Exploring Shared Understanding and Practices of Experiential Learning Among African Engineering Educators

Cedrick A. K. Kwuimy,
University of Cincinnati, USA, *Cedrick.kwuimy@uc.edu*
Yashin Brijmohan,
Utah State University, USA , *yashin.brijimohan@usu.edu*
Precious Biyela,
The University of the Witwatersrand, South Africa, *Precious.Biyela@wits.ac.za*
Michelle Maphosa,
University of Cape Town, South Africa, *mphmic006@myuct.ac.za*
Vicent Rutagangibwa,
Mbarara University of Science and Technology, Uganda, *rutagangis@must.ac.ug*

Abstract

The definition, practice, and assessment of experiential learning (EL) globally and within Africa vary significantly across institutions, even within the same country. This inconsistency is largely due to a lack of research focused on educational landmarks shaped by Africa's unique socio-cultural challenges, technological divides, and financial struggles. Additionally, there is a lack of knowledge on how to structure Afrocentric practices for EL. This research seeks to address the challenges and disparities in the implementation of EL initiatives across African educational contexts. It aims to identify commonly employed methods of EL and explore the shared understanding of EL practices among African engineering educators. Thirty-two participants from seven African countries completed a survey on their understanding and experiences with EL. Responses from nineteen of those participants were discarded due to incompleteness. The remaining thirteen participants, from seven African countries, were divided into two groups: those familiar with and actively using EL, and those familiar with EL but who have not yet used it. The analysis highlights shared practices, perceived impacts, and participants' understanding of EL. The results emphasize the need for future research to harmonize EL practices across Africa.

Keywords: Experiential Learning, Shared Understanding, Africa Engineering Education, Afrocentric Education, Harmonizing Experiential Learning Practices

1 Introduction

1.1 Experiential Learning

As pervasive and "natural" as learning is for humans, it can be challenging to define in simple and succinct terms. Learning could be "*any process that in a living organism leads to permanent capacity change and which is not solely due to biological maturation or ageing*" (Illeris, 2007, p.3 in Illeris, 2009). There are several learning theories (explaining how knowledge acquisition and learning happen in humans) that are recognized, but most scholars agree that learning theories can be grouped into three frameworks; behaviourism, cognitivism and constructivism. Constructivist learning theories centre learners, rather than teachers and/or teaching, as ultimate drivers of learning. According to these theories, learners construct their own understanding, while teaching provides some of the building blocks, in the form of content, that can be used in knowledge construction (Illeris, 2009; Ferreira and Lemmer, 2021). The context in which teaching happens becomes one part of the context in which learning is constructed. The process of knowledge construction is active and involves biological, psychological and social conditions (Illeris, 2009). Experiential learning (EL), some of whose definitions are outlined below, is more constructivist in nature (Kong, 2021), with students being both the main agent in terms of driving the learning (Kong, 2021) and the agent who experiences "*change […] that*

results from reflection on a direct experience" (Itin, 1999, p. 92 in Tembrevilla et al., 2023). Several authors have expressed varying understandings of experiential learning.

For example, Kolb's Experiential Learning Theory (Kolb, 1984; Kolb and Kolb, 2018; Wijnen-Meijer et al., 2022), which outlines an experience-based learning process, is foundational to experiential learning. In this framing learning happens via going through a four-step cycle. This cycle consists of a concrete experience, which triggers the learning process as the learner interacts with some form of reality; reflective observation, during which the learner looks back to their experience (so this is only possible after the learner has been through the concrete experience); abstract conceptualization (thinking), whereby the learner mulls over everything in order to theorize or make testable principles or some deductions; and active experimentation, during which the learner tests his/her theory and/or uses what was learned from steps one through three of the cycle to get feedback. Because this is a cycle, in step four, i.e., active experimentation, the learner also creates their subsequent experience and then goes through the cycle again. Because experiential learning is cyclic, with multiple iterations of the cycle, experiential learning fosters lifelong learning and personal development and improvement (Kolb and Kolb, 2018; Ferreira and Lemmer, 2021; Wijnen-Meijer et al., 2022).

While Kolb's conception of experiential learning mainly credits individual cognitive process for learning and zooms in on the construction of knowledge by one individual learner, there are more broader interpretations of experiential learning which emphasize the context and social interactions involved in learning. Consequently, they consider the influence of areas like teamwork, mentorship, and the real-world environment on learning. For example, while Wenger (2009) recognizes and accepts learning theories that view learning as an individual feat, he postulates a social theory of learning. For Wenger (2009), participating in society is not something that enhances learning, but is necessary for learning to happen. He argues that human beings best learn through active participation in communities of practice (CoPs). Wenger stresses that it is not just belonging to CoPs that matters, but actual active participation and identity making, all of which he says are continuous rather than "events" with clearly marked beginnings and endings (Wenger, 2009).

