress, supportive environment" (Respondent 45).

In conclusion, these comments by the tutors explain their selection of the subjects in which Scratch can be used to improve learners' achievement and illustrate how Scratch can improve achievement in various subjects. The Scratch programming and authoring environment, therefore,

> "[d]emonstrates the practical use of science, maths and language concepts, to make something work with low enough barriers (time, effort) that children can achieve and complete something tangible within one session; and can see the possibilities for further work to 'perfect' their creation" (Participant 36).

The analysis of these illustrations provides additional evidence that the Scratch programming environment is useful not only in computing and mathematics but also in literacy and English language learning, such as ESOL programmes.

8.3 Skills that can be Improved Using Scratch

Most of the respondent Scratch tutors (73 tutors, 94.8%) responded "yes" to the binary question of whether they thought Scratch was helpful in enhancing students' skills. These tutors were then asked to select the skills that, according to them, could be enhanced. The list of skills they provided is: computational thinking, imagination, creativity and expression, English as a second language skills (writing, reading or speaking), communication and "others". As with the question about subjects in Section 8.2, the skills were listed in the survey in a random order that changed automatically for each respondent. This served in avoiding leading answers by maintaining a random ranking of these skills in the online survey.

8.3.1 Findings from the Quantitative Analysis: Skills that Can be Improved Using Scratch

Table 8.4 shows the findings from the quantitative analysis of the responses concerning skills that can be enhanced using Scratch. For each subject, it illustrates the percentage of the 73 respondents who thought that Scratch could improve students' skills.

Table 8.4: students' skills that can be developed using Scratch, according to the findings from the Scratch tutors survey

Skill	Number of respondents	%
Computational thinking	73	100.00
Creativity	70	95.90
Imagination	56	76.70

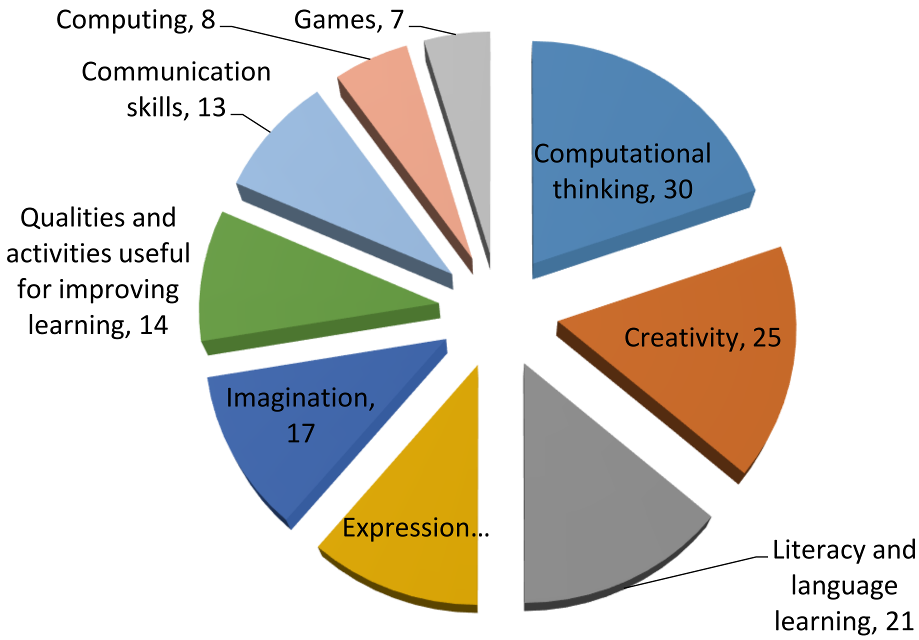
Expression	46	63.00
Communication	42	57.50
English as a second language	33	45.20
Other	6	8.20

The results regarding computational thinking skills were to be expected. However, it is notable that the tutors considered creativity and imagination to be two fundamental competencies, alongside computational thinking. Meanwhile, although the results regarding improvements in English language skills were not as high as for other skills, I argue that it is significant that nearly half of the tutors believed that Scratch could improve English language skills, especially for learners whose first spoken language was not English.

8.3.2 Findings from the Qualitative Analysis: Tutors' Views on Skills that Can be Improved

In order to give the respondents the opportunity to explain their choices of the skills that can be enhanced using Scratch, they were asked Question 14 (Survey 4, Appendix 5): "If you ticked any of the above skills, please explain why". A total of 50 tutors out of 73 (68.49%) responded by providing rationales for their selections. A coding technique, using the qualitative analysis software Nvivo, was utilised to analyse these explanations. Figure 8.3 shows the coded themes including the number of references for each category.

Figure 8.3: the coded themes and the number of references analysed from the tutor's explanations of their choices of the skills that can be improved using Scratch



The review of these clusters of themes and sub-themes revealed three main features: (1) Beyond computing and technical computer programming; (2) Scratch facilitates creativity, expression and imagination; and (3) the capacity to facilitate the development of English skills areas.

8.3.2.1 Feature 1: Beyond Computing and Technical Computer Programming

Thirty coded references were identified in the tutors' responses regarding computing and computational skills that can be improved through Scratch. These references discussed the potential of Scratch to improve students' computing and computational thinking skills. For example, some tutors noted that Scratch requires computational thinking by its nature, and as Respondent 53 indicated, "computational thinking is obvious…coding is more than just writing code".

Respondent 22 argued that utilising computational thinking skills is the "first steps [in] how to create digitally" and, therefore, these skills encourage learners to "use Scratch templates to create new worlds and games". This illustration of using templates supports the approach utilised in the case studies of providing students with templates and enabling project remixing. With this approach, students are able to construct meaningful projects, which is useful in enhancing their ESOL learning practices. Enabling the students to get started using the Scratch templates was discussed in most of the case studies as well as in the reflections on the preparation for introducing Scratch to the participant students in Chapter 5, Section 5.3, entitled "Planning the Case Studies".

Respondents suggested that by using the Scratch tool, "pupils are writing and debugging computer programs" (Respondent 22), which "allows computational thinking without the complication of the syntax of a traditional computer language" (Respondent 33). In other words, Scratch "focuses students' minds in these areas [the list of skills in question] without the worry about syntax restrictions" (Respondent 33). These remarks are borne out in several Scratch projects, especially the remixed ones that utilised aspects of abstraction and also in the English word spelling Scratch project in the case of SFL1 and KME2's Latin and Greek roots project.

These reflections about computational thinking led to the development of logical thinking skills. Students, for example, were enabled "to think logically in order to determine what their program will produce” (Respondent 02). The computing aspects were another dimension in the responses. For example, Respondent 42 noted that through “programming in Scratch all the computer science topics are covered, such as decomposition, sequencing, selection, iteration etc”. Furthermore, according to Respondent 10, computing or coding “requires clarity and organisation of thought”. Moreover, another tutor noted that “[b]ecause it reads in almost plain English, it’s excellent at getting them to think through their algorithms” (Respondent 19). In this regard, computational skills, such as thinking logically and utilising the computational concepts of debugging, decomposition, sequence and loops, were manifested in the discussions of the Scratch projects in the case studies.

8.3.2.2 Feature 2: Scratch Facilitates Creativity, Expression and Imagination

In this section, I discuss the two sub-themes of: (1) creativity and (2) expression and imagination. The discussion around the three terms of creativity, expression and imagination is woven into various sections of this study. However, the respondents provided additional insights and added a practitioner flavour regarding the impact of these terms on both learning practices and the ESOL user.

1.1 Creativity

The creativity theme was ranked second in the number of coded references regarding skills that can be enhanced using Scratch. In the Scratch tutors’ responses, creativity was intertwined with other skills, such as imagination, sharing ideas in a social context and expression. For example, Respondent 55 noted that one manifestation of the enhanced social skills gained through the Scratch environment was that “working with others on a project means having to share ideas and negotiate creativity, imagination, [and] expression”. This description reiterates the notion of creative thinking skills, including working collaboratively, communicating clearly and designing iteratively (Resnick, 2007).

Therefore, creativity and expression were used together in most of the tutors’ comments and reflections. In fact, one respondent criticised the separation of creativity and expression skills in the survey question and argued that “Creativity and Expression all mean the same thing. I don't understand why you've put them differently” (Respondent 34). Consequently, although I recognise that there are terms, such as creativity and expression, that are best used jointly to describe certain skills, I still think it was helpful to design the questionnaire in a way that distinguished between these terms and provided a more detailed breakdown of the skills, allowing the respondents to decide which of them went with which.

In this context, although there may be no clear distinctions between creativity, expression and imagination, it is still useful to separate the Scratch tutors' explanations and comments about creativity into two categories for discussion. The first of these focuses on computing and programming attributes, such as allowing students "to work out their own solutions rather than having them provided" or "encouraging students to describe a range of alternative solutions to problems" (Respondent 17).

The second category focuses on other attributes of creativity that can be of benefit in the context of improving learners' literacies and English language skills. I choose to elaborate on this second category because the non-technical attributes are of further relevance to the development of English language skills, as discussed in the affective and social contributions of the Scratch computational environment in the previous sections and chapters.

Some respondents' comments confirm the view that imagination and creativity can be harvested as a result of the development of computational thinking skills. Respondents who described creativity in terms such as "make something and then remix it" (Respondent 22) and "allowing [students] to create animated stories" (Respondent 19) that lead to enhanced learning practices and skills, lend support to this claim. In particular, one respondent suggested that:

> "Scratch allows students to translate ideas into exciting applications. Initially students need help in translating ideas into something which can be defined using Scratch (this is computational thinking) but as the students become more confident they become more ambitious, creative and imaginative." (Respondent 46)

Several tutors discussed the view of Scratch as a tool for expression. One comment indicated that "[i]n the process of creating a program, students need to use their imagination and creativity to develop their program. The program is an expression of who they are and how they operate" (Respondent 53). This illustration suggests that Scratch, as an illustration of computational environments, provides additional means of expression and communication.

A smaller number of respondents emphasised the construction of projects based on learners' personal interests while maintaining elements of "fun" and "competition". These respondents noted that, by using Scratch, students construct meaningful projects related to their own interests. This is demonstrated when they "express their creativity, and build something that means something to them" (Respondent 62). Another strand evident in the comments showed that creativity is encouraged through the use of Scratch games, which maintain a competitive and enjoyable environment. For instance, a tutor noted that "[s]etting challenges within the Scratch framework can encourage utilization and development of creative thinking and imagination" (Respondent 33).

The tutors' comments on creativity echo a number of reflections about the Scratch projects discussed in the case studies. For example, animating stories and storytelling can promote creativity as exemplified in the "Teens in the castle" project in SFL1's case study. The views of creativity in the remixed Scratch projects are moderated in the cross-language translation projects in the case of GFL1, as well as in the remixed English word roots project in the case of KME2. Lastly, as several tutors pointed to creativity as an outcome of the development of computational thinking skills, it can be argued that all of the Scratch projects discussed in the case studies exemplify aspects of computational thinking skills that promote creative practices.

1.2 Expression and Imagination

Expression and imagination were discussed in conjunction with additional attributes, including creativity, sharing and communication. For example, Respondent 47 suggested that using the Scratch authoring environment "[e]nables imagination and creativity and gives a new and different way to express and communicate ideas" (Respondent 47). This mode of expression was observed to be accomplished through various kinds of projects, such as games, storytelling and animation. Constructing meaningful and playful Scratch projects as a form of expression was frequently noted in the tutors' responses. A second example is from Respondent 53 who stated that a Scratch project "is an expression of who they are and how they operate". He also pointed to the potential of the imagination in the construction of creative practices and expressions in which "students need to use their imagination, creativity to develop their program".

With respect to the visual elements of Scratch as a visual programming language, some tutors noted that these elements facilitate expression. For example, Respondent 40 pointed out that "Scratch makes visualisation of ideas quickly implementable". In summary, expression and imagination were discussed in the tutors' responses as essential elements of computational practices. Using computational tools for expression has been discussed by introducing the term *Zone of Computational Expression and Practices* in Chapter 7, Section 7.4, entitled "Computational Perspectives".

