

# **Science trainee teachers' experience of outdoor learning and its inclusion in the curriculum.**

## **Introduction**

Within science education teachers utilise a variety of settings to promote the learning of their students, this can include classrooms, labs, fields, and school trips. Due to the dynamic nature of teaching environments, educators are given the opportunity to evidence innovative teaching practices. This is typically effective in response to STEM teaching and learning (Borrego and Henderson, 2014). The purpose of this commentary is to highlight the importance of outdoor learning and review its value within the teaching of science education. It will also include trainee teachers (preservice teachers) recounting their experience of an outdoor learning session attended during their Initial Teacher Training (ITT), and how they have collaboratively worked with their tutor to design an outdoor learning experience to develop relevant knowledge and skills that will allow them to implement such in their new roles as early career teachers.

## **Outdoor learning in practice**

Outdoor learning encompasses any learning experience that occurs outside the classroom. It can take place in various places such as botanical gardens, zoos, art galleries, museums and school trips (Best, Magaji & Smith, 2021) where students can play with materials, objects and equipment that have been planned to promote learning. Current research proposes that outdoor learning allows students to actively engage, participate and conceptualise scientific concepts taught within the curriculum. For example, Maynard et al (2013) suggests the concept of experiential learning where a play-based approach to learning develops students' systematic thinking of what has been learned. In addition, outdoor learning aids in facilitating the ability of students to apply static classroom-based knowledge and utilise it to navigate the constantly changing environment. It promotes skills such as confidence, creativity, enterprise, leadership, communication, problem-solving, scientific inquiry and relationships with nature, teachers and peers (Best et al., 2021). Across the world, the importance of outdoor learning is acknowledged, however, the entitlement and provision of outdoor learning within formal education curricula varies globally. Internationally, various governmental policies support the provision of outdoor learning experiences as an integrated and necessary aspect of a National Curriculum (Prince & Diggory, 2023). Currently, experiential education in outdoor environments can be evidenced in countries such as Denmark (Mygind, et al., 2019), Finland and Norway (Sjöblom, et al., 2021). However, in many nations, it is adjunct to the formal curriculum. Interestingly in the United Kingdom, the provision of outdoor learning is only a statutory requirement within the 'Early Years' (0 – 5 years) of education (Department for Education, 2021). Whilst outdoor play has been acknowledged as an integral part of a child's learning and development (Bento & Dias, 2017), there has been little legislation to enforce this throughout secondary and post-16 studies.

In the United States, the effects of outdoor learning were investigated using 255 school children over four primary schools in California. One group of children was given an outdoor education routine, with a control group for comparison (American Institutes for Research (AIR), 2005). The study found that the children who attended the outdoor education programmes increased their test scores by 27% and with improvements in self-esteem, conflict resolution, relationship with peers, problem-solving, motivation to learn and behaviour in class. Furthermore, research also suggests that disadvantaged children, including those from challenging backgrounds (McArdle, et al., 2013), underachievers (Maynard, et al.,

2013) and those with challenging behaviour (Roe & Aspinall, 2011) may benefit more from outdoor learning experiences than their peers. Therefore, integrating outdoor learning experiences into the science curriculum would provide an equal opportunity for all students to flourish.

### **Trainee teachers co-designing outdoor learning with their tutor.**

We have discussed the benefits of outdoor learning and why it should be included in the secondary school curriculum in the UK. Engaging trainees in outdoor learning should be a process that is carefully thought out and planned to ensure they understand the purpose by involving them in the planning. The planning stages have been summarised in Figure 6 by one of the trainees involved in this work, however, this may not be conclusive as you may use it as a guide to create one yourself as variations may exist. The way forward in encouraging outdoor learning experience for secondary school students would centre on how the government and stakeholders are promoting its benefits to learning but importantly, how ITT are embedding it in their training and ensuring that their curriculum is ambitious to provide the necessary knowledge and skills to support trainee teachers.

As a teacher trainer, I adopt two approaches to designing outdoor learning experiences for trainee teachers. Firstly, I consider the gaps in the curriculum in terms of subject knowledge and pedagogy that trainees would acquire and then research available options for outdoor learning experiences that can meet the needs of the trainees. This is summarised in Figure 6 under the sections on ‘picking the right location and pedagogy’. For example, the Tump 53 Nature Reserve discussed by the trainees (see the section on ‘Trainee teachers recount the experience of outdoor learning during their ITT programme’) provided essential training in the field of ecology, environmental science and sustainability that are required in the course. This takes into account the importance of sustainability as an element of learning and importantly demonstrates how the trainees can fulfil the United Nations Sustainable Development Goals (UNSDG) (UN, 2021) that includes quality education, reducing inequalities, sustainable cities and communities, climate action and life on land. This is on the premise that whatever they learned from this experience, will become useful in their new roles when they qualify as teachers.