Another variation of understanding EL is where it can be expressed based on some kind of experience as the main trigger for the learning cycle. Both authentic, i.e., real world experiences, and simulated experiences (Clark et al., 2016; Wijnen-Meijer et al., 2022; Nhan, 2024) can be used to anchor experiential learning. Regardless of whether the anchoring experience is real or simulated, it is vital for it to closely mimic professional engineering practice in terms of both the context and types of problems (Nhan, 2024). For engineering students, the context is often internships, either located at certain intervals between years of study or after students have completed all coursework but before they can graduate; community-based projects, often done in the second to last or last year of study, industry collaborations, which can take different forms; and co-ops, amongst other situations. There are many reasons why a simulated experience might be preferred, either to supplement and or in place of a real-world experience. An example of simulated experiences could include case studies, and capstone projects undertaken within the academic environment. In their study, Clark et al (2016) highlights that simulated experiences provide students with the benefits of an experience "at a low cost" and with a lower risk than what students might be exposed to in real world professional environments. This is not unlike what motivates the creation of experiential learning in clinical programs, whereby students might work with models and or contribute towards "old" case analysis, rather than work with real patients (Wijnen-Meijer et al., 2022). Here the concern is patient safety more than it is the safety of the students undergoing experiential learning, but both configurations are about providing a context that closely mimics a real professional setting, so students can learn through experience, while lowering the risk that comes with such learning.

Experiential learning is popular, and very widely used, because of its many benefits. These include but are not limited to deep learning, skill development (Nhan, 2024), increased students' engagement and motivation (Nhan, 2024; Kong, 2021) opportunities to practically apply knowledge (Clark et al., 2016; Wijnen-Meijer et al., 2022; Nhan, 2024), employability, and personal and professional growth (Wijnen-Meijer et al., 2022; Nhan, 2024). In addition, experiential learning can improve student academic outcomes and enhance performance

in the classroom (Kolb, 2013; Tembrevilla et al., 2024) In modern engineering, experiential learning is indispensable due to its focus on “learning by doing" and “reflecting on the experience” (Clark et al., 2016). The focus on the development of skills that are personalized, accessible, inclusive, problem-based, collaborative, lifelong, and student-driven (Nhan, 2024) further strengthens the position of experiential education as a serious contender for a category of teaching methodologies capable of educating the engineer of the future.

1.2 Motivation: Codifying Experiential Learning in Africa

Africa is a continent rich with opportunities for experiential learning, leveraging diverse approaches like internships, project-based learning, and field visits. It is important to note that African indigenous education traditions have long embodied experiential principles through apprenticeships, storytelling, and community involvement. Learning by doing and oral knowledge transfer are deeply rooted in African cultures (Odendall, 2013; Frimpong et al., 2024). Across Africa, experiential learning is conceptualised as a transformative pedagogy that makes education more relevant to social needs and student development. Although such experiences may not be systematically documented in mainstream literature, they represent a culturally relevant mode of experiential education, one that warrants deeper exploration in the context of African engineering pedagogy. For example, in Engaging Communities in Sustainable Development: Universities as Active Partners, university students in Lesotho collaborated with local communities through culturally grounded environmental education, drawing on the Botho philosophy and indigenous knowledge to co-develop ecotourism and conservation initiatives (United Nations University, 2018).

While EL in African engineering education faces several challenges, its integration is crucial for developing a workforce capable of meeting the local and international demands of the engineering sector. Efforts to expand and improve experiential learning should continue, with an emphasis on aligning educational outcomes with industry needs and enhancing the overall quality of engineering education. Africa's diverse educational needs and resource limitations highlight the necessity for innovative approaches tailored to local contexts. As such, Africa could serve as a valuable research context to explore how experiential learning can be adapted and optimized to enhance its impact.

Future initiatives should aim at enhancing university-industry collaborations and developing robust accreditation systems to ensure the quality and international recognition of engineering programs. This will not only improve the quality of education but also enhance the employability of graduates within the global market. Across the African continent, there is a lack of a shared understanding among educators and regulatory bodies regarding the definition, application, and assessment of experiential learning.

Given the multiple variations in the understanding of experiential learning from literature, and the incorporation of EL into engineering curricula in Africa, a shared understanding of EL's practice and definition could enhance graduates' mobility and employability, particularly when seeking employment outside their home country. To aid this understanding, this paper explored how engineering educators in Africa define, apply, and perceive the usefulness of experiential learning practices. The research question is defined as*:*

How do engineering educators in Africa perceive and implement experiential learning in engineering undergraduate studies?

2 Research Method

2.1 Methods/Design

A mixed method design has been employed to answer the research questions. This approach integrates both quantitative and qualitative research designs and have informed the data collection. The qualitative design was primarily used to understand how experiential learning was understood, and the quantitative design provided more insights on the understanding of EL but was more focussed on understanding the perceived usefulness of EL practices and how it was implemented.

Most authors agree that there are two research approaches that mix qualitative and quantitative data collection and handling, namely, the mixed method and multi method approaches (Anguera et al., 2018; Creswell and Tashakkori, 2007; Weller and Barnes, 2017). Recognising that some studies use mixed method and multi method approaches interchangeably Kasirye, 2021), it is vital for one to explain that this study is considered mixed method due to its alignment with the criterion put forward by Creswell and Tashakkori (2007) who asserted that in mixed methods, researchers use both qualitative and quantitative approaches to collect and analyse data, integrating discoveries and drawing a unified set of conclusions (Creswell and Tashakkori, 2007). This approach was chosen to allow more robust analysis than what is possible with simple methodologies.