8.3.2.3 Feature 3: The Capacity to Facilitate the Development of English Skills Areas

The respondents generally had a positive perception of improvements achieved through the use of Scratch in learning and teaching. As such, this presents a strong indication that the usage of Scratch brings about enhancement in English skills areas. This enhancement was highlighted through the following threads in the Scratch tutors' responses:

(a) *Reading and Writing Skills*

Some tutors demonstrated how Scratch could assist students in developing their English skills areas. For example, Respondent 07 mentioned that Scratch helps in the developments of English as Additional Language (EAL) skills:

> "[in] writing - ensuring that text used within programs is fit for purpose; reading - proof-reading each other's work and reviewing examples of good practice; speaking - incorporating recorded speech into a program to play in response to specific actions".

The second illustration is from Respondents 58 and 60 respectively, who suggested that Scratch enables learners to benefit linguistically:

> "They can read and process information, express their creativity and show imagination. Yet at the same time it allows students to perfect computational thinking skills which enhance learning in the subject. Students then can discuss and communicate their experience with the software."

And:

> “Using Scratch usually involves reading instructions, so kids get to practise reading. If they work together, they also practise talking and teamwork.”

The projects on English word roots, including Greek and Latin roots, augment the potential for Scratch to improve the English skills areas. Respondent 68 illustrated this potential by arguing that “the use of [the] Greek and English interface helps many of the kids to connect the notions between words that are used in the bricks”. This argument supports using the English word roots Scratch projects, as discussed in the case studies of KSE2 and SME2.

(b) Speaking and Listening Skills

Some comments exemplified how Scratch could be beneficial in enhancing learners’ speaking and listening skills. For example, Respondent 07 noted that these skills can be improved through the process of “incorporating recorded speech into a program to play in response to specific actions”. The second illustration is “the use of speech bubbles, instructions onscreen, recorded speech...the message of the product” (Respondent 55). These comments support using simple conversation projects, as in the case studies of JFE2 and GFL1, who constructed cross-language projects.

(c) Increased Classroom Communication and Interaction

Tutors noted that communication and interaction facilitate the development of literacy and language skills. According to Respondent 69, “the social interaction between the students that comes from the collaboration, problem-solving and secondary benefits of Scratch will enhance literacy”. A second illustration is from Respondent 10, who noted that “[p]upils with English as a second language benefit from explaining and discussing what they are coding with other pupils”. In addition, Respondent 45 illustrated the classroom interaction that is observed throughout Scratch activities. She argued that “for English as another language practice, students are often sharing ideas with others and listening to other students talking”. These remarks echo the findings that emerged from the case studies, especially the Scratch themes that portray high level of students’ classroom interaction that arose during the construction of the Scratch projects.

(d) Storytelling and Digital Stories

Respondents 07 and 28 referred to storytelling techniques as a way to improve the English language skills of learners, and they noted, respectively, that "[i]maginative thinking can be encouraged through working on animation and digital storytelling activities" and:

> "Teachers already know how to teach story-telling, so they can engage their pupils in story structure, narrative design, use of dialogue, characterisation etc. Add bi-lingual."

In addition, Respondent 71 stated that learners "can use their imagination to create new stories or game play". Although the storytelling techniques and activities were only employed in the case study of SFL1, their potential to improve English language skills is significant, especially within a complementary nature of computational activities.

(e) Motivation

Some comments conveyed the view that Scratch motivates learners. For example, Respondent 50 indicated that "[f]or me, the key point is that most children are motivated to learn - they carry on at home and in the holidays". He also suggested:

> "For those who don't read or write so well (whether native or not) the small vocabulary and the prompts of the coloured blocks make it easy for them to master... plus, they're 'motivated' to, which I feel is key. I worry a little how far they get beyond talking/reading/writing about Scratch, but it's a first step."

Another illustration of this view came from Respondent 56, who argued that motivation and accessibility are two essential outcomes. A similar remark suggested that "[g]enerally pupils enjoy working with Scratch, so it is motivational" (Respondent 11).

(f) *Features that Promote the Development of other Skills Useful for Learning*

The qualitative analysis of the tutors' responses reveals a theme through which tutors reflected on both the qualities and the activities of Scratch that were beneficial in improving learning. These responses included a mix of qualities, such as interest-driven projects that promote self-expression, engaging activities, and challenging the students to “create newer and ever more imaginative and complex creations using metaphors and mathematical concepts in design” (Respondent 44).

Some respondents described Scratch projects as joyful and playful learning activities in which students “have as much fun drawing the graphics as with programming” (Respondent 50). Also, the social interaction provided through the Scratch environment was another facet highlighted in the responses.

Finally, it was argued that the repetition function available in the Scratch environment was useful for facilitating the development of English language skills. This was noted by Respondent 22, who said that the “use of basic instructions in Scratch will help people to learn English through practical application and repetition”. The benefits of repetition in the development of English language skills are manifested in the Scratch computational projects. The repetition concept is discussed in more detail in Chapter 7, Section 7.4, entitled “Computational Perspectives”.

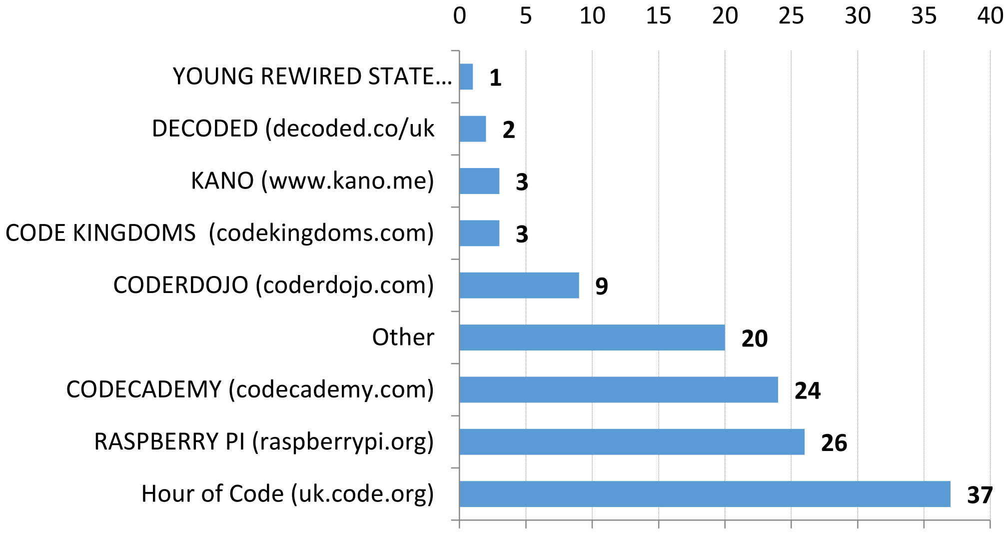
8.4 The Effects of Other Computational Tools the Tutors Utilised

The survey asked about computational and visual programming tools other than Scratch that the tutors utilised in their teaching and learning and provided a list of the available computational tools. This list was based on the most frequently used computational and computing platforms in the UK, all of which were available at the Year of Code initiative in the UK in 2014 (Year of Code, 2015). Figure 8.4 summarises the responses regarding these other computing and computational tools.

The findings from the quantitative analysis of the responses show that 80.52% of the respondents (62 out of 77) indicated that they were using or had used one or more computational or computing tool in their teaching and learning.

The respondents were given the opportunity to explain whether and how other computing and computational platforms were different from Scratch. A review of the tutors’ responses shows that most of their comments described technical differences regarding computing, programming concepts and techniques. However, several comments revealed that all of these tools “allow computational thinking skills” (Respondent 48) and that they all constitute “various ways to present coding” (Respondent 15).

Figure 8.4: the computing and computational tools (other than Scratch) used by tutors in their teaching and learning



8.5 Reflections on the Survey of Scratch tutors in the UK

The respondents were given the opportunity to share their reflections on their overall experience of using Scratch in their teaching and learning. As a result, about two-thirds of the tutors (50 tutors, 64.93%) provided comments about their overall experience of teaching Scratch to students. These comments included both positive and negative remarks. While one group of respondents pointed out the potential of Scratch effectively to enhance the development of computational and computing skills, another group was cautious about using the Scratch tool, or technology in general, in teaching and learning. The latter group drew more attention than the former to the role of pedagogy in learning and to some of the limitations of the Scratch computational environment. In contrast, the former group reiterated the computational gains developed through using Scratch and described it as an easy tool to use and one that could support playful learning.

To elaborate on some of the critical responses, Respondent 10 argued that "[t]he teacher really does need to have computational thinking at the forefront when planning the learning activity. If not, then it can descend into just fun and tinkering". This remark sheds light on the approach used in introducing Scratch to ESOL learners, which did not focus solely on computing and computational concepts. The learners were, however, provided with training about basic Scratch screens and functions, and they learned more about computing and computational concepts as they engaged in activities that complemented their ESOL learning practices.

In addition, some respondents were critical in their reflections about the tool and about how it could be used in literacy and language learning. For example, Respondents 53 and 71 respectively argued:

> "Specifically for Language development this isn't an area I've used Scratch but again the command still includes English words so their meaning needs to be understood and communication is required. Students would have to be clear on what they are say, asking or advise they are giving. I do not specifically believe Scratch gives a unique opportunity for language development but it is a softer slope if the wish is to use programming and computational thinking as a resource in teaching English compared to some other resources."

And:

> "Although quite impressive small programs can be made with Scratch, the visual system becomes unwieldy for larger projects and text-based languages are better - it would be a real advantage to be able to translate between the two systems".

The above reflections echo the challenges faced in trying to meet both the learners' needs as well as the tutor's capacity to adopt new technologies in classrooms, as discussed in Chapter 3, Section 3.5, entitled "Technology-Enhanced Teaching and Learning". These reflections illustrate legitimate concerns about, and limitations of, using the Scratch tool in a literacy and language learning context, and, therefore, provide a sceptical view of a distinct positive role for digital technologies in practice.

Perhaps Scratch, similar to other computational tools, contains various limitations that hinder the implementation of activities and plans that could be useful for literacy and language development as well as in other subjects. However, I argue that this study demonstrates emerging notions of computational practices and shows how these notions can be used in language learning and teaching subjects, of which literacy and ESOL learning programmes are one illustration. Consequently, the demonstration is conducted using the Scratch tool, but the potential is not limited to the technical specification of one computational tool or another.

Some limitations of using Scratch for language development through text-level learning activities were discussed in more detail in Chapter 7, Section 7.2, entitled "The Scratch Projects Serve the Adult ESOL Core Curriculum". The analysis of the outcomes of the case studies suggests that Scratch can be more useful in English skills areas at the sentence and word levels than at the text level and in writing compositions. This may explain, in part, the Scratch tutors' comments about the limitations of using Scratch for language development through text-level learning activities.

On a different note, teenage students at secondary school or in further education sometimes viewed Scratch as a "childish" tool: "[w]ith more primary schools adopting Scratch in their curriculum I am finding the need to drop it as students see it as childish and something they did at primary" (Respondent 58). A similar situation occurred in the ESOL Level 1 class, at the research site. One student described Scratch as "childish", and that perhaps affected the perception of other students in the classroom.

There are, therefore, advantages and disadvantages to each computing and computational tool currently in use. I argue that developments in these tools will continue to occur. However, my aim is to draw a snapshot of the emerging dynamic sociocultural computational medium, not of the line of development of computing and computational tools that are but one illustration of this emerging medium. In summary, Respondent 05 highlighted how Scratch is just one tool in the computational environment. However, it is "not the outcome". He advocated that:

> "Sound pedagogy needs to be applied to ensure that pupils are experiencing a progressive curriculum that allows them to develop transferable skills that they get to apply in engaging and purposeful contexts. Without this, technology brings nothing new to the lesson and therefore should not be used."