Secondly, I deliver a seminar to the trainees where we discuss the benefits of outdoor learning, and how to plan and carry out a school visit to an outdoor learning destination. Figure 6 summarises the stages involved during the discussions and the trainees are then set a task in their groups where they research various locations of choice for an outdoor learning experience and justify why their chosen venue would be ideal considering the contents of the National Curriculum as a guide. They then present the outcomes to their peers who listen and ask questions where necessary. After the presentations, the trainees are required to vote and decide the best location from the options. The team that won will plan an outdoor learning experience for others to attend (see Figure 6). This year 2023, the winning team’s locations were the Science Museum/Natural History Museum which varies each year.

### **Moving toward science-based pedagogy**

Learning in nature allows students to make connections between ecosystems, habitats, climate change and living organisms. Given the drive towards sustainability, high-quality, goal-driven and reflective outdoor learning experiences must be incorporated into the curriculum early on, to enable students to have the opportunity to see how the static knowledge they receive in the classroom relates to the continuously changing environment. Outdoor learning creates an equal opportunity to promote metacognitive ascension by learning in environments that require learners to make connections with discrete pieces of information as exemplified in the trainees’ experience during their visits, thus allowing them to conceptualise their learning in the changing environment around them. These trainees can

then apply the knowledge and skills learned when planning similar learning experiences for their students.

To ensure outdoor learning experiences are effective in promoting metacognitive ascension, effective goal setting and providing a framework for all students to critically reflect on their outdoor learning experience must be a priority for trainee teachers.

### **Trainee teachers recount the experience of outdoor learning during their ITT programme.**

The PGCE Science programme at the University of Greenwich is one of several providers that embed outdoor learning pedagogy within the course content to support trainee teachers. Trainees benefit from a variety of outdoor learning experiences throughout the curriculum, such as the Tump 53 Nature Reserve, whose primary focus is to promote a highly valued community space that connects children, young people, and the wider community with nature and the environment (Peabody, 2023). Here trainees are taught sustainable practices in line with the five essential components of outdoor experience including reflecting on the local landscapes, balancing risks and benefits, reconsidering time, materials, space and sustaining the natural learning environment (Sisson and Lash, 2017). Trainees are prompted to consider innovative ways in which teachers can use outdoor experiences to support learning within secondary science curricula in line with the UNSDG mentioned earlier.

Trainees begin their experience with a tour of the nature reserve (Figure 1), where the lead ecologist discusses the history of the centre and the important role it plays in supporting the education of schools in the community. Tump 53 often facilitate trips for early-year pupils, however, more recently they have begun to host experiences for secondary students with a focus on students with special educational needs and disabilities (SEND). Trainees are introduced to the equipment required for a successful nature reserve trip and briefed on the health and safety procedures that would need to have been carried out if children were onsite. The remainder of the day is then divided into two fundamental sections: 1. applying scientific knowledge to the real world and 2. developing practical skills in our environment.



Figure 1: Source Tump 53 Nature Reserve

During section 1 trainees complete biology related tasks that are used to support student understandings of food webs and organism growth. For instance, within the pond dipping (figure 2) activity students



Figure 2

extract samples from different areas of the pond. They are then given a reference card and are tasked with observing which organisms habituate in each section and explaining which food chain they may belong to. This activity allows students to collate their knowledge and begin to picture how different food chains come together to create a food web in a specific habitat. Another activity provided to support this area included the observation and prediction of the micro-ecosystem underneath a log (see figure 3).



Figure 3

Trainees were taught simple sampling techniques (figure 3) and observational skills which could be transferred into the classroom. There is an added benefit of how trainees can support their students to be dexterous in their work, showing scientific skill, which they are expected to develop across secondary education DfE (2015). Additionally, these tasks provide children with the opportunity to further contextualise biological theory and continue to promote the real-life application of science.

Section 2 (developing practical skills in our environment) has a focus on innovation and stimulating creativity. Trainees were presented with various scenarios where they had to use the equipment provided to form survival strategies in accordance with the environment. For instance, to build an area of shelter trainees had to find the most suitable area which considered the ground levelling, placement of trees and safety from wildlife if they were required to camp in that location. This presented a great opportunity where school students could use their cultural capital to support the team in tying knots and experiences where they may have had to use survival skills. During this time the ecologist would prompt participants to use their senses to form their decisions such as listening for wildlife, touching the soil to assess which areas were kept the driest after rainfall and examining the location of trees where



Figure 2

pitching of the canopy may not compromise the ecosystem. Once a team's decision was formed a canopy was built (figure 4) and then tested for durability using buckets of water and applying weight to the surface. This is a great example where teachers would be able to promote teamwork and collaborative learning, both benefiting students' well-being as well as metacognition. It creates an opportunity for the teacher to ask questions, check students' knowledge and address misconceptions, and to some extent, reduce cognitive load with the view of promoting working memory. The final activity of the day included a campfire (figure 5). Trainee discussed the various responses students may give when asked how to set up a campfire and why it may be necessary in the given environment. Physicists could use this opportunity to discuss thermodynamics while chemists can discuss the conditions necessary to produce a fire by referring to the fire triangle. During this time the ecologist also summarised the importance of ecology and trainees reflected upon their experiences, discussing how it could be used to support biology, chemistry, and physics.

