Fostering a Community of Inquiry for Engaging Undergraduate Students in Research: A Systematic Literature Review

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***Abstract*— This systematic literature review explores strategies and best practices for fostering a community of inquiry to engage undergraduate students in research in higher education environments. The review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria to conduct a thorough analysis of academic publications and 15 articles were analysed. The study adopted a framework developed by Healy and Jenkins in 2009 which articulated different types of research-based learning. The findings shed insight into effective treatments, difficulties encountered by lecturers, and the positive benefits of community-based research activities on students' personal and academic growth. Our discussion is centred around three key concepts arising from the theoretical underpinnings and these are: research-based, tutor-based, and research-oriented. In addition, our findings suggest that fostering a community of inquiry in undergraduate research strengthens undergraduate education by providing additional outlets for faculty to teach, research, and serve, and by fostering the creation of a community of scholars that is essential to the intellectual health of the university. This study's practical contribution is that universities should develop a subunit devoted to undergraduate research rather than embedding student research into the curriculum. Our findings would have been more insightful if we had employed case studies of universities with undergraduate research-intensive communities of inquiry. Nonetheless, the study provided illuminating conclusions from building a community of inquiry to involve undergraduate students in research.**

Keywords*— *Undergraduate research, Community of Inquiry, student engagement, Research, Pedagogical Approaches

I. INTRODUCTION

Progressive universities worldwide are under pressure to seek innovative ways to incorporate and integrate undergraduate research into their structured research and academic programmes [1]. These universities are developing a culture that acknowledges undergraduate students as capable of contributing to scholarship [2]. The economic structural changes that have taken place at the turn of the century, coupled with rapid automation and advancement in technology, are exerting pressure on students to do more than academic achievement and acquire skills that make them competitive and marketable on the job market [3]. Engaging current undergraduate students in research is believed to provide the bedrock or foundation for future academic excellence and building a knowledge repository. The premise is that engaging them in the early years of their study would equip them with the skills required for conducting publishable research or providing practical solutions to real-time company or industry problems. As undergraduate students, it is rare for them to enter into university with motivation, interest, and skill to engage in research, it is therefore incumbent upon universities and their faculties to foster an environment that would stimulate student interest [4]. Conventional methods of engaging students in research simply include a research component in their curriculum [2], however, this is not enough to stimulate the interest of the students as their involvement will be merely to fulfil the requirements of their programme of study. The increasing focus on bridging the gap between academia and industry has augmented emphasis on experience-based learning, rendering student research skills a prerequisite rather than an elective.

Substantial amounts of recent study findings show that universities engage undergraduate students through curriculum co-creation using a multi-disciplinary approach, coursework, research mentorship programme sessions, traditional research projects, consultancy projects, and decolonising research process [5]. The question is, are these strategies as different in practice as they appear to be in theory? And are these strategies working for the universities? Despite conducive- environments, the effort and strategies put forward by universities to engage undergraduate students in research, studies have shown that the students are reluctant to participate in research outside of their normal programme of study, are indifferent about research initiatives, resist any work that is in addition to their normal assignments and just do not care about research and the future of their studies. These perceptions pose challenges to student recruitment and retention during research [2], [6], [7]. We argue that due to the introduction of inclusion and diversity policies at universities, undergraduate students are a mixed multitude, as such, the strategies used by universities to engage undergraduate students are not all-encompassing. For a mixed multitude, universities would need to consider factors such as cultural liability. Minority sections of the mixed multitude, who are normally underrepresented, feel inferior to partake in research initiatives if not properly incorporated. We also argue that

traditional academic research courses embedded in the curriculum are less engaging and do not speak to the skills required. While we concur with [6] that sometimes students are reluctant to engage in research because of a lack of numerical, analytic, and computing skills, the availability of research tools and Artificial Intelligence platforms are key enablers of student research regardless of their level. In light of this, it is imperative to compile best practices and effective tactics used by educators and institutions to engage undergraduate students in research by answering the following research question:

How can a Community of Inquiry be effectively fostered to engage undergraduate students in research?

The rest of the paper is structured as follows: Section II gives the theoretical background, Section III discusses the methodology adopted, Section IV presents the findings, Section V discusses the findings, and Section VI concludes the paper.