This comment echoes the non-technological determinist approach, which focuses more on teaching and learning activities than on de-contextualised computing and technical skills. Furthermore, the tutor suggested that using Scratch to motivate learners "removes barriers that may exist and gives them a purpose to use language, to find information, to write scripts. However, this is not Scratch; this is how the teacher makes use of Scratch" (Respondent 05).

8.6 CHAPTER SUMMARY

This section has discussed the survey of Scratch tutors. The survey was administered to 225 tutors with experience of teaching and learning Scratch in the UK and a total of 77 tutors responded (34.22% response rate). The findings from this survey have demonstrated that the Scratch tool has the potential to develop not only students' computing and computational thinking skills but also their English language skills. These findings provided important triangulations of the findings of the case studies. The Scratch tutors' notes were underpinned by essential empirical experiences that provided addition insight into the field of this study. Consequently, the results and analysis of the survey have provided evidence that supports both the findings of and the conclusions that emerged from the case studies and the direction of this research, which suggests a constructionist approach to multimodal literacy.

A qualitative analysis followed the quantitative analysis of the responses in order to explain further the quantitative results. The Nvivo qualitative analysis software was used to analyse the tutors' responses to the open-ended questions and this analysis was divided into four parts:

(1) Demographic information, which showed the respondents to be a diverse group in terms of gender, age, teaching experience, Scratch teaching experience and the levels (school/college) at which they were teaching or had previously taught.

(2) Subject areas in which learners' achievement can be improved using Scratch. The findings here show that English language was ranked third after mathematics and computing. The qualitative analysis of the open-ended question about the selection of the subjects revealed around a dozen themes that discussed the learning subjects in question. These themes are presented in Table 8.3. In this regard, three themes were discussed in relation to language learning: (a) capacity to facilitate the spoken and written aspects of literacy and language learning; (b) features of Scratch that promote the development of other skills useful for learning; and (c) supportive environment for teaching and learning.

(3) The skills that can be enhanced using Scratch were investigated through the quantitative analysis of the respondents' selection of skills in the closed-ended question. The findings show that almost all of the respondents (94.8%) thought that Scratch facilitated the enhancement of the skills of their students. The clustering and analysis of the responses vary according to the skills and the subject associated with each skill. Table 8.4 illustrates the responses regarding the skills that can be improved using Scratch and shows that around half of the tutors (45.2%) thought that English language skills could be enhanced in this way. I consider this percentage to be significant enough to demonstrate the relevance of using the Scratch computational tool in language learning

and development, as well as to providing supplementary evidence and a complementary perspective to that given in the 'close-up' case study (Trowler, 2012).

The respondents were given the opportunity to explain their choices through an open-ended question, and the qualitative analysis of their responses revealed several sub-themes (Figure 8.3) that were categorised into three broad themes of: (1) beyond computing and technical concepts of computer programming; (2) Scratch facilitates creativity, expression and imagination; and (3) the capacity to facilitate the development of English skill areas.

(4) The survey asked about other computational tools the tutors might have utilised in addition to Scratch. The findings from the responses suggest technical descriptions and differences between several computational platforms and applications that were not relevant to language learning.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

This research set out to investigate the impact of a computational and constructionist intervention on the achievement of higher levels of multiliteracies among a group of young adult ESOL learners in a Sixth Form College in London. The project utilised a case study approach to record improvements in learning. The research sought to develop fresh understandings of the pedagogical and curricular perspectives of emerging computational environments exemplified by Scratch.

In fieldwork stretching over 23 weeks, and in synthesising in-depth case studies of core participant students, this project has tracked the enhancement of the English language skills and learning practices of ESOL learners by complementing their ESOL classes with computational practices using Scratch. The study is an interdisciplinary project that draws from several disciplines in theory and practice, but it is largely located within both the concept of a sociocultural view of literacy and constructionist learning theory. Through this, it proposes an innovative approach that synthesises perspectives from constructionist learning theory and the multiliteracies approach to learning and demonstrates a convergence between the two.

In this chapter, I present a synthesis of the research's planning cycles; a review of the research aims; a synthesis of the empirical findings and conclusions; an exploration of the theoretical implications of the findings; a discussion of the contributions to knowledge that originate from the research; some reflection on the difficulties and limitations of the study; recommendations from the researcher and the implications of the findings for future research.

9.2 A SYNTHESIS OF THE RESEARCH'S PLANNING CYCLES

In this study, I have discussed relevant literature and provided the perceptions of literacy and the constructionist framework in the context of English for Speakers of Other Language (ESOL) programmes. The study is significantly informed by views identified in the literature on four main themes: (a) interactive digital media and art using Scratch; (b) popular culture and new digital technologies; (c) multimodality and encoded texts; and (d) computing and digital practices in mainstream education in the UK.

Inspired by the ontological views of pragmatism, this research utilised a mixed methods research that employs a case study approach. This entailed an iterative process which collected data from non-core participant students and tutors in order to support and triangulate the data sets collected from core research participants. The triangulation of the data sets from multiple sources helped to enhance the validity, reliability and trustworthiness of the research.

As discussed in Chapter 5, there were three phases of data collection: Phase 1 was a piloting phase that took place before the research site was secured and the research participants recruited; Phase 2 was the process of recruiting of the core research participants; and Phase 3 focused on the project implementation process and the commencement of the work with the ESOL students. These three phases followed both the inductive and deductive nature of research. Each phase initially drew on the contentions of previous cycles of planning and the literature that informed the next phases while maintaining flexibility around re-planning and exploring new learning practices.

In addition, as discussed in Chapter 6, the five case studies helped to tell the stories of ESOL learners and exemplified the potential contribution of computational resources to the students and tutors involved in the project, and, therefore, to the community of ESOL learners at the research site.

9.2.1 Research Journey

From carrying out this project, I am now able to sit back and look at my own practices as a learner, and see how computational tools could help learners and tutors in ESOL programmes to enhance their learning practices. I have also been able to travel from the theoretical point of multiliteracies and new literacies to the practical implication of constructionism. This experience has allowed me to experiment with aspects that can inform the incorporation of computational tools in literacy teaching and learning.

This research has helped me to investigate and learn about not only my own practices for engaging ESOL learners with computational tools but also the context and needs of individual students and tutors in ESOL programmes. As a constructionist learner, I have identified areas of intervention in the field of literacy and language learning and have developed new insights in this area. Therefore, the study has advanced my understanding and practical utilisation of constructionist practices that employ computational tools in learning and language development.

9.3 REVIEW OF THE RESEARCH AIMS

Three overarching aims underpin this study. The first aim was *to incorporate constructionist new media interventions, using the Scratch tool, into lifelong sociocultural practices*. The study has shown that not only are there useful language elements in the Scratch tool but also that it can be used as an essential complementary teaching and learning strategy for ESOL learners and tutors.

The second aim was *to explore the pedagogical relevance of the constructionist tool that is Scratch for ESOL students and tutors as well as for practitioners in the Further Education context*. The study has documented relevant constructionist practices for ESOL literacy learners and practitioners. In essence, the case studies have confirmed that using Scratch in the ESOL classrooms preserves vital pedagogical elements that are relevant to ESOL learning and teaching within a complementary framework. The study shows how ESOL learning activities were complemented by the Scratch tool which allowed for a broad range of learning activities in and outside of the classroom.

The third aim of the study was *to utilise, evaluate and refine computational learning practices for ESOL literacy learners*. The research utilised a number of computational practices in the targeted ESOL programme, with many of them reviewed and re-applied in the course of the project. The Scratch projects and activities were used to compliment the ESOL learning programme and were planned and evaluated according to the skills areas in the Adult ESOL Core Curriculum.

9.3.1 Review of the specific aims

The study has two specific aims. The first was to e*xplore and develop insights into the use of the constructionist and technological tool of Scratch in the context of the classroom with young and adult ESOL literacy learners.* The study identified different levels of improvement in English language skills areas through the use of a range of Scratch projects, such as common English word roots and games. On the basis of these, the study makes recommendations regarding the utilisation of the instrument, as discussed in Section 8 of this chapter.

The second specific aim was *to investigate the effectiveness of the Scratch computational environment in terms of its pedagogical contribution to helping young adult ESOL learners to improve their English language skills.* The study has shown the potential for Scratch effectively to enhance the learning and teaching practices in ESOL programmes. The study explored and evaluated the impact of computational environments on improving the English skill areas of ESOL students. The findings revealed that there are linguistic, computational and attitudinal gains. In specific terms and in line with the framework of the Adult ESOL Core Curriculum (Steeds, 2001), the linguistic outcomes of the case studies show that the Scratch computational interventions were more useful and effective at the word and sentence level than the text level.

9.4 A Summary of the Empirical Findings and Conclusions

The main empirical findings were discussed and summarised in the preceding three chapters, Chapter 6: Case Studies, Chapter 7: Discussion and Reflection, and Chapter 8: Scratch Tutors' Views on the Impact of Scratch (Survey 4), which served in triangulating the findings from multiple data sets. This section will, however, synthesise the empirical findings in order to answer the research question: *to what extent can constructionist interventions such as Scratch contribute to the achievement of higher levels of literacies among young adult ESOL learners?*

The study showed that Scratch can contribute to improving the multiliteracies of the core research participants through engaging them in constructionist, computational and multimodal practices. The projects discussed are an illustration of contextualised, personalised and computational learning activities that demonstrate aspects of emerging learning trends such as personalised and adaptive learning. In addition, the employment of Scratch can engender linguistic, computational and attitudinal gains that contributed to enhancing the English skills of ESOL students. These gains are in line with the cognitive, psycho-motor and affective learning domains respectively, which shows a convergence with Bloom's Taxonomy of learning domains (Anderson et al., 2001; Krathwohl, 2002).

9.4.1 Conclusion Drawn from the Case Studies

The case studies provide a framework for incorporating Scratch into ESOL classrooms. This process employed a complementary approach which suggests a framework for thinking about the potential of constructionist and computational interventions to complement ESOL teaching and learning. When groups of students were engaged in Scratch activities, they developed their computational thinking skills which are considered life skills (Wing, 2006). They experimented with Scratch projects in their learning and developed new techniques for acquiring knowledge. During this process, a number of Scratch projects were created, remixed and used by the core participant students. This had social and cultural effects such as higher levels of classroom communication, cultural expression and cross-language projects. In particular, using Scratch and computational practices to complement the ESOL classroom activities led and contributed to enhancing learning practices at the following three levels:

Level 1: direct outcomes:

a) A number of students and tutors were trained in using Scratch, which enabled the students to develop new understandings of computational thinking skills as documented in the Scratch projects created, remixed and used in the case studies.

b) The students were encouraged to experiment with and to construct Scratch projects related to the topics discussed in their ESOL classes.

c) There were higher levels of incorporation of students' mother tongue in classroom activities, more cross-language projects and activities, and more potential for cultural expression and inclusion.

d) There was effective employment of ESOL learning strategies. The Scratch computational environment helped to serve the visual, structural, contextual, and phonic ESOL learning strategies indicated in the Adult ESOL Core Curriculum (Steeds, 2001).

e) Increased English vocabulary was achieved through the enhanced ability to develop the knowledge and skills of word families, shared roots, prefixes and suffixes.

Level 2: intermediate outcomes

a) New abilities and learning attitudes were developed towards learning English as a second language, the use of didactic learning techniques decreased, and learning activities were extending outside of the normal classroom teaching hours.

b) The use of personalised and favourable learning practices increased, and there was more enriched active and playful learning.

c) Meaningful self-expression and motivation to learn were supported and self-confidence increased.

Level 3: ultimate outcomes

a) The exploration, design and development of new multimodal literacy practices using the Scratch tool were enhanced.

b) The incorporation of interest-driven learning activities was maximised and opportunities for self and creative expressions increased. In essence, computational thinking practices produced a catalyst environment for encouraging creativity in the ESOL learning programme.

c) The tutor's competencies were developed and he provided additional opportunities for literacy learning via classroom activities, ICT sessions and extra-curricular activities tailored to ESOL and literacy learners which portrayed the complementary approach of using the Scratch computational tool.

d) Ultimately, this contributed to the development of innovative and creative literacy learning practices, which were helpful in improving learners' skills and their understanding of English as a second language.