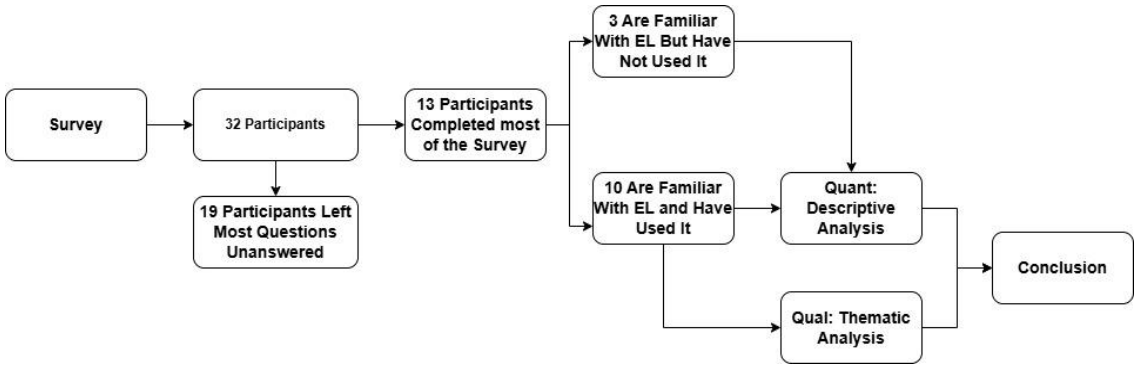

Figure 1: Research Design

2.2 Participants and Data collection

Participants were recruited for this study using surveys. The participants include African engineering educators, and persons from professional and educational engineering institutions across three African regions. They were recruited through communities of practice using snowballing. These communities will include the Engineering Education Research Network-Africa, the Africa Engineering education Forum, and Africa Engineering Education Council. Data was collected using a Qualtrics Survey distributed via email and WhatsApp groups. 32 people completed the survey. However, only 13 (9 male, 4 female) respondents completed the questions. They were from Cameroon, Gambia, Ghana, Kenya, South Africa, Uganda, Zimbabwe.

2.3 Quantitative and Qualitative Data analysis

Thematic analysis was used for qualitative analysis. We first familiarized ourselves with the data to gain a deeper understanding by reading and re-reading it. Secondly, initial codes were generated by identifying important features of the data that are relevant to the research question based on the diverse perspectives of the participants. Two AI tools (ChatGPT and NotebookLM) were used to analyze the data to produce the initial codes. After the researchers familiarized themselves with the data, they used specific prompting to interrogate the data further. To prevent hallucination effects, two tools were used, and the data analysis was compared between them. Furthermore, the functionality of NotebookLM allowed the researchers to review the analysis. Thirdly, the codes were organized into broader patterns or themes, and then refined, revised, and named for coherence. Given the limited number of quantitative data, quantitative analysis was limited to general descriptive analysis, and graphical representation for visualization using Excel.

3 Results

3.1 Shared Perceived Impact of Experiential Learning on Learning Outcomes

The survey includes a question on a 6-point Likert scale to invite participants to express the extent to which they believe experiential learning supports key associated outcomes published in the literature (Brijmohan, 2025; Wurdinger & Allison, 2017) (1) *Creativity, (2) Communication, (3) Collaboration, (4) Time management, (5) Social/Contextual, (6) Social responsibility, (7) Skills for lifelong learning, (8) Ethical Reasoning, (9) Critical Thinking, (10) Inquiring and analysis, (11) Global Competence, (12) Technical skills.* The average score and the corresponding variability for the 13 responses received is plotted in Figure 2.

Group 1 was categorized as those participants who were both familiar with and used experiential learning, while Group 2 included participants who were familiar with experiential learning but did not use it. Each group was asked to rate the extent to which they agreed that each learning outcome is enhanced in developing engineers through experiential learning. It was found that Group 2, who did not use experiential learning, had a higher belief that experiential learning could enhance various learning outcomes compared to Group 1, who did implement it. The finding that Group 2 held a higher belief in its potential to enhance learning outcomes compared to Group 1 presents a seemingly paradoxical situation. While conventional wisdom and much of the literature suggest that direct experience often leads to a stronger understanding and appreciation of a method's effectiveness, several factors could contribute to this counterintuitive result.