II. THEORETICAL BACKGROUND

A. Defining Undergraduate Student Research, Engagement and Pathways

Undergraduate student research was defined by the University of Gloucestershire as the participation of students in study and inquiry into disciplinary, professional, and community-based problems and challenges, both individually and in groups, from admission through graduation; this includes participation in knowledge-sharing initiatives [8]. This definition seems to suggest that undergraduate research can follow various pathways; traditional academic research to fulfil the requirements of a program of study in a particular discipline, a professional project-based consultancy that involves providing solutions to a company's real-time problems and resolving community-based problems with practical solutions and experiments. Whatever pathway an undergraduate student chooses, it leads them to distinguishable types of experiences:

- Field research, common in the discipline of sciences and humanities
- Laboratory research
- Business consultancy
- Traditional academic research

The Council on Undergraduate Research defines undergraduate research as an investigation or creative inquiry that is mentored and done by undergraduates to make a scholarly or artistic contribution to knowledge (The Council on Undergraduate Research, 2023). This definition seems to be anchored in traditional undergraduate student engagement where students are involved in research primarily to complete their degrees of study by contributing to knowledge. It ignores the current labour market requirements of a graduate who is endowed with what [2] term in-class and out-class hands-on experience. To achieve this hands-on experience, progressive universities give undergraduate students an option to choose a consultancy-based project in which they identify a company's problem and provide solutions as part of their research project. Discourse on what constitutes engagement of undergraduate students in research is still raging in academic circles.

A somewhat similar dimension of undergraduate research was provided by the Undergraduate Research Opportunity Center (2014) by regarding it as an all-encompassing inquiry or investigation done by the undergraduate student to address a specific research question, utilising appropriate research methodologies, and subsequently resulting in the dissemination of findings. Similar arguments can be made that using this definition, students are mainly prepared for contributing to knowledge. ".

B. Strategies for Engaging Undergraduate Students in Research

The ever-changing student demographics, increasing diversity, and changes in labour market preferences have made undergraduate student engagement difficult for universities. The varied nature of programmes offered by universities, together with differences in pedagogical approach, make it impossible to have a universal approach to undergraduate student engagement. Miller, Drewery, and Waliczek [5] enumerate the strategies ranging from coursework, and formal research projects to the inclusion of underrepresented minorities. The challenge of engaging students in coursework is that it limits their innovation and ability to the confines of the curriculum and is done to fulfill the requirements of their degree. It is very rare for faculty members or academics to include students in publishable research projects because they have no luxury of training students when chasing deadlines to submit their papers. In addition, academics are normally busy with their academic workload and can only assist undergraduate students if the activity is embedded in the Key Performance Indicators of their deliverables. Using coursework to engage with students will not produce a graduate who is keen to explore new ways of thinking and who can actively discover new knowledge.

Using formal research projects has the potential to motivate students to get involved in research in their future academic endeavours [9]. Zvobgo, Pickering, Settle, and Tierney [2] concur with this supposition that competitive environments force undergraduate students to take projects that go well beyond the class exercise. While this strategy is desirable, it requires universities to collaborate with industries so that companies will assign practical projects to undergraduate students. In the recent past, university and industry collaboration has been quite sluggish, with the latter accusing universities of taking too long to churn out graduates because of the length of degree programmes. Using formal research projects, in this research, will be deemed to include consultancy, where students deal with real company problems in real time. Sometimes companies do not have the luxury of using university students but would rather use their own apprentices to carry out the consultancy task.

Risinamhodzi and Matobobo [10] believe that a Project-Based Assessment empowers students in the acquisition of knowledge by making them participants in undertaking meaningful real-life projects and developing real-world products. Project-based assessment requires a multi-disciplinary approach, but sometimes faculties are not willing to work with each other, making the strategy untenable. The advantage of Project-Based Assessment is that it can take place at the pre-primary, secondary, and undergraduate levels [11]. This implies

that the students would have been engaged and progressed from their early years at school to university.

There are some interesting strategies from [2] on how to effectively engage undergraduate students in research:

- Establishment of an institutional culture that recognises the importance of undergraduate research by fostering collaboration between schools. Authors [5] and [6] refer to it as interdisciplinary collaboration. This is likely to captivate interest and broaden student activity across the university. Sometimes the collaboration is affected by structural conflict within the university; among students and professors or faculty versus faculty [12].