9.4.2 Conclusions Drawn from Scratch Tutors' Views

The findings from the Scratch tutors' survey in the UK revealed important indicators that associate the use of Scratch with improvements in students' skills in various subjects including English. In particular, the survey showed that 64.8% of Scratch tutors believed that Scratch could be used to improve learners' achievement in English language subjects. It also showed that 45.2% of tutors thought that English language skills could be enhanced using Scratch. These indicators challenge the perception of using Scratch, and computing learning activities in general, merely as technical tools to promote programming, computing and technical knowledge as discussed in Section 2.4 entitled, “Computing, ICT and Literacy”, in Chapter 2.

9.4.3 Bridging the Gap between Research and Practice

The application of computational medium, exemplified by Scratch, in ESOL programmes symbolises a nascent approach to literacy teaching and learning. The study has shown how the multiliteracies framework can be actualised through the application of the computational environments in ESOL literacy teaching and learning. This project, therefore, contributes to strengthening the relationship between researchers and tutors, as the gap between research and practitioners has been more evident in education discipline than in other disciplines such as science, medicine and engineering (Ollofsson and Lindberg, 2014).

In this context, this study has provided a distinctive empirical approach to multimodal literacy and multiliteracies through the constructionist and computational frameworks. I believe that this empirical approach to sociocultural literacy contributes to narrowing the gap between research and practice in literacy teaching and learning. I argue that the emerging views of the computational and constructionist environments provide an essential application for the promotion of an understanding of the multiliteracies approach in theory and practice. These emerging views are particularly useful for tutors and practitioners in literacy and ESOL programmes as they may support the deployment of multimodality and multiliteracies practices in mainstream education. As such, this deployment contributes to tackling the deficit, cognitive and human-resource-centred models of education in the UK as noted by Murphy et al. (2009), Ade-Ojo (2015) and Hamilton and Barton (2000) respectively. In addition, the approach taken in this study serves to explore not only necessary understandings of new forms of text (Jewitt, 2013; Kress, 2000) but also an application of these understandings in a mainstream literacy programme.

9.5 Theoretical Implications

There are four key issues that underpin the discussion of the theoretical implications of this study and which contribute to answering the study’s research questions:

First is the relevance and effectiveness of the Scratch computational tool to improve the multimodality and multiliteracies of the ESOL learners. The study has not only shown that using Scratch is useful in ESOL teaching and learning practice; it has also demonstrated its potential for enhancing the English skill areas of learners. This has provided insights into the application of multiliteracies in practice, as evidenced in the projects discussed in the case studies.

Second, this study has documented a contribution to the group of core participant ESOL students and their tutor who benefited from taking part in the project. Those participant students were able to improve their English skills, engage more deeply in classroom discussion and take their work on ESOL activities home. They were able to gain new abilities that contributed to the development of attitudes and techniques to improve their English skills and learning practices, as established in the case studies. The tutor also benefited by taking part in this study. The project provided him with an additional pedagogical tool, which he continued to utilise with his students, as discussed in Section 6 entitled, "Evidence that Use of Scratch Continued after the End of the Study", in Chapter 7.

Third, the complementary approach developed in this study demonstrates the incorporation of computational environments and constructionist tools into ESOL and literacy programmes. This approach is operationalised by employing computational and constructionist tools, such as Scratch, in the delivery of ESOL curricular activities. Therefore, the complementary approach offers an effective pedagogical framework for literacy teaching and learning, which transcends the technical representations of Scratch and encourages learning inside and outside of the classroom.

Fourth, although this research may not be statistically generalisable, it can be argued that it maintains a theoretical and analytical generalisation (Yin, 2009) because it represents a contextualised learning hypothesis (Lincoln and Guba, 1985), as discussed in Chapter 4, Section 4.6, entitled "Internal Validity and Reliability". It can, therefore, be argued that the research has generated a theoretical and analytical framework that can be applied to other ESOL programmes and literacy learning contexts given the following four primary assumptions: (1) tutors are willing to commit themselves to one or two terms; (2) learners attend the centre or college regularly; (3) students have regular access to the Internet at college and at home and are willing to take part in complementary Scratch activities; and (4) there is a well-equipped learning institution with computers and computing devices and a broadband internet connection.

9.6 Contribution to Knowledge

This study demonstrates how Scratch as an illustration of constructionist tools can generate pedagogical frameworks that are useful for promoting literacy teaching and learning. This is one way of showing how multiliteracies theoretical arguments can be utilised in practice. The research shows a synergy between constructionist learning theory and the sociocultural, multimodal and new literacy approaches to literacy. The study has explored an innovative approach to improving learning and teaching in ESOL programmes. It demonstrates the impact of using Scratch in promoting and facilitating literacy learning in a multimodal context. This approach has shown how contextualised, personalised, and meaningful computational practices can contribute to improving learning and can benefit users in developing higher levels of multiliteracies.

In theory, the research contributes to the discussions of the application of multimodal and multiliteracies in literacy teaching and learning. These are explored below:

1. The *dynamic computational sociocultural medium*: This computational medium (Figure 3.3 in Chapter 3) was proposed as a conceptual framework for understanding recent computational trends incorporating forms of digitisation, abstraction and encapsulation of social practices. This medium offers a new conceptualisation of an emerging computational culture. This structure also integrates the concept of sociocultural views of literacy. In essence, the medium hypothesises fundamental changes in the technology timeline and suggests computational thinking as one of the attributes of this expanding new medium. This conceptualisation of the computational sociocultural medium provides a historical illustration of interdisciplinary shifts around education, media and society. These shifts were marked through the four eras of: (1) industrial societies, (2) the communication revolution (e.g. telephone, radio and television), (3) knowledge societies (e.g. digital media, Internet, and mobile), and (4) the computational culture, which is marked by creativity (Resnick, 2008) and new media (Jenkins, 2006).

2. *The zone of computational practices and expression* (Figure 7.1 in Chapter 7): This *computational zone* presents a computational version of Vygotsky's Zone of Proximal Development (ZDP). This computational zone is helpful to operationalise and maximise

learning through computational thinking and computational environments. The *computational zone* presents new perspectives on the computational environments in which the participation of learners is underpinned by concepts around abstraction and usability. This notion presents a zone in which expression and learning using computational practices is maximised. It demarcates areas that distinguish computational practices from technical practices and passive ones. This concept provides insights into the relationship between computational thinking practices on the one hand and abstraction, usability and, therefore, participation on the other. As such, the computational zone provides a framework for understanding emerging computational practices which include visual programming environments such as Scratch.

3. *The complementary approach* to incorporating computational practices into literacy teaching and learning: I argue that the complementary approach has contributed to balancing the focus between the curriculum-centred and student-centred views of teaching and learning. Although this approach is at the heart of the empirical side of this study, it contributes to the development of pedagogical notions around the complementary role of computational tools. Therefore, complementing literacy learning programmes with computational tools constitutes another theoretical contribution in this research.

9.7 Difficulties and Limitations of the Study

1. Access to research sites was key a challenge in this project. Given that this type of research requires an initial commitment for an extended period, the recruitment process constituted a challenge and imposed several limitations and difficulties during the research journey. The following remarks provide details of the limitations and difficulties caused by access and recruitment cycles:

    a) Common barriers that emerged during the communication phase were initiated by the effects of the principles of the assessment-led, or instruction-led, curriculum model on ESOL tutors as discussed in Chapter 5 regarding Phase 1 and Phase 2 of communications.

b) Literacy tutors usually lack technical experience and understanding, and sometimes they develop a phobia-like attitude towards topics such as computing and computational programming and practices.

c) Lack of incentives for tutors to experiment and develop new ways of learning.

d) Lack of institutional support and planning, and perhaps the absence of a functional strategic vision to host new studies that could help in developing the communities of learners at these institutions. The targeted institutions follow the dominant top-down system that provides them with the instructions and manuals for teaching and assessing ESOL and literacy students.

2. Time was a major constraint for the researcher as well as for the project core participants. Most of the students those who participated and whose who did not eventually agree to participate more fully in the study raised the issues of time constraints and of their college workload. It was crucial for the ESOL students to achieve the best possible grades to be accepted onto their favourite courses at the college. Failure to be accepted onto their preferred courses meant that they were forced to apply for an alternative course or to go to another college. In addition, because the study aimed to complement the existing ESOL curriculum with Scratch activities, classroom time constrained the possibility of students exploring more Scratch projects in further detail.

3. The diversity of ESOL students was another challenge in carrying out this study. ESOL students usually have diverse attributes including age, culture, and level of English language skills. Therefore, this posed a challenge not only to the researcher but also to the ESOL tutors. Furthermore, researching teenagers and young people raises the challenge bar higher. Teenagers are harder to work with and less predictable than adults. For example, scheduling an interview with a student is not an easy process particularly in the case of vulnerable students or new residents who have moved to England in the previous 1-3 years.

4. Scratch is seen as "childish" computer software: existing users of Scratch sometimes describe it as a "game" or a "childish" programme, and this can negatively impact on other students in the classroom. Students sometimes associate the use of Scratch with the computing classes in primary schools that started in 2014 with the introduction of the

new computing curriculum in the UK. Given the social effects in a classroom, labelling Scratch as “childish” can impose a barrier to a larger segment of students engaging deeply in Scratch activities.

5. From a positivist point of view, perhaps the major limitation of this study is that it is not generalisable or replicable as is the case with “true” experiments. That is following the naturalistic paradigm, it may not be replicable in a similar way to experimental or quasi-experimental research. However, from a post-positivist perspective, this study shows “transferability” with the findings and conclusions leading to “lessons learned that may be germane to a larger population, a different setting, or another group” (O’Leary 2014, p62). The study also demonstrates “audibility” that “accepts the importance of the research context and, therefore, seeks full explication of methods to allow others to see how and why the researchers arrived at their conclusions” (OLeary 2014, p62).

9.8 RECOMMENDATIONS

The recommendations arising from this research regarding using Scratch to support ESOL learners to achieve higher levels of multiliteracies and improve their English skills are synthesised in the subsequent sections:

9.8.1 The Incorporation of Constructionist Tools and Computational Medium

As discussed earlier in this chapter, this study contributed to improving the English skill areas of ESOL learners as a result of utilising Scratch in their teaching and learning. The following three key recommendations guide the process of incorporating Scratch into ESOL programmes using a complementary approach.

a) The incorporation of Scratch, as an illustration of a constructionist tool, into ESOL programmes, is beneficial to ESOL students.

b) The incorporation of Scratch into ESOL programmes should be more focused on the applications constructed through the computational environment than on technical programming skills. The latter are developed as learners engage in constructing meaningful projects related to their own interests.

c) The complementary approach should be adapted to the design of the computational pedagogy for ESOL programmes that employ the Scratch tool.

9.8.2 Recruitment, Training and Induction

The main recommendations regarding securing research sites, recruiting participants, and carrying out training and induction are vital to a successful incorporation of Scratch into an ESOL programme. The following recommendations emerged from the processes of recruitment, training and induction at the research site:

a. The complementary approach to incorporating Scratch into ESOL programmes should follow participatory techniques aimed at involving tutors in the planning and design of the training and implementation processes.

b. Engaging institutions (e.g. colleges, schools and community centres) should maintain a balance between a top-down and the bottom-up approach in inviting institutions to participate in similar interventions.

c. The training of ESOL tutors should be in line with the context and needs of their working environment. The induction and training should also be designed in advance, in collaboration with participant tutors.

9.8.3 Working with ESOL Students

Engaging ESOL students is a key issue in complementing their teaching and learning using Scratch. The following list provides recommendations for inviting and working with ESOL students on Scratch complementary activities:

a. Provide a basic orientation about Scratch and start simple. There should be no detailed technical instructions similar to in IT or computing class.

b. Tutors should use Scratch templates that are related to topics discussed in the ESOL class which will serve to fulfil and extend the ESOL core curriculum.

c. Tutors should be encouraged to use Scratch themes that complement their teachings, such as storytelling, games, daily communication routines and real-life scenarios.