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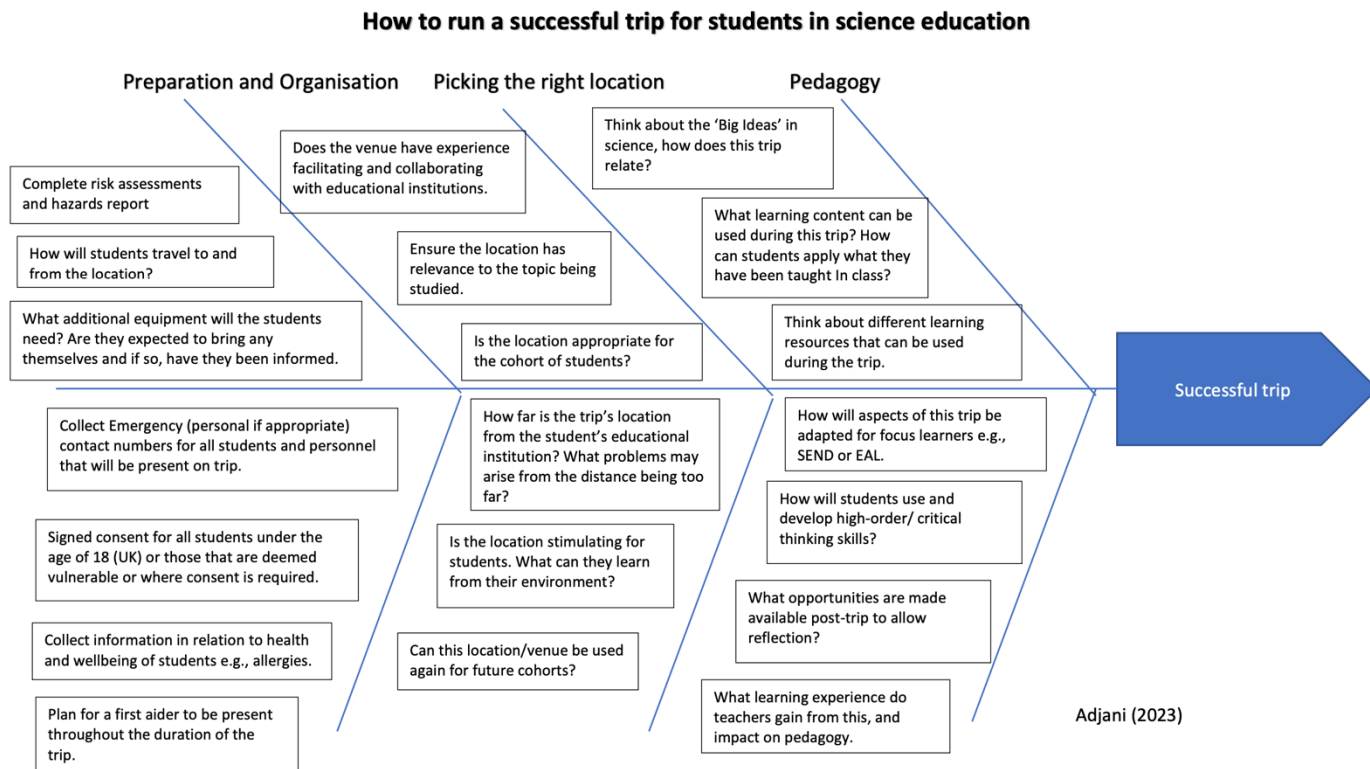
Figure 5

Overall, the attendance to Tump 53 nature reserve was an enriching experience where trainees were able to better comprehend the rewards of multi-sensory learning and generate new ways of outdoor learning for their future students.

## Conclusion

In summary, there is sufficient evidence which supports the advantages of outdoor learning in pedagogy. However, considering the lack of direct enforcement of this within education policy calls for ITT providers to take this into account when updating their curriculum and share its importance with partner schools. Feasible methods to facilitate this could include opportunities where trainee teachers can plan outdoor trips and learning experiences where they are required to map tasks to different areas of the science curriculum such as those experienced at the University of Greenwich. Additionally, these tasks would be used to document trainees' pedagogical knowledge and divergent thinking in response to improving their practices. In doing so trainee teachers will progress to understand the benefits of outdoor learning through first hand experiences, whilst developing the ability to embed this in their teaching to promote the value of outdoor learning. Figure 6 shows a framework produced by one of the trainee teachers to guide both educational institutions and ITT students in how to create a successful trip and hope it would be useful.

Figure 6





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