- Grant and conference funding will motivate undergraduate students to earn while studying. This is a difficult strategy for the universities as funding is limited unless the university gets involved in projects that attract funding. These projects normally have timeframes that make it difficult to include undergraduate students. Some universities get funding through the Alumni community. Petrella and Jung [13] indicate that other organisations realise the importance of undergraduate research and fund it. These institutions are usually inundated with requests.

- The conventional model of faculty members recruiting research assistants still works as it exposes students to some kind of research. The challenge with this model is that some academics do not allocate time to transfer knowledge to the students as they are normally given repetitive and frustrating tasks. The number of undergraduate students involved in research is dependent on the research projects available at a given time, it may follow that this strategy will not get many undergraduate students engaged. There might also be limited skills affecting the students [14]. Conversely, [15] argues that graduate students who collaborated with undergraduate research assistants were seen to benefit greatly from the mentoring and instruction that undergraduate research provided.

- Inclusion of underrepresented minorities is an important strategy to include students whose interests may be ignored at the universities because they belong to minority groups.

Adoption and use of these strategies vary from institution to institution.

C. *Adopted Framework*

In this research, we adopt a framework developed by Healy and Jenkins [16] in which they articulated different types of research-based learning. Fig 1 shows the framework adopted for the study.

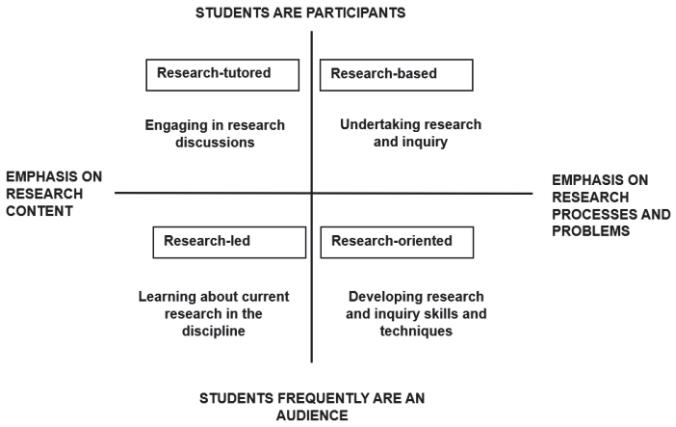

Fig. 1. Framework on undergraduate research and inquiry [17]

In this framework, undergraduate study and inquiry are viewed from two perspectives. The vertical axis identifies students as research viewers and participants, whereas the horizontal axis concentrates on research content and the vertical axis on research methods and challenges. Students should conduct research in all four of the approaches listed in this model, whether they are doing so inside their courses or outside of it by, for instance, taking part in events, seminars, and specific undergraduate research programmes [17]. This is regardless of whether the undergraduate student takes a consultancy route or a conventional academic model. Healy and Jenkins [16] framework is supported by [18]. According to Healey and Jenkins [16], the framework in Fig 1 is based on the following assumptions: Students can be research participants who are research-based when the emphasis is on research processes and problems. In this case, students undertake research and inquiry. Where the emphasis is on research content, then it is tutor-led. When students are taken as an audience and the emphasis is on research processes and problems, then the engagement is research-oriented.

D. *Benefits and Challenges of Engaging Undergraduate Students in Research*

The benefits of engaging undergraduate students in research are numerous, they range from increased academic achievement, increased retention and application of knowledge, critical thinking, and problem-solving [10]. Fung [19] adds the acquisition of a wide range of transferable skills and instills confidence in students in a complex world to the list of benefits. Zvobgo et al. [2] believe that engaging undergraduate students in research creates a student who can engage in projects that go beyond the classroom.

Some policies at universities make it difficult for academics to engage students; either they have strict performance-based contracts or do not have resources to promote undergraduate students. In some cases, the organisational structures of the universities inhibit innovation, the lecturers at universities do not believe that undergraduate students can be engaged in meaningful research, lack skills, or may not have time due to the demands of the curriculum [20]. Blakemore and Howard [6] believe that the perceptions students have about research make it difficult to involve them; they feel they lack the skills required

for research, especially statistics. They further argue that students' lack of confidence is a major cause for concern.