9.8.4 Policy Recommendations

As discussed in Chapter 2 Section 2.3 entitled, “Literacy Language Learning: The Context of the UK”, profound changes took place after the commencement of this study. The Department for Education (2014) announced new statutory computing programmes in the national curriculum for England which replace the old ICT curriculum and widely use the Scratch tool; the "Year of Code" initiative was launched and many other initiatives that promote computing have been established. These changes can be seen as a response to the continual development of computing tools and computational medium. Yet this study recommends allocating additional funding, for ESOL learning programmes, which supports upgrading the existing computer hardware in the Sixth Form Colleges.

In this context, one manifestation of this study is that it provides a framework for shedding light on the potential of constructionist and computational interventions, exemplified by Scratch, in subjects other than computing. This framework suggests that, from a computational perspective, the pedagogy of computing should not be solely focused on technical skills and competencies (e.g. coding and programming). Nevertheless, computational applications can enrich technical skills and make them relevant and attractive to students. One way to accomplish this is through utilising the complementary approach illustrated in this study.

9.9 Implications for Future Research

This study has highlighted a number of potential areas for research:

1- Complementary computational literacy interventions: while the conceptual and theoretical generalisability of this study is at this stage tentative, possible future projects would be to test the application of this approach in a variety of literacy learning settings, recruiting either a larger number of research participants and/or conducting a longitudinal study. In addition, the study has suggested that further research be conducted into additional second-language learning programmes, such as Modern Foreign Languages and English as an Additional Language. This would be beneficial in drawing a broader picture of the approach utilised in this project.

2- Personalised and adaptive learning environments: this study has suggested that further research be carried out into the implications and implementation of personalised and adaptive learning environments and strategies based on computational interventions.

3- The complementary approach embraced in this study has promoted the idea of additional research into the design and implementation of computational cross-curricular activities. While the complementary approach has shown to be helpful to engaging ESOL students, the conceptualisation and implications of cross-curricular activities within computational frameworks would be a useful addition to this project.

4- Creativity: the creative expression illustrated in the employment of the constructionist approach has implications for future research that investigates perspectives on creativity in literacy and language learning and teaching.

5- Balancing the curriculum-centred and student-centred approaches: the constructionist-computational framework in this research advocates a balance between the curriculum-centred and student centred approaches. This type of balance has been shown to be beneficial for encouraging relevant and interesting learning activities in ESOL classrooms.

6- The "quality" of literacy teachers: the framework of the complementary interventions in this project has suggested further research to examine the impact of the framework on increasing the quality and effectiveness of literacy teachers in the UK.

9.10 A FINAL REFLECTION

While the theorisation and proliferation of terminologies around the on-going developments in technological innovations as well as literacy notion may continue to increase, I think that applications of knowledge and theory are driving positive changes that benefit learners and, therefore, societies at large. In the meantime, this study has not only contributed to the generation of new knowledge but has also helped the participant learners and tutor and supported the learners in enhancing their English skills using computational activities. The results that have emerged from this project show that although this study that combines perspective on theory and practice is harder to carry out, it is definitely more rewarding.

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APPENDICES

Appendix 1

Core Participants Consent Form. Page 1 of 3.

RESEARCH ON USING SCRATCH PROGRAMMING LANGUAGE IN LITERACY STUDIES

UNIVERSITY of GREENWICH

PARTICIPANT CONSENT FORM

To be completed by the participant. If the participant is under 18, to be completed by the parent / guardian / person acting *in loco parentis*.

- I have read the information sheet about this study
- I have had an opportunity to ask questions and discuss this study
- I have received satisfactory answers to all my questions
- I have received enough information about this study
- I understand that I am / the participant is free to withdraw from this study:
  - At any time (until such date as this will no longer be possible, which I have been told).
  - Without giving a reason for withdrawing.
- I understand that my research data may be used for a further project in anonymous form, but I am able to opt out of this if I so wish, by ticking here. ☐
- I agree to take part in this study.
- I agree to participate in the following-up interviews and focus groups.

(Please tick all that apply)

[ ] I give permission for this interview and/or focus group to be recorded using a digital audio recorder.

[ ] I give permission for the following information to be included in publications resulting from this study.

[ ] "Pretend" name [ ] my title [ ] direct quotes from this interview and/or focus group.

[ ] As a parent / guardian, I give my permission for my son/daughter ________________ to participate in this research.

Signed (participant)	Date
Name in block letters	
Signed (parent/guardian/other) (if under 18)	Date
Name in block letters	
Signature of researcher	Date

This project is supervised by:

1- Dr. Gordon Ade-Ojo. **Email address:** G.O.Ade-Ojo@greenwich.ac.uk
2- Professor Ian McNay. **Email address:** i.mcnay@gre.ac.uk

Researcher's contact details (including telephone number and e-mail address):
Raed Yacoub – Room: H111 – Address: Mansion House, Bexley Road, London SE9 2PQ
Office: +44 (0)20 8331 9552 – Email: R.Yacoub@gre.ac.uk

Page 1 of 3

Appendix 1

Participant Consent Form. Page 2 of 3.

RESEARCH ON USING SCRATCH PROGRAMMING LANGUAGE IN LITERACY STUDIES

UNIVERSITY of GREENWICH

CONSENT TO PARTICIPATE IN RESEARCH – INFORMATION SHEET

My name is Raed Yacoub, I`m a PhD student at the School of Education in the Faculty of Education and Health at the University of Greenwich in London. Please read all the items on this list and the attached interview and focus group consent form. Then, if you understand and agree with them all, sign in the space at the cover page. I will also sign and give that copy to you.

1. We are asking you to take part in a research study because we are trying to learn more about how learners can enhance their learning process using a friendly computer-programming-language called Scratch.

2. If you agree to take part in this research, you will be introduced to the Scratch programming language. After you have used the programme for some time, we will have some interviews and/or focus group sessions with you. With your permission, we will record these interviews. We will also be looking at the portfolio you will have produced while using the programme and will speak to your teacher. The reason is for us to find out more about how useful this programme has been for you.

3. **For participants under 18 years old:** Please talk this over with your parents or guardian before you decide whether or not to participate. We will also ask your parents or guardian to give their permission for you to take part in this study. But even if they say "yes" you can still decide not to participate.

4. We will be observing your class and taking notes about the progress of the work you are doing.

5. If you ever feel uncomfortable or distressed from being part of this research, please let us know immediately. At any stage of the project, you may choose not to answer any of the questions you may be asked, discuss any of the questions with your school counsellor or withdraw from the study if you wish to.

6. You have a right to refuse to participate in this research even if it was introduced to you by your teachers. Remember, deciding to participate in this research is up to you and no one will be upset if you don't want to participate or even if you change your mind later and want to stop.

7. You can ask any questions that you have about the research now or at any time during the project. If you want to check the Scratch computer programming language, you may see the following web link:
Scratch online community: http://scratch.mit.edu/
About Scratch: http://scratch.mit.edu/about/

8. We hope that this research will give you an opportunity to experience new ways of using the computer to develop new literacy and life skills. We also hope you will enjoy taking part in this research,

9. Signing your name on the cover page means that you agree to take part in this research. I will also sign my name and give a copy to you.

10. If you ever feel you have been treated unfairly, or you have concerns regarding your rights as a research subject, you may contact my research supervisor, Dr. Gordon Ade-Ojo, Centre for Leadership/ Dept. of LLTE, Avery Hill Campus, University of Greenwich - London SE9 2PQ. Tel: 0208 331 9349.

Appendix 1

Participant Consent Form. Page 3 of 3.

RESEARCH ON USING SCRATCH PROGRAMMING LANGUAGE IN LITERACY STUDIES

UNIVERSITY *of* GREENWICH

Consent to Participate in Focus Group and Interview

You have been asked to participate in a PhD research conducted by Raed Yacoub from the School of Education at the University of Greenwich. The purpose of this research is to examine and discover how Scratch programming language may contribute in enhancing the learning process of learners. Specifically, the research aims to:

1. Examine the effectiveness of Scratch programming language in supporting learners through their learning activities.
2. Discover insights on using the new tool of Scratch in classroom, apprenticeship and workshop settings.
3. To investigate how helpful and effective is the Scratch programming language in enhancing teaching and learning in classrooms and workshops settings.

Please read all the items on this list. Then, if you understand and agree with them all, sign in the space at the cover page. I will also sign and give that copy to you:

- This Interview/focus group discussion is voluntary. You have the right not to answer any question, and to leave the discussion at any time or for any reason. We expect the focus group to take up to one and half hours and the interview to take up to one hour.
- You will not be compensated for participating in the interview or the focus group discussions.
- Any information you provide will be confidential.
- Your "pretend" name, title, and/or quote will not be used in any publication that may result from this research without your permission.
- We wish to record this discussion using a digital audio recorder. We will not record this discussion without your permission. If you do grant permission for your conversation to be recorded, you have the right to revoke recording permission and/or end your participation at any time.
- This research will be completed by December 2015. All recordings of the focus group discussions and interviews will be stored in a password protected secure work space until a suitable time to erase the data, usually a year after the project finished.

- **For participants under 18 years old:** Please talk this over with your parents or guardian before you decide whether or not to participate. We will also ask your parents or guardian to give their permission for you to take part in this study. But even if they say "yes" you can still decide not to participate.

Appendix 2

An **e**xample of the survey on the Usage of the Internet and Scratch (Survey 1). Page 1 of 1

RESEARCH ON USING SCRATCH PROGRAMMING
LANGUAGE IN LITERACY STUDIES

UNIVERSITY of GREENWICH

Internet Usage Questionnaire

Date:

Instructions: Please complete this questionnaire by answering the following 4 Questions:

Question (1): How often do you use the Internet?

Most days ○	More than ○ once a week	Once a week ○	Once a month ○	Less than ○ once a month

Question (1.1): If you use Internet every day how many hours do you use it for?

Less than 1 ○ hour a day	1-2 hours ○	2-3 hours ○	3 - 4 hours ○	More than 4 ○ hours a day

Question (2): Where do you use the internet most?

Home ○	School ○	Café ○	Library ○	Your Moble ○ Phone	Family's ○ House	Other (Please specify) ....

Question (3): What do you use the internet for? (Tick all that applies)

School ○ work	Shopping ○	Entertainment (i.e., games & Movies)	Social Media ○ (i.e., facebook)	Gathering ○ information for personal needs	Other ○ (Please specify) ....

Question (4): Have you ever used the Scratch Software before you heard about it from your tutor or from the researcher?

I use Scratch ○ frequently	I have used ○ Scratch few times	I have not used ○ Scratch	I have no knowledge ○ of Scratch

Optional Question, if you would like to share your name and class

Name:__________________________ Class:________________________

Thank You

Questionnaire for Research conducting by Raed Yacoub – University of Greenwich - Page 1 of 1

Appendix 3

An example of the students' survey who were not able to participate more fully in the study (Survey 2). Page 1 of 1

RESEARCH ON USING SCRATCH PROGRAMMING
LANGUAGE IN LITERACY STUDIES

Questionnaire for students who did not participate in the Scratch project

Date: 19 May 2015

Instructions: Please complete this questionnaire by answering the following 4 Questions (Your participation is voluntary in this questionnaire)

Class:

Gender: [ ] Male [ ] Female

Question (1): I decided not to participate in the Scratch group because: (Tick all that applies)

[ ] I have little or no time
[ ] It is a complicated programme, I don't understand it.
[ ] I think it is not relevant for my studies.
[ ] I am just not interested.
[ ] Other: ____________________

Question (2): I have been given enough information to make a decision about my participation in the Scratch group.

[ ] Strongly agree [ ] agree [ ] neutral [ ] do not agree [ ] strongly do not agree

---

Question (3): The opinion and comments of other students in the class affected my decision to not take part in the Scratch team.

[ ] Strongly agree [ ] agree [ ] neutral [ ] do not agree [ ] strongly do not agree

---

Question (4): Have you ever used the Scratch Software before you heard about it from your tutor or from the researcher?