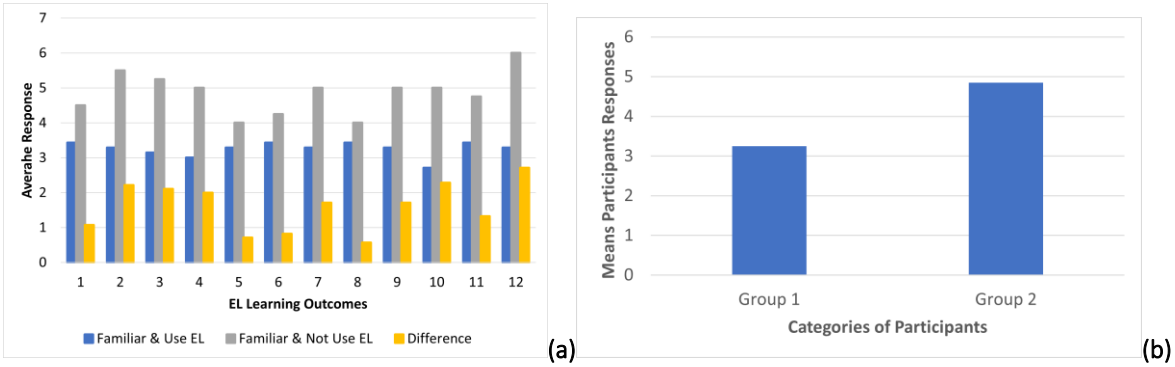

Figure 2: Perceived Impacts of Experiential Learning.
(a) Mean Response for (1) Creativity, (2) Communication, (3) Collaboration, (4) Time management, (5) Social/Contextual, (6) Social responsibility, (7) Skills for lifelong learning, (8) Ethical Reasoning, (9) Critical Thinking, (10) Inquiring and analysis, (11) Global Competence, (12) Technical skills. (b): Aggregate Response – Group1: Familiar with Experiential Learning and Have Use It. Group2: Familiar with Experiential Learning but Have Note Used It.

One potential explanation lies in the realm of idealized perceptions. Individuals who have not directly engaged in a particular practice might hold an overly optimistic view of its benefits, unburdened by the realities of its implementation. Research on enthusiasm for new organizational practices suggests that individuals might perceive greater benefits in novel or unfamiliar approaches (Van Eerde & Van der Velde, 2005). In this context, Group 2 may focus on the theoretical advantages of experiential learning, overlooking the potential challenges and complexities that Group 1 encountered.

Furthermore, the Dunning-Kruger effect could offer another lens through which to understand this phenomenon. This effect posits that individuals with low competence in a particular area tend to overestimate their ability or understanding (Kruger & Dunning, 1999). Group 2, lacking direct experience with experiential learning, might have a superficial understanding of its nuances and therefore hold an inflated belief in its universal efficacy compared to Group 1, who have a more grounded perspective informed by their practical engagement.

Conversely, the challenges inherent in implementing EL effectively could have influenced Group 1's beliefs. Literature on scaffolding and complex learning often highlights the difficulties in orchestrating meaningful experiential activities that lead to desired outcomes (Hmelo-Silver et al., 2007). If Group 1 faced significant hurdles or did not perceive the implementation as entirely successful, their belief in experiential learning's potential might be tempered by their actual experience.

In contrast to these explanations, much of the foundational literature on experiential learning suggests that direct experience should lead to a greater appreciation of its value. Kolb's (2015) theory emphasizes that learning is derived from experience, implying that those who have engaged in experiential learning should have a deeper understanding of its impact. Similarly, the emphasis on reflection in experiential learning (Moon, 2004) suggests that if Group 1 engaged in meaningful reflection on their experiences, they should have a clearer grasp of the learning outcomes and thus a potentially stronger belief in its effectiveness. Moreover, principles of self-efficacy (Bandura, 1977) suggest that positive experiences generally foster stronger beliefs. If Group 1 had positive learning experiences through EL, their belief in its potential should logically be higher than that of Group 2.

3.2 Shared Perceived Understanding of Experiential Learning

Participants in Group 1 were asked to select from a list of experiential learning practices (Yates et al., 2015) the practices they had employed. Aggregated results are plotted in percentage in Figure 3.

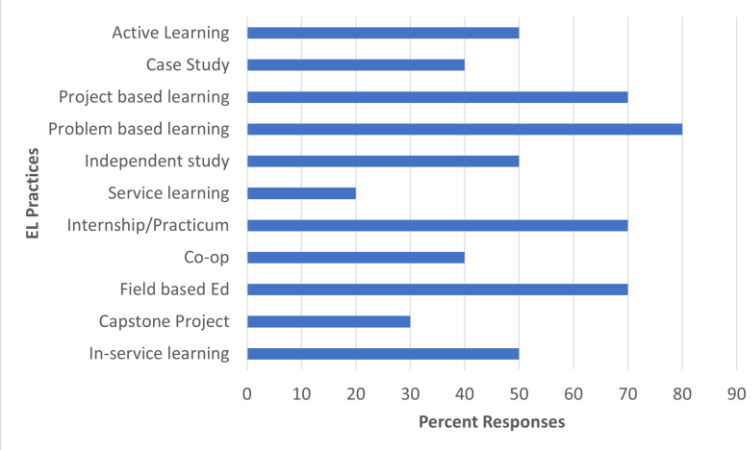

Figure 3: Percentage Used of Experiential Learning Practice

A variety of experiential practices were found to be implemented across the African continent, albeit to varying extents. A greater number of these practices were reported in academic institutions compared to those implemented outside. Within academic settings, problem-based learning, project-based learning, and active learning were the most frequently cited, whereas case studies and capstone projects received the least mention. Outside the classroom, internships and field-based education were the most referenced, with internships being significantly more prevalent than co-ops. While we observe a diverse range of implementation types for experiential learning, it remains unclear whether the responses were based on a consistent or varied understanding of each type. Despite these potential discrepancies, further investigation was conducted into how these EL types are perceived across the African continent.

Question 1: Shared Understanding of Experiential Learning Practices

Participants in Group 1 defined these experiential learning practices. Their responses are synthesized below. The aggregate Cohen's Kappa coefficient $\kappa = 0.67$ indicates substantial agreement.