E. Context of Study

In this paper, we study universities because they are institutions that specialise in research. There are different models offered by universities to engage undergraduate students in research and these models vary according to size, capitalisation, enrollment size, geography, and type. The paper is limited to universities as the researchers are all university lecturers and also participate in finding ways to engage undergraduate students in research.

III. METHODOLOGY

A comprehensive review of the literature was carried out following the PRISMA guidelines to investigate the most effective ways to promote a community of inquiry and involve undergraduate students in research. The literature review methodology was utilized by researchers to gain an understanding of previous investigations, methodologies, and published findings on fostering a community of inquiry and engaging undergraduate students in research. Our research philosophy is interpretivist which involves interpreting and understanding the experiences, perceptions, and outcomes related to this educational approach. The study uses a deductive technique to synthesize available material to draw conclusions and insights about the issue. The Scopus database was used to find articles that could assist in the study because it is a global database that contains multidisciplinary databases covering a wide range of academic disciplines. The researchers believed that the articles retrieved were adequate for the study the articles represented different fields. The following research string on the Scopus database was used: "conducting research at the undergraduate level". Fig 2 shows the screening of articles. The following inclusion and exclusion criteria were used:

Inclusion criteria

- Articles published between 2012 and 2023
- Articles written in English
- Articles focusing on research at the undergraduate level
- Articles focusing on higher education

Exclusion criteria

- Articles published before 2012
- Articles written in other languages which are not English
- Not focusing on higher education
- Not focusing on undergraduate research
- No abstract

The initial search retrieved 221 articles. 166 articles were retrieved after filtering articles that were published between 2012 to 2023. After that 9 articles were excluded because they were not written in the English language and 157 articles remained. The researchers excluded 85 articles after reading the topic and abstract. 72 articles were considered for analysis. The researchers analysed the first 15 articles that met the inclusion criteria. The researchers believed that these 15 articles were a representation as they covered different research fields.

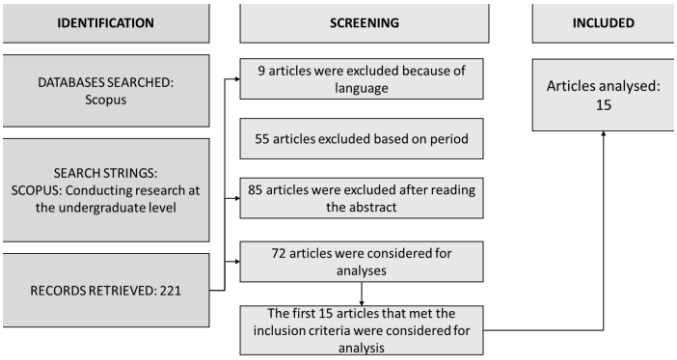

Fig. 2. Diagram representation of the screening process

IV. FINDINGS

This section presents the findings of the study. The findings are presented in Table I.

TABLE I. KEY FINDINGS

Citation	Challenges	Strategy/Findings
[21]	The most frequent obstacles were a lack of funds, time, and research methodology training.	Undergraduate medical students require research opportunities and training to assist in solving issues related to inadequate research capability. Including formal research training in the curriculum could contribute to a rise in research engagement and knowledge.
[8]	The most common challenges were selecting a compelling research question, creating a theoretical framework that was pertinent to	Findings demonstrate that EFL students had favorable attitudes regarding engaging in research as student researchers and were aware of the value of doing