[ ] I use Scratch frequently [ ] I have used Scratch few times [ ] I have not used Scratch [ ] I have no knowledge of Scratch

Other comments: ____

Thank You

Questionnaire for Research conducting by Raed Yacoub – University of Greenwich - Page 1 of 1

Appendix 4

An example of the tutors' survey who were not able to participate more fully in the study (Survey 3). Page 1 of 2.

Survey For the Tutors Who were Not Able to Participate in the Scratch Study

You have been asked to participate in this survey which is part of a PhD research conducted at the Faculty of Education and Health at the University of Greenwich in London. The purpose of this research is to explore the extent to which Scratch may be helpful in supporting Literacy learners (i.e NEET, ESOL, EAL) in achieving higher levels of literacies.

This survey is tailored to tutors and educators who were unable to take part in the study. Our objective is to explore reasons why several educators and tutors were unable to participate in this study. The survey should take no longer than 5 minutes to complete.

For any question about this survey, please contact the researcher Raed Yacoub on r.yacoub@greenwich.ac.uk, or the research supervisors: Dr Gordon Ade-ojo on G.O.Ade-Ojo@greenwich.ac.uk or Professor Ian Mcnay on I.McNay@greenwich.ac.uk
Thank you for your contribution, your opinion is very important for us. Please read the following and if you agree, tick the box 'Yes' and click 'Continue' to start the survey.

CONSENT
• I have read the information about this survey.
• I have received a contact email to ask questions and discuss the evaluation if I so wish.
• I understand all information will be anonymised except where I have chosen otherwise.
• I understand that my consent is voluntary.

*Required

1. **Have you read and understood the contents of this form and agree to participate in this study? * ***
Mark only one oval.
◯ Yes
◯ No *Stop filling out this form.*

2. **Age** *
Mark only one oval.
◯ 18 - 19 years old
◯ 20 - 29 years old
◯ 30 - 39 years old
◯ 40 - 49 years old
◯ 50+ years old

3. **Gender** *
Mark only one oval.
◯ Female
◯ Male

4. **Number of years of teaching experience** *

....

Appendix 4

An example of the Tutors' Survey who were not able to participate in the study (Survey 3). Page 2 of 2.

5. **On which of the following programmes do you teach?** *
   < please tick all that apply >
   Tick all that apply.
   - ☐ English for Speakers of Other Languages (ESOL)
   - ☐ English as an Additional Language (EAL)
   - ☐ Not in Education, Employment, or Training (NEET)
   - ☐ Other: ____________

6. **At what level or levels do you teach?** *
   Tick all that apply.
   - ☐ Primary education
   - ☐ Secondary education
   - ☐ Sixth Form College
   - ☐ Mainstream FE College
   - ☐ Adult Community Centre
   - ☐ Other: ____________

7. **Have you ever utilised any computing or computational tools or software in your teaching with students?** *
   Mark only one oval.
   - ◯ Yes
   - ◯ No

8. **If you answered 'yes' to the question above, please name the tool(s) you have used with your students.**

   ____
   ____
   ____
   ____
   ____

9. **Please share up to three reasons why you decided not to take part in this Study?** *

   ____
   ____
   ____
   ____
   ____

Appendix 5

An example of the survey for Scratch tutors in the UK (Survey 4). Page 1 of 5.

Survey on using Scratch to support learners in developing their English language skills.

This survey is part of a PhD research conducted at the Faculty of Education and Health at the University of Greenwich in London. The purpose of this research is to examine and discover how Scratch may be helpful in supporting English for speakers of Other Languages (ESOL) learners and programmes, and help ESOL students achieve higher levels of literacies. It should take around 5-7 minutes to complete this survey.

For any question about this survey, please contact the researcher Raed Yacoub on r.yacoub@greenwich.ac.uk.Or the research supervisors: Dr Gordon Ade-ojo on G.O.Ade-Ojo@greenwich.ac.uk, or Professor Ian Mcnay on I.McNay@greenwich.ac.uk.

Thank you for your contribution, your opinion is very important for us. Please read the followings and if you agree, tick the box 'Yes' and click 'Continue' to start the survey.

CONSENT
• I have read the information about this survey.
• I have received a contact email to ask questions and discuss the evaluation if I so wish.
• I understand all information will be anonymised except where I have chosen otherwise.
• I understand that my consent is voluntary.

*Required

1. **Have you read and understood the contents of this form and agree to participate in this study?** *

   Mark only one oval.

   - ◯ Yes *Skip to question 2.*
   - ◯ No *Stop filling out this form.*

2. **Country** *

   Mark only one oval.

   - ◯ UK
   - ◯ Other: ____________

3. **Age** *

   Mark only one oval.

   - ◯ 18 - 19 years old
   - ◯ 20 - 29 years old
   - ◯ 30 - 39 years old
   - ◯ 40 - 49 years old
   - ◯ 50+ years old

4. **Gender** *

   Mark only one oval.

   - ◯ Female
   - ◯ Male

Appendix 5

An example of the survey for Scratch tutors on the UK (Survey 4). Page 2 of 5.

5. **Number of years of teaching experience?** *

____

6. **Do you have experience of teaching Scratch to students?** *
   Mark only one oval.
   - ( ) Yes *Skip to question 7.*
   - ( ) No *Skip to question 12.*

7. **How many years of experience do you have of using Scratch with students?**
   Mark only one oval.
   - ( ) Less than 1 year
   - ( ) 1 - 2 years
   - ( ) 3 - 4 years
   - ( ) 5 years or more

8. **At what levels have you do you teach Scratch?**
   Tick all that apply.
   - [ ] Primary school
   - [ ] Elementary school
   - [ ] High school
   - [ ] Six Form Centres and Post compulsory education
   - [ ] Community collage
   - [ ] Voluntary or after-school programmes.
   - [ ] Other: _______________

9. **Scratch and computing skills are helpful to enable students achieve higher levels of literacies?** *
   < agree or disagree >
   Mark only one oval.
   - ( ) Yes
   - ( ) No *Skip to question 12.*

Appendix 5

An example of the survey for Scratch tutors on the UK (Survey 4). Page 3 of 5.

10. **In which subject area do you think Scratch can be used to improve learners' achievement?**
   < please tick all that apply >
   Tick all that apply.

   - [ ] Science
   - [ ] Computing subjects
   - [ ] Art and Design
   - [ ] Music
   - [ ] Mathematics subjects
   - [ ] Geography
   - [ ] English Language
   - [ ] Physical Education
   - [ ] Citizenship
   - [ ] Other: ....

11. **Please explain how you think Scratch has improved the achievement of your learners in the subject(s) identified above.**
   < Please give 3 reasons why you think so >

   ....
   ....
   ....
   ....
   ....

12. **Scratch is helpful in enhancing the skills of students** *
   < agree or disagree >
   Mark only one oval.

   - ( ) Yes
   - ( ) No *Skip to question 15.*

13. **Which of the following skills do you think can be improved using Scratch?**
   < tick all that apply >
   Tick all that apply.

   - [ ] Computational thinking
   - [ ] Imaginations
   - [ ] Creativity
   - [ ] Expression
   - [ ] English Language as a second language (writing, reading, or speaking)
   - [ ] Communication
   - [ ] Other: ....

Appendix 5

An example of the survey for Scratch tutors on the UK (Survey 4). Page 4 of 5.

14. **If you ticked any of the above skills, please explain why:**

....

....

....

....

....

15. **Do you utilise any of the following in your teaching with students?**

< please tick all that apply >

Tick all that apply.

- ☐ YOUNG REWIRED STATE (youngrewiredstate.org)
- ☐ RASPBERRY PI (raspberrypi.org)
- ☐ DECODED (decoded.co/uk
- ☐ CODERDOJO (coderdojo.com)
- ☐ CODE KINGDOMS (codekingdoms.com)
- ☐ CODECADEMY (codecademy.com)
- ☐ Hour of Code (uk.code.org)
- ☐ KANO (www.kano.me)
- ☐ Other: ....

16. **If you ticked any of the above computational platforms, please explain how this may be different from Scratch?**

....

....

....

....

....

17. **Please share one or two key points of learning from your reflections based on your experience of using Scratch or computational environments with students?**

....

....

....

....

....

Appendix 5

An example of the survey for Scratch tutors on the UK (Survey 4). Page 5 of 5.

11/18/2015 Survey on using Scratch to support learners in developing their English language skills.

18. **Contact details: Name, email and institution**

< Optional Question, we may contact you to learn more about your experience using Scratch with your students >

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Appendix 6

A list of the semi-structured interviews conducted in this study. Page 1 of 1.

	Interview	Date and location	Notes
1	Interview with The ESOL tutor, David Alexander.	11 June 2015, Haringey Sixth Form Centre.	The core participant ESOL tutor
2	Interview with JFE2	13 May 2015, Haringey Sixth Form Centre.	Core participant student
3	Interview with SFL1	20 May 2015, Haringey Sixth Form Centre.	Core participant student
4	Interview with SME2	27 May 2015, Haringey Sixth Form Centre.	Core participant student
5	Interview with GFL1	6 June 2015, Haringey Sixth Form Centre.	Core participant student
6	Interview with KME2	10 June 2015, Haringey Sixth Form Centre.	Core participant student
7	Interview with non-core participant student AML1	12 May 2015, Haringey Sixth Form Centre.	Non-core participant student
8	Interview with tutor N	23 January 2015, Greenwich	non-core participant tutor
9	Interview with D	20 November 2014 East London	non-core participant tutor

Appendix 7

Training outline and schedule for the ESOL tutors at the research site. Page 1 of 1.

28th of November 2014

Training outline

Scratch programming environment

Session 1: Friday 28th of November, 12:00 - 1:30 pm
- Background and Overview: why Scratch?
- Create, Save and Share projects
- Scratch screens and blocks: Motion, Looks, Sound, Pen, Events, Control, Sensing, Coordinates
- Create your own Scratch project
- Short break
- Scratch Online Community: Project Themes and Project Studios:
    - Storytelling projects
    - Music, songs, and fan clubs
    - English language projects: English alphabet, spelling, and pronunciation.
- Your Scratch project
- Intro to Variables and Lists, Sharing and Remixing projects

Session 2: Tuesday 2nd of December, 2:00 - 3:30 pm
- Review of session 1
- Sensing: touching, colours, sound levels, video motion, and other sensing functions.
- Variables and Lists
- Short break
- English alphabet and Spelling Scratch Projects
- Sharing and Remixing
- Working on your project

Session 3: Friday 5th of December, 12:00 - 1:30 pm
- Review of Session 2
- Finalising teachers Scratch projects.
- Presenting and discussing ESOL teachers Scratch Projects
- Short break
- Reflecting on ESOL Themes and Scratch through selected ESOL Exercises and mini Projects through Scratch.
- Looking ahead and reflecting on how this can be helpful for ESOL and English language learners.

Session 4: Tuesday 9th of December, 2:00 - 3:30 pm
- Planning introducing Scratch into one or two of your ESOL classes.
- Set classes and dates.

Training conducted by: Raed Yacoub, PhD Research Fellow
School of Education, University of Greenwich, Avery Hill Campus, London SE9 2PQ
Email: R.Yacoub@gre.ac.uk * Office: +44 (0)20 8331 9552

Appendix 8

The UK national qualification framework. Page 1 of 1.

		Key skills Level 5	National qualifications framework Level 5
		Key skills Level 4	National qualifications framework Level 4
		Key skills Level 3	National qualifications framework Level 3 (e.g. A level)
	Literacy/Numeracy Level 2	Key skills Level 2	National qualifications framework Level 2 (e.g. GCSE A*–C)
National Curriculum Level 5	Literacy/Numeracy Level 1	Key skills Level 1	National qualifications framework Level 1 (e.g. NVQ level)
National Curriculum Level 4			
National Curriculum Level 3	Literacy/Numeracy Entry 3		Entry Level
National Curriculum Level 2	Literacy/Numeracy Entry 2		
National Curriculum Level 1	Literacy/Numeracy Entry 1		

Source: Adult Core Curriculum (Steeds, 2001, p4)

Appendix 9

Words and sentences in the Scratch project entitled "Spelling Game" by a Scratch user called "srearley". Page 1 of 1.