Experiential Education: While one participant declared, "I don't know what this is", other participants attempted defining the expression. Themes include the following. **Learning through Experience:** Experiential education is defined by learning through real-life experiences, emphasizing direct engagement rather than theoretical or abstract learning. This theme points to the process of learning through doing, through experiments or engaging with experiences that foster deeper understanding. ***Key Phrases***: "Learning through experiments," "learning through experience." **Reflection and Guidance:** Experiential education involves not only engaging in experiences but also reflecting on them. Reflection plays a crucial role in this process, allowing students to derive meaning from the experience. Additionally, guidance helps students navigate and learn from their reflections to gain insights. ***Key Phrases***: "Have an experience to reflect on," "be guided through." **Practical Application: EL** provides students with opportunities to apply theoretical knowledge in real-world settings. This theme highlights the importance of practical activities that connect theory to practice, making learning more meaningful and relevant. ***Key Phrases***: "Students being offered an opportunity to be exposed to practical activities," "bring meaning to what they have learned."

Active learning: The responses were divided in three themes. Active Participation: Students are engaged directly in their learning, which goes beyond just listening to a lecture. ***Key Phrases***: "*Learning through engagement," "students are actively involved with learning," "actively participate*." Student Accountability: Learners take responsibility for their educational progress with guided support. ***Key Phrases***: "*Students take responsibility for their learning," "guided instructions," "actively engaged process*." Full Participation: Students are encouraged to participate fully, with no reluctance or passive involvement. ***Key Phrases***: "*Actively participate without reservation*."

Case study: The responses were divided in four themes*:* Contextual Learning: Case studies are defined by specific examples and their contextual backgrounds. ***Key Phrases***: "*Specifying a specific example and contexts*." Focused Inquiry: Students focus their analysis on a particular topic or problem. ***Key Phrases***: "*Students are asked to concentrate on a particular topic*." Real-Life Scenarios: Case studies provide scenarios that challenge students to study and analyze real-world situations. ***Key Phrases***: "*Learners are given a scenario to study and analyze*." Real-World Relevance: The cases are drawn from real environments and often involve real-world challenges. Key Phrases: "A piece of work from a real environment," "real world tensions." Student Engagement and Understanding: Case studies actively engage students and help them demonstrate their understanding of the material. ***Key Phrases***: "*Animate the students' engagement," "Using objects to demonstrate understanding*."

Cooperative Education: The responses were divided in four themes: Work-Based Learning: Cooperative education is like an internship, where students gain practical work experience during their undergraduate studies. ***Key Phrases:*** *"Like an internship, but typically during an undergraduate program."* Collaborative Learning: The learning environment involves collaboration, where learners work together and share knowledge. ***Key Phrases:*** *"This involves collaboration," "Learners collaborate and share knowledge."* Peer Teaching and Collective Knowledge: Students not only learn individually but also teach their peers, ensuring collective understanding. ***Key Phrases:*** *"Students learning themselves and teaching others," "All of them know everything at the end without studying everything themselves specifically."* Industry-Academia Collaboration: Cooperative education connects academic learning with real-world industry experiences, giving students the chance to apply theoretical knowledge in practice. ***Key Phrases:*** *"A place to coordinate the process of allowing students to go to industry for practical purposes."*

Internship/Practicum: The responses were divided in five themes: Work-Based Learning During Breaks: Internships or practicums often take place during academic breaks, allowing students to engage in industry-related work outside of their regular academic schedule. ***Key Phrases:*** *"Learning during breaks in industry."* Skill Development: Internships and practicums are primarily focused on providing students with practical, hands-on skills that are essential for their future careers. ***Key Phrases:*** *"Learner being sent to institutions to acquire practical skills."* Mentorship and Professional Guidance: Students receive guidance from professionals, which helps them understand the realities of the profession and the tasks they will perform in the future. ***Key Phrases:*** *"Completing some work at an engineering practice with guidance," "What the profession looks like*." Practical Application of Learning: Internships and practicums involve direct, hands-on experience where students work on relevant tasks and gain insights into the day-to-day responsibilities of their profession. ***Key Phrases:*** *"Students attached to industry for hands-on experience during their course."* Job-Specific Learning: Internships and practicums provide students with opportunities to apply discipline-specific knowledge in real job settings, enhancing their preparedness for their chosen careers. ***Key Phrases:*** *"Opportunity to learn about a job based on their discipline."*

Field-Based Education: The responses were divided in five themes: Long-Term Practical Experience: Field-based education often provides students with years of hands-on exposure and learning, accumulating practical knowledge over time. ***Key Phrases:*** *"Years of experiencing."* Experiential Learning Beyond the Classroom: It emphasizes learning outside of the classroom, where students are immersed in real-world contexts and gain experiential knowledge. ***Key Phrases:*** *"Learning outside the classroom."* Mentorship and Goal-Oriented Learning: Students work alongside mentors in the field, focusing on specific outcomes and developing

professional competencies relevant to their discipline. ***Key Phrases:*** *"Work on site with a mentor towards a specific outcome,"* *"Develop competencies."* Real-World Job Application: It bridges the gap between academic learning and professional practice by providing students with hands-on experience in job settings, allowing them to connect their theoretical knowledge with industry expectations. ***Key Phrases:*** *"Hands-on experience in the job market."* Practice in Real-World Settings: Field-based education allows students to actively engage in practice, providing them with the opportunity to apply classroom knowledge to real-life challenges. ***Key Phrases:*** *"Going to the field for practice purposes."*