	the study's goals, and determining research gaps by looking at earlier studies.	research at the undergraduate level. While conducting their research, students received support from their institution, specifically from the library, faculty, staff, and supervisors.
[22]	-	This study discovered that typical causes of research anxiety among students were failure in research, inadequate knowledge or preparation, and the need to balance research time with other academic and/or personal obligations.
[23]	It can be quite difficult for certain undergraduate students to express their ideas in writing, which presents a significant obstacle in their writing studies.	Create writing programs with an emphasis on language proficiency, critical and reasonable thinking, and thought development.
[24]	Challenges included inaccessibility of online resources, failure to complete some small tasks, and lack of time to conduct peer review	Breaking down a large research project into smaller manageable parts enabled students to engage in research. Training is provided by creating modifications to the assignment that instruct students on how to do research using various social science research methodologies.
[25]	To develop graduate doctors capable of performing, interpreting, and publishing scientific research	Medical graduates' research productivity increased as a result of mandatory teaching of research skills and competencies in the curriculum.
[26]	Improve writing abilities	Students highlighted several ways in which the workshops had enhanced their capacity to compose parts of scientific reports.
[27]	Scale-up undergraduate access to research experiences	Course-based undergraduate research experiences (CUREs) offer a feasible means of increasing access to research opportunities that more effectively support anticipated learning outcomes.
[28]	Use of experimental design in the undergraduate teaching laboratory	Students were able to acquire 21st-century skills through the experience, such as communication, cooperation, self-directed learning, creativity and entrepreneurship, innovation, critical thinking, and problem-solving.
[29]	To improve the research skills of students studying civil engineering by involving them in various kinds of research projects	Students were taught how to conduct research in a more enthusiastic, fruitful, and practical way by using organized and well-organized research procedures. Students' reflections revealed how incredibly satisfied they were with this experience of lifelong learning.
[30]	Before beginning a research project, students might not fully comprehend the research process.	When students showed less self-efficacy before the workshop, the researchers saw increased self-efficacy in certain research skills. Student replies showed that the focus of the research had shifted from solving specific problems to making new discoveries or advances in a discipline.
[31]	Students responded to a survey with	Positive comments were provided by the participants,

	questions about the undergraduate research model's general merits and drawbacks, weekly research sessions, course structure, supervision, and research process.	who stated that they were well-prepared for postgraduate courses, had a strong understanding of the research process, and felt very confident undertaking independent research.
[32]	Examine the information literacy procedures used by undergraduate researchers.	This study indicates that instruction librarians can support students in developing a sense of self-efficacy by providing opportunities for students to practice difficult research tasks that build on prior knowledge, addressing the affective and self-regulatory aspects of conducting higher-level research and modeling advanced research strategies.
[33]	To assess the challenges, practices, attitudes, and perceptions of undergraduate students toward medical research	Undergraduate medical research programs are essential for assisting students with their future professional pursuits. As a result, to ensure that institutions have a research-oriented atmosphere, research programs should be continuously reviewed.
[34]	Many nursing students may find it difficult to perform and publish high-quality research since it requires a variety of abilities, including academic writing and reading.	The study suggests that language lecturers use explicit teaching of reading skills that support critical reading and teach academic writing at both the macro and micro levels in an English for Academic Purposes (EAP) classroom.

The next section discusses our findings in connection to the objectives, literature review, theoretical underpinnings, and findings.

V. Discussion

Engaging undergraduate students in research is a topical issue in the current discourse on creating a curriculum that produces a competitive graduate that matches the ever-changing demands of the labour market. Undergraduate research is directly linked to the direction and future of university education, forming the basis for a repository in the knowledge economy. Progressive universities are constantly looking for innovative ways to engage students in a way that will produce a graduate with in-class and out-of-class hands-on experience. On the other hand, the graduates themselves are working to acquire skills that make them competitive. Our findings set to answer the following research question:

How can a Community of Inquiry be effectively fostered to engage undergraduate students in research?

Our discussion is centred around three key concepts arising from the theoretical underpinnings and these are: research-based, tutor-based, and research-oriented. Our discussions did not consider the research-led aspect of the theoretical framework because the discussions are a traditional method of student engagement which is losing popularity among universities and this was not evident in the findings as articles considered are quite recent.

A. Engaging students through practical projects

Indications from the literature reviewed show that research-based student engagement involves students as participants undertaking research and inquiry [17]. These indications are synonymous with findings in the study that engaging undergraduate students in research is beneficial and effective in exposing students to 21st-century skills through self-directed learning, communication, creative problem-solving, and entrepreneurship. This finding is synonymous with the findings in [9] that students get exposure to new ideas and innovative ways of acquiring new knowledge. This finding also mirrored what Fung [19] argued that undergraduate students who are engaged in research, in the early years of their schooling, can deal with complex problems. Predictably, the findings seem to show that students who participate in research and inquiry in the early years of their academic journey are likely to be involved in research in the later years of their lives [8]. Similar sentiments were echoed in the literature review [4], [5], [6], [9], [10], [19]. As indicated in the theoretical framework, if the students are research participants, they develop skills to undertake research and themselves. The findings also indicate that undergraduate students have an interest in being involved in research as they argue that it prepares them for future research.