#	English word	Example heard
1	Keeping	Jane is keeping her old car.
2	Feature	Jim outstanding feature is his long crochet nose.
3	Queen	England is ruled by a queen.
4	Method	The scientific method is very useful.
5	Asleep	She dreamed while she was asleep.
6	Spelling	Your spelling needs improvement.
7	Empty	The treasure chest was empty.
8	Television	Eric lost his television remote.
9	Elevator	There is nothing worse than elevator music.
10	Agree	They both agree to behave
11	Beneath	The mammoth is barred beneath the ice
12	Metal	Jane likes heavy metal music.
13	Disease	We should always try to prevent disease.
14	Tea	Would you like a cup of tea?
15	Feelings	He called her a name and hurt her feelings
16	Coffee	Without coffee the world will surely end.
17	Suggested	Eric suggested that Jane get a new car.
18	Deal	That price is a great deal.
19	East	The opposite direction from West is East.
20	Needed	All he needed was a nap.

Appendix 10

Copy of a handout of common Greek and Latin roots and common prefixes and suffixes of English words. Page 1 of 5

Hand-out for participants in the Scratch team – ESOL L1 and E 2/1 classes.

How you can increase your English vocabulary

One way to increase your English vocabulary is to learn the roots of English words. English words usually have either Latin or Greek roots. Therefore, when you learn part of these roots, you will enrich your English vocabulary.

You can have a look at the selected list of common Latin and Greek roots of English words. Then, you can search for Scratch projects that use Latin and Greek roots.

Our best wishes in your written exam. We look forward to seeing you after the Easter break.

David and Raed

Appendix 10

Copy of a handout of common Greek and Latin roots as well as common prefixes and suffixes of English words. Page 2 of 5.

Greek Root	Definition	Example
anthropo	man; human; humanity	anthropologist, philanthropy
auto	self	autobiography, automobile
bio	life	biology, biography
chron	time	chronological, chronic
dyna	power	dynamic, dynamite
dys	bad; hard; unlucky	dysfunctional, dyslexic
gram	thing written	epigram, telegram
graph	writing	graphic, phonograph
hetero	different	heteronym, heterogeneous
homo	same	homonym, homogenous
hydr	water	hydration, dehydrate
hyper	over; above; beyond	hyperactive, hyperbole
hypo	below; beneath	hypothermia, hypothetical
logy	study of	biology, psychology
meter/metr	measure	thermometer, perimeter
micro	small	microbe, microscope
mis/miso	hate	misanthrope, misogyny
mono	one	monologue, monotonous
morph	form; shape	morphology, morphing
nym	name	antonym, synonym
phil	love	philanthropist, philosophy
phobia	fear	claustrophobia, phobic
photo/phos	light	photograph, phosphorous
pseudo	false	pseudonym, pseudoscience
psycho	soul; spirit	psychology, psychic
scope	viewing instrument	microscope, telescope
techno	art; science; skill	technique, technological
tele	far off	television, telephone
therm	heat	thermal, thermometer

Appendix 10

Copy of a handout of common Greek and Latin roots as well as common prefixes and suffixes of English words. Page 3 of 5.

Latin Root	Definition	Example
ambi	both	ambiguous, ambidextrous
aqua	water	aquarium, aquamarine
aud	to hear	audience, audition
bene	good	benefactor, benevolent
cent	one hundred	century, percent
circum	around	circumference, circumstance
contra/counter	against	contradict, encounter
dict	to say	dictation, dictator
duc/duct	to lead	conduct, induce
fac	to do; to make	factory, manufacture
form	shape	conform, reform
fort	strength	fortitude, fortress
fract	break	fracture, fraction
ject	throw	projection, rejection
jud	judge	judicial, prejudice
mal	bad	malevolent, malefactor
mater	mother	maternal, maternity
mit	to send	transmit, admit
mort	death	mortal, mortician
multi	many	multimedia, multiple
pater	father	paternal, paternity
port	to carry	portable, transportation
rupt	to break	bankrupt, disruption
scrib/script	to write	inscription, prescribe
sect/sec	to cut	bisect, section
sent	to feel; to send	consent, resent
spect	to look	inspection, spectator
struct	to build	destruction, restructure
vid/vis	to see	televise, video

Appendix 10

Copy of a handout of common Greek and Latin roots as well as common prefixes and suffixes of English words. Page 4 of 5.

Prefix	Definition	Example
anti-	against	anticlimax
de-	opposite	devalue
dis-	not; opposite of	discover
en-, em-	cause to	enact, empower
fore-	before; front of	foreshadow, forearm
In-, im-	in	income, impulse
in-, im-, il-, ir-	not	indirect, immoral, illiterate, irreverent
inter-	between; among	interrupt
mid-	middle	midfield
mis-	wrongly	misspell
non-	not	nonviolent
over-	over; too much	overeat
pre-	before	preview
re-	again	rewrite
semi-	half; partly; not fully	semifinal
sub-	Under	subway
super-	above; beyond	superhuman
trans-	across	transmit
un-	not; opposite of	unusual
under-	under; too little	underestimate

Appendix 10

Copy of a handout of common Greek and Latin roots as well as common prefixes and suffixes of English words. Page 5 of 5.

Suffix	Definition	Example
-able, -ible	is; can be	affordable, sensible
-al, -ial	having characteristics of	universal, facial
-ed	past tense verbs; adjectives	the dog walked, the walked dog
-en	made of	golden
-er, -or	one who; person connected with	teacher, professor
-er	more	taller
-est	the most	tallest
-ful	full of	helpful
-ic	having characteristics of	poetic
-ing	verb forms; present participles	sleeping
-ion, -tion, -ation, -ition	act; process	submission, motion, Relation, edition
-ity, -ty	state of	activity, society
-ive, -ative, -itive	adjective form of noun	active, comparative, sensitive
-less	without	hopeless
-ly	how something is	lovely
-ment	state of being; act of	contentment
-ness	state of; condition of	openness
-ous, -eous, -ious	having qualities of	riotous, courageous, gracious
-s, -es	more than one	trains, trenches
-y	characterized by	gloomy

Source: http://www.readingrockets.org/article/root-words-roots-and-affixes

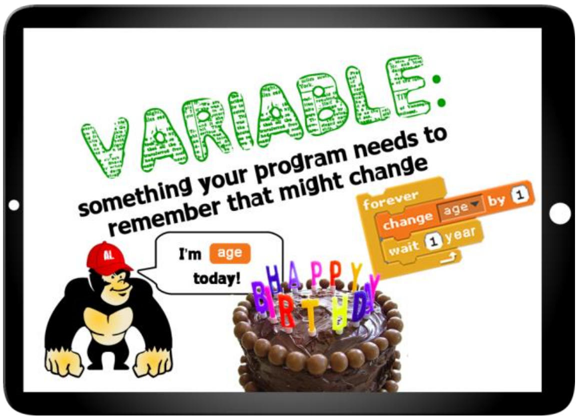
Appendix 11

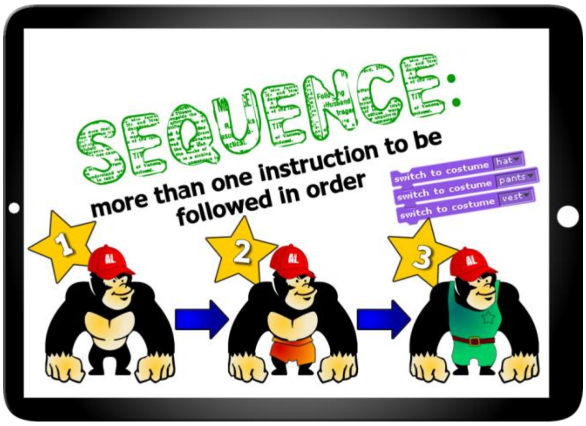
Using Scratch to develop English phonics: List provides the complete phonics and the example provided for each phonic in Scratch Project 4, Case Study 3. Page 1 of 1.

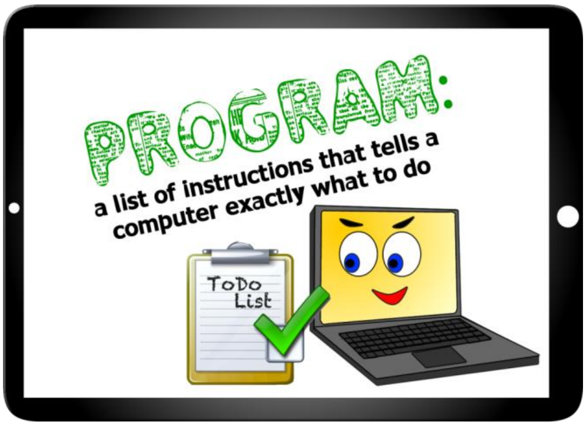
Phonics	Example
A,	Ant
B	Bat
C	Cat
D	Drum
E	Egg
F	Fish
G	Gurgle
H	Hot
I	Ink
J	Jam,
K	[no example]
L	Lollypop
M	Meal,
N	Net,
O	On,
P	Path
Qu	Quack
R	Rag
S	Sneak,
T	Tennis,
U	umbrella,
V	Van,
W	Wind
X	Fox
Y	Yogurt
Z	Buzz

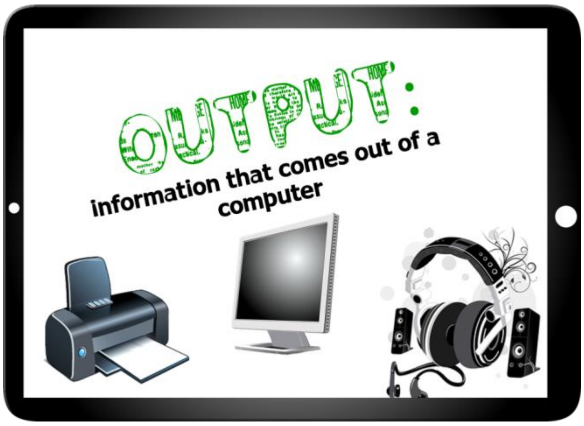
Appendix 12

A handout that illustrates the essential computing keywords and concepts. Page 1 of 2.



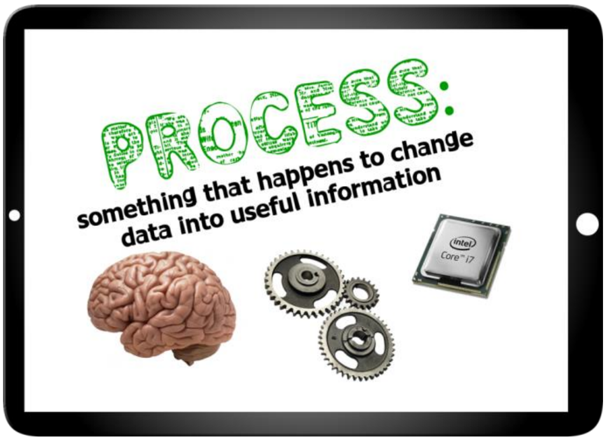


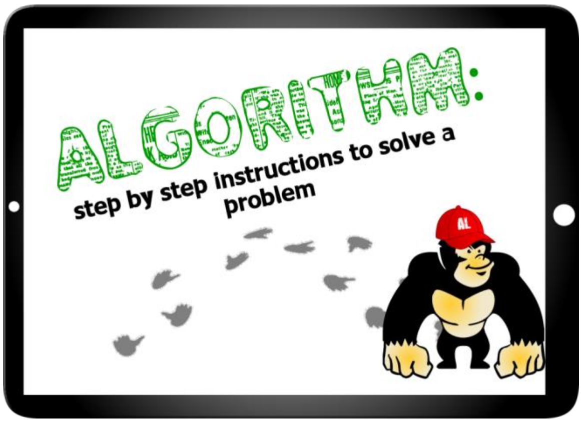




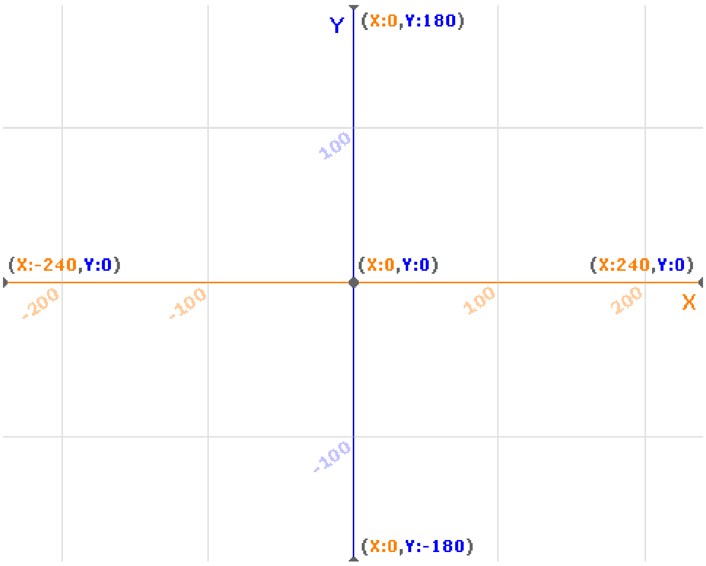
Appendix 12

A handout that illustrates the essential computing keywords and concepts. Page 2 of 2.