Problem-Based Learning (PBL): The responses were divided in five themes. Active Problem Engagement: PBL is driven by the active engagement of students with real, relevant problems. The learning process starts with the problem, making it central to educational experience. ***Key Phrases:*** *"Learning by engaging with a problem."* Problem-Solving as the Core Learning Activity: Students learn through the process of problem-solving. This hands-on approach challenges students to use their knowledge and skills to find solutions to complex, real-world issues. ***Key Phrases:*** *"Learning by problem solving*." Guided Inquiry and Self-Directed Learning: While PBL involves some guidance from instructors, it largely promotes self-directed learning. Students are encouraged to inquire and explore independently, fostering deeper understanding through discovery. ***Key Phrases:*** *"Guided active learning,"* *"The problem is the centre,"* *"Learning is unscripted.*" Problems as Learning Context: Problems are not just topics for study in PBL; they are the mechanisms by which learning happens. By addressing these problems, students develop critical thinking, collaboration, and analytical skills. ***Key Phrases:*** *"Using problems to learn."*

Project-Based Learning (PBL): The responses were divided in five themes. Active, Hands-On Learning: PBL is centred around students actively engaging in projects. Learning takes place through direct involvement in tasks that have real-world applications, promoting experiential learning. ***Key Phrases:*** *"Learning while undertaking a project.*" Investigation and Problem-Solving: Students are given a problem or challenge to investigate. The process of working through this issue, gathering data, and reporting findings is crucial to the learning experience, fostering problem-solving and analytical skills. ***Key Phrases:*** *"Learners being given a problem to investigate and report."* Structured, Guided Learning: While the project is the central focus, students are not left entirely on their own. There is guidance provided to help them engage effectively with the project and to develop the competencies required to complete it successfully. ***Key Phrases:*** *"Project is the centre of the learning,"* *"Guided engagement,"* *"Support the students' ability to engage with the project."* Projects as Learning Tools: Projects in PBL are not just tasks to complete but are the main instruments through which learning occurs. They are designed to promote critical thinking, collaboration, and the application of knowledge. ***Key Phrases:*** *"Using projects to learn."*

Independent Study: The responses were divided in five themes. Self-Directed Learning: Independent study is rooted in the learner's ability to take control of their own learning. The individual decides on the content, pace, and methods, making the process more personal and tailored to their needs. ***Key Phrases:*** *"Learning on my own."* Autonomy and Independence: Learners in independent study are not reliant on teachers or peers for regular guidance. They are expected to navigate their own learning, which fosters self-reliance and independence. ***Key Phrases:*** *"Learners learning on their own."* Minimal Guidance with Initial Structure: Although independent study is primarily self-guided, there is sometimes initial structure or guidance, such as starting questions or frameworks provided by a mentor or knowledgeable other. This structure helps learners get started but leaves the rest of the learning process up to the individual. ***Key Phrases:*** *"Work on your own,"* *"Starting guiding questions from a knowledgeable other."* Self-Paced Learning: Independent study allows learners to set their own pace, deciding when and how to engage with their studies. This flexibility is central to the concept, as it places the responsibility for progress on the learner. ***Key Phrases:*** *"Study on your own."*

Service Learning: The responses were divided in five themes. Community-Based Learning: Service learning is anchored in the concept of learning through community engagement. Students actively participate in community service, bringing real-world contexts into their learning process. ***Key Phrases:*** *"Learning in a community."* Service as a Learning Process: Students learn not just through lectures but also through the act

of rendering services, which connects their academic knowledge with practical, community-oriented outcomes. ***Key Phrases:*** *"Learning through rendering services."* Experiential Learning with Real-World Challenges: Service learning combines problem-based and project-based learning approaches, where students engage in real challenges in the community. This combination encourages active learning in real-world contexts. ***Key Phrases:*** *"Problem and project-based learning combined," "Partner in community with a real challenge," "Students can engage with."* Real-World Exposure and Social Responsibility: Service learning takes students out of their academic comfort zones and exposes them to diverse societal issues. This exposure helps develop professional skills while encouraging social responsibility. ***Key Phrases:*** *"Taken out of their comfort of university confines," "Engage with society," "Take responsibility as a developing professional."* Professional Development and Societal Impact: Service learning fosters a deeper understanding of how students' academic disciplines can directly affect society. It encourages students to see themselves as responsible professionals contributing to society. ***Key Phrases:*** *"Seeing how the discipline can influence and impact society."* Service as a Learning Tool: Service is not just an altruistic activity; it is a tool for learning. Through service, students gain practical skills and insights that enhance their academic and professional development. ***Key Phrases:*** *"Provide service for the sake of learning."*