Our findings also show that universities can help students feel more confident in their abilities by giving them the chance to practise challenging research tasks that draw on their prior knowledge, addressing the affective and self-regulatory aspects of conducting higher-level research and modelling sophisticated research techniques. This finding is echoed by Zvobgo et al. [2] who believe that establishing an institutional culture that recognises the capability of undergraduate students to contribute through research is important for success.

B. Engaging students through research tutorials

Our findings indicate that students felt that research-tutored projects made them feel extremely competent in conducting independent research, having a solid grasp of the research process, and being well-prepared for postgraduate courses. This finding was not reflected in the literature reviewed. Possible reasons could be that research-tutored student engagement is losing popularity as universities strive to produce graduates who are practically oriented. In addition, students now want to learn by doing.

C. Engaging students through research coaching

According to the reviewed literature, research-oriented student engagement entails lecturing processes of research knowledge construction in a particular discipline. Our research findings indicate that undergraduate students in practical subjects like Medicine need research opportunities and coaching to help resolve issues related to a lack of research skills. This empowerment includes formal research training in the curriculum that has an effect of contributing to a rise in research engagement and knowledge. This finding resonates with discussions by authors in [35] who believe that students must gain knowledge. Although this engagement is beneficial to students undertaking practical courses, it is losing popularity as students and universities are getting inclined to project-based learning.

The findings from the systematic literature review show varying levels of approach to engaging undergraduate students in research, most of the authors argue and support the traditional engagement strategy of supporting the students through the normal coursework and staff support [8], [14], [23], [24], [25], [29], [32]. These authors seem to suggest that the research skills of undergraduate students are best developed through intense teaching, learning support, and including research-related content in the curriculum. In as much as support is given to the students through this strategy, [22] believes that there is always anxiety amongst students due to factors beyond the University or Faculty's control; lack of planning, and challenges associated with balancing the research activity with normal academic requirements. Authors [21]presents a contrasting view to traditional student support through curriculum and staff support, he argues that students require research opportunities. This seems to suggest that what should be part of the strategy to engage undergraduate students in research is to give them practical experience by involving them in the actual research. Authors [21]'s view is echoed by [28] who feel that students get practical skills for the 21st century by actually involving them in the actual research.

The different approaches to engaging students in research might arise from the fact that some disciplines, like the medical field, require students to practically get involved in the research projects. Practical projects equip students with both knowledge and practical skills whereas, in some disciplines, knowledge does not necessarily need to be acquired practically.

VI. Conclusions and Recommendations

The study has provided valuable insights into the critical elements of a community of inquiry (CoI) and its significance in engaging undergraduate students in research. The importance of research in the undergraduate setting at a university is multifaceted and impactful. Our study emphasised the importance of research-based, research-tutored, and research-oriented. We can extend our findings to suggest that a university with all three foci will produce graduates who are easily employable and can address societal challenges with ease.

In addition, our findings suggest that fostering a community of inquiry in undergraduate research strengthens undergraduate education by providing additional outlets for faculty to teach, research, and serve, and by fostering the creation of a community of scholars that is essential to the intellectual health of the university. We should, however, stress the importance of administering research incentives fairly and inclusively to avoid disgruntlement among emerging scholars.

We are also of the view that universities with research-intensive focus are more likely to produce graduates with improved academic performance, societal participation, and positive personal development changes. Three key concepts from Healey and Jenkins [16] sufficiently provided theoretical underpinnings providing a solid base for our findings. The systematic review approach gave a solid understanding of undergraduate research and answered our search question.

Researchers and universities can use the findings of this study to enhance engagement and learning outcomes for fostering a community of inquiry for undergraduate research students.

Other than undergraduate research being embedded within the curriculum, universities must establish a sub-unit to concentrate on undergraduate research. There is currently a belief that undergraduate research is a burden on the curriculum since students need to grasp the foundations of their career options, which are core academics. The most recommended way out of this is to put funds in place that will drive colleges to examine the outcome.

Future studies should implement case studies of universities with undergraduate research-intensive communities of inquiry.

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