Scratch XY grid reference - you may show this by choosing the “xy-grid” when changing the Backdrop image.



Appendix 13

An illustration of observed session A: Performance of Core and Non-Core Participant Students. Page 1 of 1.

The first observed class was a similar to the ESOL Level 1 class, at the same college with a similar group of students. The tutor reported that the number of students registered in the class was 11, and that between six and eight students attended on a regular basis. The number of students who attended this observed session was five.

In this observed session, the tutor asked the students to write a letter of complaint to the local council, providing details of a broken step in the street, which was a similar exercise to the one the core participant students did in their writing class. The tutor wrote the subject on the board and, before asking the students to start writing, he brainstormed ideas with them and asked three sequential rhetorical questions, in order to attract and engage the students' attention: "Imagine the step in your street is broken, do you think this is safe? How can you report it?" Later, the tutor asked seven questions to encourage the students to think about what they would include in the letter. The tutor switched back and forth between addressing the whole class and speaking to selected students, one at a time. For instance, when addressing the class, he asked some display and referential questions, for example: "What do you think, do you think it is safe?" Two students responded at the same time, and the tutor called each of the remaining three students by his/her name and asked for their opinions about what they might include in the letter. The tutor also received and addressed three questions from the students. Therefore, in the introduction to the topic, there were three questions asked by the students and ten questions initiated by the tutor, including the three rhetorical sequential ones.

Later, three students asked one question each. One question was about the header of the letter, and the other two were about the title of the person addressed in the letter and whether to use "Dear", "first name" or "last name" when addressing this person. The tutor responded to the three questions immediately, and received two follow-up questions, which he also addressed. The tutor checked whether the students had any questions before they started writing, and he then asked them to pick up their booklets and notebooks and start writing the letter. In this part of the session, the students asked five questions.

Finally, while the students were writing their assignment, the tutor moved between them and checked each individual progress and whether they needed any help. During this period, three students asked three different questions about their draft, and they received an answer from the tutor. In this part of the class, three questions were asked.

During this period of observation, a total of 21 questions were asked, including the three rhetorical sequential questions from the tutor. The students asked 11 questions and responded to ten questions asked by the tutor. Only two students asked three follow-up questions between them.

Appendix 14

Findings from the questionnaire on the impact of computing and computational tools on students' learning and achievement. Page 1 of 5.

This survey aimed to capture any significant differences between the core and non-core participant groups of students regarding the impact of using computational programmes and animation software on the development of their English skills. The rationale was to construct an understanding of and a correlation between the possible enhancement of the students' English language skills and their usage of computer programmes and computational tools, including Scratch.

The second aim of the survey was to draw a contrast between the perceptions of the core and non-core students of improvements in their English skills as a result of using computing and computational tools in their learning activities. This is particularly relevant because the questionnaire targeted both core and non-core participant ESOL students at the research site.

The focus of this segment of data collection was to investigate the potential of computing and computational tools to influence the progress in language learning of the core and non-core participant students. Consequently, this questionnaire was administered at the end of the study, with a particular focus on exploring the views of the students regarding any possible improvements in their English language skills as a result of using computing or computational tools during the period of the study (spring and summer terms 2015).

A total of 27 (N= 41) core participant and non-core participant students responded to the questionnaire and shared how often they used computer programmes for animations or games in their learning, as well as whether they thought this was linked to improvement in their English language skills. The findings show that students who utilise computational tools, including Scratch, in their learning, link their progress in English to the use of these tools.

Appendix 14

Findings from the questionnaire on the impact of computing and computational tools on students' learning and achievement. Page 2 of 5.

Figure showing the gender distribution of the respondents to the survey on the impact of Scratch.

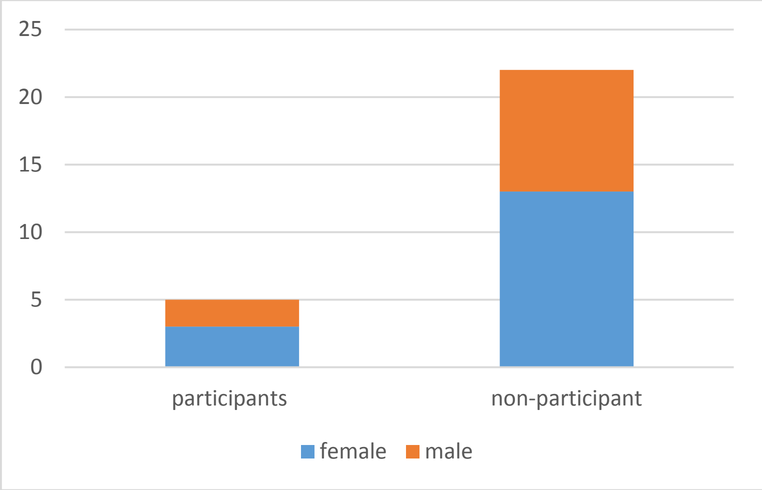
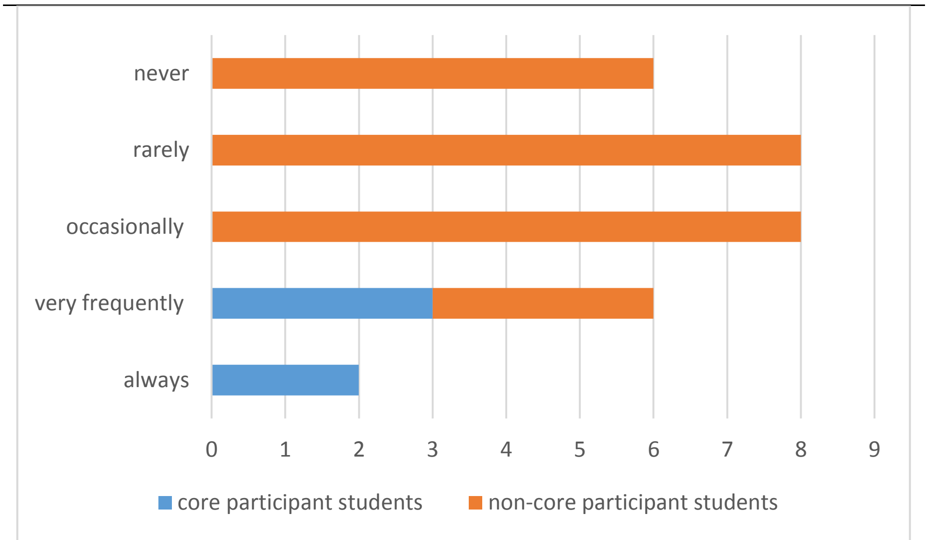


Figure showing the frequency of use of computer programmes for animations or games.



Appendix 14

Findings from questionnaire on the impact of computing and computational tools on the students' learning and achievement. Page 3 of 5.

Survey for ESOL student on the impact of computing and computational tools on the students' achievement

Informed Consent

You have been asked to participate in this survey that is part of a PhD research conducted by Raed Yacoub from the School of Education at the University of Greenwich. The purpose of this research is to examine and discover how Scratch programming language may contribute in enhancing the learning process of learners. Specifically, the research aims to:

1. Examine the effectiveness of Scratch programming language in supporting learners through their learning activities.
2. Discover insights on using the new tool of Scratch in helping speakers whose first language is not English to develop higher levels if literacies.
3. To investigate how helpful and effective is Scratch programming language in enhancing teaching and learning.

We tried this survey and we found that it may take around 5 minutes to complete. Please read all the items on this list. Then, if you understand and agree with them all, please click continue to begin the survey:

1. You were selected to participate in this survey because you are a student at Haringey Sixth Form Centre.
2. Your participation is voluntary in this survey, and you may choose not to participate
3. this is an anonymous survey, which mean we will not gather any personal information about you, except if you chose to voluntary provide you name and/or email address.
4. This survey is part of a study we are conducting to learn more about how learners can enhance their learning using friendly computer-programming language called Scratch.
5. For participants under 18 years old: Please talk this over with your parents or guardian before you decide whether or not to participate. But even if they say "yes" you can still decide not to participate in this survey.

Researcher's contact details (including telephone number and e-mail address):
Raed Yacoub – Room: H111 – Address: Mansion House, Bexley Road, London SE9 2PQ / Office: 020 8331 9552 – Email: R.Yacoub@greenwich.ac.uk

*Required

Skip to question 1.

Survey for ESOL student on the impact of computing and computational tools on the students' achievement

Survey for ESOL student on using and creating computer animation, games, and learning programmes

1. **At what level are you studying?** *
   <Please select one below >
   Tick all that apply.
   - [ ] ESOL Class Entry 2/3
   - [ ] ESOL Class Level 1
   - [ ] Other: ____________

Findings from questionnaire on the impact of computing and computational tools on the students' learning and achievement. Page 4 of 5.

2. **Gender** *
Mark only one oval.
   - ◯ Female
   - ◯ Male

3. **Do you think your English has improved in the last 6 months?** *
Mark only one oval.
   - ◯ YES
   - ◯ NO

4. **If you answered YES to the above Question, please tell us how it improved?**
< Please tell us some of the things you did to improve your English >

....

....

....

....

....

5. **Have you ever used computer programmes for animations or games?** *
< select from the scale below >
Mark only one oval.
   - ◯ Never
   - ◯ Rarely
   - ◯ Occasionally
   - ◯ Very Frequently
   - ◯ Always

6. **If you used computer programmes for animation and games, which of the following did you use?**
< please tick all that apply >
Tick all that apply.
   - ☐ YOUNG REWIRED STATE (youngrewiredstate.org)
   - ☐ Scratch (Scratch.mit.edu)
   - ☐ RASPBERRY PI (raspberrypi.org)
   - ☐ CODECADEMY (codecademy.com)
   - ☐ KANO (www.kano.me)
   - ☐ CODE KINGDOMS (codekingdoms.com)
   - ☐ DECODED (decoded.co/uk)
   - ☐ Hour of Code (uk.code.org)
   - ☐ CODERDOJO (coderdojo.com)
   - ☐ Other: ....

Findings from questionnaire on the impact of computing and computational tools on the students' learning and achievement. Page 5 of 5.

7. **Do you use computer programmes and animation in my personal learning and studying?** *

< please select YES or NO >

Mark only one oval.

- YES
- NO

8. **If you answered YES to the above Question, please tell us how you use computer animation or games in your learning?**

< please let us know how do you use computer in your learning >

....

....

....

....

....

9. **Are you part of Scratch team in David's ESOL class?** *

Mark only one oval.

- Yes, I am a member of the Scratch team
- No, I am not a member of the Scratch team

10. **Your Name**

< Optional Question >

....

11. **Your email address**

< Optional Question >

....

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