In-Service Training: There were four these identified in the responses: Practical Learning in Industry Settings: In-service training offers an opportunity for learning within the industry, where employees or students gain practical experience that complements their academic knowledge. ***Key Phrases:*** *"Learning in industry."* Professional Development and Skill Enhancement: The primary aim of in-service training is to improve and upgrade the skills of employees, ensuring they stay competitive and aligned with industry needs. ***Key Phrases:*** *"Training employees to upgrade them."* Structured, Focused Learning Experience: In-service training is designed to be more structured and guided compared to internships, providing a more curated and goal-oriented learning process. ***Key Phrases:*** *"Similar to internship but perhaps more curated and guided."* Bridging Theory and Practice: In-service training helps bridge the gap between theoretical education and real-world practice by allowing students or employees to apply their academic knowledge in an industry setting. ***Key Phrases:*** *"Students going to industry after they are done with their theoretical work."*

Capstone Project: There were four of these identified in the responses: Integration of Learning and Application: The Capstone project allows students to integrate and apply knowledge from different areas learned throughout their academic program. It serves as a comprehensive learning experience that synthesizes multiple disciplines. ***Key Phrases:*** *"Project-based learning after key learnings," "Execute projects to gather knowledge."* Practical Application of Knowledge: The project is a hands-on opportunity for students to implement their theoretical learning into practice, providing real-world relevance and testing the application of knowledge. ***Key Phrases:*** *"Executing projects to gather knowledge."* Independent and Self-Directed Learning: The Capstone project encourages students to take ownership of their learning process, fostering autonomy and responsibility. Students can work independently or in teams to demonstrate their abilities. ***Key Phrases:*** *"Final year project," "Independent learning."* Holistic Skill Development and Competency Integration: The project requires students to apply and showcase a variety of competencies, including technical, problem-solving, and communication skills, often involving cross-disciplinary work. ***Key Phrases:*** *"Integrates multiple competencies."* Real-World Relevance and Industry Collaboration: Many Capstone projects involve industry-based problems, which enhances the students' understanding of real-world challenges and prepares them for their professional careers by linking academia with industry. ***Key Phrases:*** *"Using industry-based projects to learn."*

Question 2: Could you briefly describe your understanding of experiential learning?

Two themes were identified for participants who self-declared to be familiar with experiential learning but have not use it (3 responses): Practical and Hands-on Learning: Emphasizing that experience is gained through practice and the real-world application of learned concepts. Illustrations include: "*Experience by practising," "Hands-on learning," and "Practical application of concepts*." Active Engagement and Reflective Learning: Highlighting that engagement and reflection are integral components that enhance the learning process and

deepen understanding. Illustrations include: *"Teaching approach that encourages active engagement," "Reflection," and "Real-world application."*

Four themes were identified for participants who declared to be familiar with experiential learning and have used it (6 responses): Practical and Hands-On Learning: Experiential learning emphasizes learning by doing and applying knowledge through hands-on experiences, often in real-world settings. Illustration Includes: *"Learning by doing," "Hands-on experience," "Practical application of theory," "Working with the community."* The second theme was found to be Real-World Application and Challenges: Experiential learning prepares students for the real world by presenting them with challenges they are likely to face in their careers, such as internships and work-related learning journeys. Illustrations Includes: *"Internships/work-related learning journeys," "Real-world challenges," "Embodied experience of engineering practice*." The third theme includes Collaborative Learning and Global Interaction: Through engagement with peers from different countries and cultures, experiential learning encourages collaboration, global interaction, and the exchange of diverse ideas. Illustration Includes: *"Students from different countries interact and learn together," "Active learning pedagogies," "Engagement with real-world challenges. "The fourth theme was found the be* Bridging the Gap Between Theory and Practice: Experiential learning helps students connect theoretical knowledge with real-world applications, making learning more meaningful and reinforcing the fundamentals of their field of study. Illustration Includes: *"Putting theory into practice," "Understanding through involvement," "Gaining more understanding."*

4 Conclusions and Limitations

4.1 Shared Perceived Impact of Experiential Learning

The observed finding that Group 2 holds a higher belief in experiential learning's potential could be attributed to a combination of idealized perceptions stemming from a lack of direct experience, a potential manifestation of the Dunning-Kruger effect, and the possibility that challenges encountered during implementation might have tempered Group 1's enthusiasm. While conventional wisdom and established theories often suggest that direct experience should bolster belief in a method's efficacy, the specific context and quality of implementation play crucial roles in shaping these perceptions. Further investigation into the specific experiences of Group 1 and the understanding of experiential learning within Group 2 would be necessary to fully elucidate this intriguing finding.

4.2 Shared Perceived Practices and Understanding of Experiential Learning

Among the proposed EL practices, problem-based learning, project-based learning, field-based education and internship form the top four most used EL practices, while service learning, capstone project, case study, co-op, and independent study form the top four of unpopular EL practices. The research reveals a variation in the definition application of EL. It underscores the need for harmonizing EL practices to foster greater coherence and effectiveness in engineering education across Africa.

4.3 Limitations & Future Investigations

This study was based on a small set of participants. Yet, the findings make the case for future investigation into the factors driving the choice and perceived impacts of EL, as well as a depth analysis of the shared understanding of EL practices. This research warrants further investigations in the integration of EL practices within the African engineering education context, to include indigenous education. For instance, the following questions should be considered: How can African indigenous knowledge systems be meaningfully structured into formal EL? In what ways can traditional experiential approaches, such as those rooted in observation, imitation, and community storytelling inform the design/adaptation of EL? Could similar culturally embedded EL practices enrich engineering education in Africa? What models exist for leveraging community knowledge and indigenous practices to develop contextually relevant EL practices? From a qualitative point of view, using AI for qualitative analysis is relatively new in the field, with the risk of AI generating hallucinations about the

data. Although the methods outlined in this paper offer a way to reduce hallucinations, researchers might have overlooked other perspectives on the data. A future study comparing AI qualitative analysis results with human-only qualitative analysis results could help identify differences and insights. This future study can highlight perspectives missed by AI and include aspects overlooked by human analysis.

5 References

Academia and Communities: Engaging for Change, ed. Fadeeva, Zinaida, Galkute, Laima and Chhokar, Kiran B. (Tokyo: United Nations University Institute for the Advanced Study of Sustainability, 2018).

Anguera, M. T., Blanco-Villaseñor, A., Losada, J. L., Sánchez-Algarra, P., & Onwuegbuzie, A. J. (2018). Revisiting the difference between mixed methods and multimethods: Is it all in the name? *Quality & Quantity*, *52*(6), 2757-2770.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215.

Barnes, J., & Weller, N. (2017). Case studies and analytic transparency in causal-oriented mixed-methods research. *PS: Political Science & Politics*, *50*(4), 1019-1022.

Brijmohan, Y (2025). Overview of innovative pedagogies from a global perspective, highlighting sustainability, the need for contextual awareness, research, and harmonization of Engineering Competencies. Keynote Presented online at IFEES GEDC IUCEE Webinar.

Clark, R. M., Kaw, A., & Besterfield-Sacre, M. (2016). Use of simulated experiences in engineering education. *International Journal of Engineering Education*, 32(1B), 410-419.

Creswell, J. W., & Tashakkori, A. (2007). Editorial: Differing Perspectives on Mixed Methods Research. *Journal of Mixed Methods Research*, *1*(4), 303-308. https://doi.org/10.1177/1558689807306132 (Original work published 2007)

Ferreira, A., & Lemmer, M. (2021). A fine-grained teaching activity to establish conceptual coherence in introductory physics concepts and representations. *Journal of Physics: Conference Series*, 1929, 012003.

Frimpong, L.K., Mensah, S.L., Angmor, E., Gbedemah, S.F. and Okyere, S.A. (2024). Experiential learning as community engagement: Exploring the experiences of undergraduate students in an African university, Societal Impacts, Volume 4, 100064.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and the learning of complex systems. *International Journal of Science Education*, 29(2), 153–171.

Illeris, K. (2009) A comprehensive understanding of human learning. In Illeris, K. (Ed) *Contemporary theories of learning: learning theorists in their own words* (7-20). Oxford: Routledge.

Kasirye, F. (2021). An Overview of Mixed and Multi Method Research.

Kolb, A. & Kolb, D. (2018). Eight import ant things to know about The Experiential Learning Cycle. AEL 40(3).

Kolb, D. A. (2015). *Experiential learning: Experience as the source of learning and development* (2nd ed.). Pearson Education.

Kong, Y. (2021). The role of experiential learning on students' motivation and classroom engagement. *Frontiers in psychology*, 12, 771272.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, 77(6), 1121–1134.

Moon, J. A. (2004). *A handbook of reflective and experiential learning: Theory and practice*. Routledge.

Nancy Odendaal (2013) Experiential Learning in African Planning Schools: Reflections on the Association of African Planning Schools (AAPS) case study project, in *R. B. Estudos Urbanos e Regionais*, 15(1). 155 – 166.

Nhan, P. (2024). Bridging the Gap: A Framework for Experiential Learning in Higher Education. *Business and Professional Communication Quarterly*, *0*(0).

Tembrevilla, G., & Phillion, A. (2023). First-Year Students in Experiential Learning in Engineering Education: A Systematic Literature Review. In 2023 ASEE Annual Conference & Exposition.

Tembrevilla, G., Phillion, A., & Zeadin, M. (2024). Experiential learning in engineering education: A systematic literature review. *Journal of Engineering Education*, 113(1), 195–218.

Van Eerde, W., & Van der Velde, M. E. G. (2005). Enthusiasm for new organizational practices: The role of employees' openness to experience and perceived benefits. *Journal of Organizational Change Management*, 18(4), 365–383.

Wenger, E. (2009) A social theory of learning. In Illeris, K. (Ed*) Contemporary theories of learning: learning theorists in their own words* (209-218). Oxford: Routledge.

Wijnen-Meijer, M., Brandhuber, T., Schneider, A., & Berberat, P. O. (2022). Implementing Kolb´s Experiential Learning Cycle by Linking Real Experience, Case-Based Discussion and Simulation. *Journal of medical education and curricular development*, *9*, 23821205221091511.

Wurdinger, S., & Allison, P. (2017). Faculty Perceptions and Use of Experiential Learning In Higher Education. *Journal of E-Learning and Knowledge Society*, 13(1).

Yates, T., Wilson, J., & Purton, K. (2015). Surveying Assessment in Experiential Learning: A Single Campus Study. *The Canadian Journal for the Scholarship of Teaching and Learning*, 6(3).

Yatesolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall.