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Impact of Experiential Learning on Learning Outcomes Among Engineering Students Based on Kolb's Model: A Netnography Study

Dr. Mita Mehta[1], Nishant Mehta[2]
[1] Research Professor, Symbiosis Institute of Health Sciences – Pune, Symbiosis International (Deemed University), Pune Maharashtra
[2] Group Project Manager, Infosys Limited, Pune, India
[1] tnrcms.mita@gmail.com
[2] mehta_nishu@yahoo.com

Abstract : This article aims to explore the impact of experiential learning on learning outcomes and clarify how and what makes experiential learning more impactful, keeping Kolb's learning model at the center. This study was conducted for engineering students through netnography methodology. By analyzing comments, we have gathered insights about the learning outcomes and type of experiential learning from engineering students through online forums and community pages. The study has a netnography tool, a most advanced and extended version of ethnography. For this study, we have referred to Kolb's experiential learning model to interpret the results gathered through netnography. The authors developed five dominating themes based on comments received and analyzed. The findings are five significant themes 1, Cooperative learning, 2. Consistency, 3. Relevance, 4. Simulation and 5 Transparency. Our study has important practical and theoretical implications considering how Engineering students' EL tasks should be framed, keeping Kolb's learning model in the center.

Dr. Mita Mehta
Research Professor, Symbiosis Institute of Health Sciences, Pune, Symbiosis International (Deemed University), Pune Maharashtra
tnrcms.mita@gmail.com

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1. Introduction

"Learning beyond the books" is often expected from the students and teaching faculty among engineering students. Experiential learning (EL) is more recognized as delivering courses across international universities. 'Experiential learning is understood as learning from experiences. Learner constructs knowledge, skill, and values through EL. Engineers are supposed to learn from the doing part rather than just reading or listening to lectures. The experiential learning (EL) concept has been practiced since ancient times. Students are expected to learn the idea by doing it themselves and develop their synthesis level. When it comes to engineering studies, it is observed that classroom teaching is insufficient to meet the expected learning outcomes among the students. Even it is the responsibility of the faculty to introduce experiential learning as a part of the pedagogical tool in teaching and learning.

Learning outcomes with experiential learning have proved to be pragmatic in earlier literature. This study aimed to further the knowledge about experiential learning in the engineering curriculum for improved learning outcomes. The present study has used netnography (Al-Rahmi et al., 2019) as a research methodology to gauge the impact of experiential pedagogy on learning outcomes. (Hopkinson & Hogg,

2004). Education sectors have seen mass changes in the past few years, especially during and after the post-pandemic. Students, on the other hand, come from different generations and cultures. Diversity among students always expects innovation in teaching pedagogy and learning styles. Past studies have yet to cover experiential learning and its impact on learning outcomes, especially for engineering students. Engineering is a field of study where only classroom teaching may not be helpful. Especially when higher education institutions are directly aiming for employment and skill development, innovative pedagogy becomes essential.

The world is experiencing changes in skillset requirements across sectors. Whatever has been taught in the classroom soon becomes soon outmoded. Such a trend has emerged in various discussions and forums as well. Higher education institutions need help to improvise their pedagogy that contributes to skill development. Skill development is essential for critical thinking (Walker & Finney, 1999). Kolb's Model which was designed many years ago holds value to date. Taking research experimentation ideas from Kolb's model gave strong theoretical background to this research. The authors have used a unique methodology for this research that is more advanced and contemporary in the field of research. Doing qualitative research through netnography was most appropriate (Ivan, 2019) for the target group we have taken for this study i.e., Engineering students.

A. Research Objectives

1. To understand the experiential model for engineering college students

2. To evaluate the impact of experiential learning on learning outcomes for engineering college students

3. To develop themes based on Kolb's model for the expectations of engineering students for impactful experiential learning as a part of pedagogy.

2. Literature Review

There is a total amount of interest among students to pursue higher education in engineering (Borrego & Bernhard, 2011). Students pursue their higher education not only to advance their knowledge but also to make them skillful for the job market. Employers look at the learning reflections when it comes to the engineering stream. The improved interest must result in advancing curriculum and teaching pedagogy that solves complex problems.

There has been a tremendous change in the learning pattern and mode of learning in recent years (Tarrayo et al., 2021). The introduction of technology, social media, and online learning platforms (Evans et al., 2020) has opened an avenue of various tools for teaching pedagogy. Considering the exposure students get through various sources (Al-Rahmi et al., 2019), their exposure should improve learning outcomes. The studies also show some drawbacks (Le et al., 2022) if they are designed unscientifically. The experiential learning method has various phases for learning outcomes (Morris, 2020). Experiential learning using Kolb's model (Kurt, 2020) gives more insights into different stages of learning outcomes. Concept learned from the book, and experiential learning has far more impact on learning outcomes. Experiential learning gives conceptually rich experience through strong learning reflections (Morris, 2020). Experiential learning provides learning in a natural context (Andresen et al., 2020). Experiential learning conducted in innovative ways has become challenging in the past few years due to the impact of the pandemic (Chick et al., 2020).

Previous studies mentioned outcomes-based learning approaches (Driscoll & Wood, 2020). Learning based on reinforcement significantly impacts learning outcomes (Dabney et al., 10--15 Jul 2018). Students often resist active learning (Deslauriers et al., 2019) due to their pre-learning notions. For practical learning, a learner-centric approach, user-friendly technology, and collaboration between the learner and facilitator are essential (Regmi & Jones, 2020). Students sometimes have unrealistic expectations (Heidhues et al., 2018) from learning which may lead to communication gaps. This might fail in the teaching task. To make effective use of teaching pedagogy, it has to be learner-focused (Garnjost & Lawter, 2019). Experiential learning helps to engineer students to develop an innovation quotient. In their studies, Kolb (1984) mentioned that learning is the outcome of knowledge creation. Curriculum design to delivery needs the active involvement of learners and facilitators (Parashar & Parashar, 2012). Higher education institutions must prepare engineers for tomorrow (Parashar & Parashar, 2012). Engineering curriculum has enormous significance in addressing the issues related to the world. The issues about sustainability, global

warming, innovation, pollution, and so on initially come from the engineering discipline is mainstreaming. The engineering curriculum has technical areas to be looked into while learning and the human side to execute it (Reid & Griesinger, 2021). If the application part has not been taken care of, it might become a disaster. Application of learning is the key to any curriculum, especially engineering.

Kolb (1984) and Kolb and Kolb (2013) articulated that learning should be a process and not only outcome-oriented. The experiential learning process would be more facilitated when students, after learning the concepts in the classroom, can test and retest the application of learning in or outside the class. Learning can be called experiential when the student applies it per different setups and settings. Learning is the whole process of learning and then reflecting, which might differ for different students (Dantas & Cunha, 2020). In the model, Kolb explained how active experimentation results in a substantial experience that happens through doing or having an experience. Post the concrete experience learning cycle results in reflection. Reflection is the process of reviewing and reflecting based on the experience. Each student would learn the same concept in class but may have a different style of reflection based on their reviewing and experience cycle. Cognitive analysis of concepts also differs from person to person, and no standard time is expected to be observed. In this model, Kolb mentioned that post reflective observation, student learning results in abstract conceptualization that is concluding or learning from the experience. The authors have presented the Kolb (1984) learning theory in Figure 1 below. The learning cycle presented by Kolb is also popularly known as the process of delivering, assimilating, converging, and accommodating. The learning cycle may have different patterns and timelines from learner to learner, especially in adult learning.

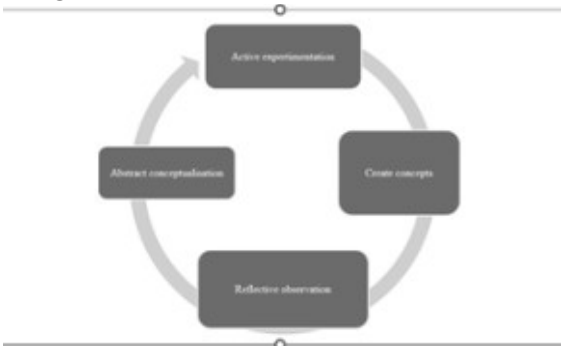

Fig.1: Kolb's experiential learning model

Experiential learning in the engineering stream takes various forms (Coker et al., 2017). Though for this study, authors have yet to study the types and duration of experiential learning and learning outcomes. Experiential learning varies across semesters and years in the journey of engineering studies (Coker et al., 2017). However, a substantial part of the learning remains with the students for extended periods. For example, studying abroad or internship are examples where students can keep applying the learning from and to the role he was assigned during the internship. In the same way, the project techniques or fieldwork are also considered part of experiential learning. This study has mentioned the concept of experiential learning in a broader way, where all types of experiential learning tools across all semesters and all disciplines are mapped and clubbed under one umbrella for the simplification of the study.

3. Research Methodology

Research Design: Qualitative approach has been used to address the research question framed for this research. Since such research can capture the qualitative aspects of EL, such methodology is essential.

Qualitative approach: The study uses the netnography method, a qualitative research method (Kozinets,1997) is the extended version of ethnography (Costello et al., 2017). Netnography methodology is considered the most robust, reliable, and faster than traditional setups. Qualitative research in online setup is still in the introductory stage. Qualitative research methodology for online communities with broader scope and coverage compared to qualitative ethnography is in its nascent stage. The advancement of social media usage among the young generation results in sharing their feelings and experiences on social media than in a personal setup. Students are studying in engineering colleges across India. For this study, authors collected data from selected online platforms like Facebook, Twitter, blogs, and Instagram, where discussions related to online studies, curriculum, pedagogy, etc. occur. We excluded LinkedIn and Quora because of disguise, and factual comments can only be gathered from selected platforms. While using netnography as a methodology, authors were aware of the natural sampling bias (Lugosi et al., 2012). Considering the benefits of a large audience and their presence on social media platforms, netnography is the most

appropriate tool for this research. Hence to fetch more accurate and natural reactions through netnography (Robert V. Kozinets, 1998) on learning experiences and pedagogy, we collected data through comments on these platforms and analyzed them. We have used all the steps of the netnography method (Kozinets, 2002), including planning, Entrée stage, analysis, and interpreting data. We took comments from the keywords search base which has strong validity in netnography (Kozinets, 2002).

For this study, we have used convenient sampling and data collected with the planning of research questions and frames through online communities mentioned earlier in the article. Since the engineering stream and curriculum impact the entire demography of India, we have not limited the study to a particular region or stream/specialization. To have the advantage of reach to the larger community, we collected comments from various platforms. Data presentation has been done through thematic analysis.

The online forums of engineering students on social media platforms of the past two years have been collected. Comments related to curriculum, experiential learning, classroom learning, and learning outcomes have been selected and retained for the data analysis. Authors had no influence or bias during this research methodology since they had no direct contact with commenters posting comments on social media. This is the most scientific approach to digital ethnography since commenters and data collectors have no direct contact with each other, which eliminates the chances of any biases during the research or data collection. Around 10000 ten thousand comments were downloaded where authors could see a connection with curriculum, experiential learning, classroom learning, and learning outcomes related to the subject matters discussed. Out of 10000 comments, 7546 comments were retained through debris cleaning and raw peeling of data.

We have maintained the confidentiality of commenters while downloading comments and all aspects of ethical standards followed during this research (Anne-Marie et al., 2017). Anonymity has been maintained by masking commenter names X1, X2, and likewise. The entire task was conducted with the help of Microsoft Word documents, and data were analyzed through deductive coding. The thematic analysis gives detailed insights into the study (Braun & Clarke, 2006). The benefit of conducting thematic analysis remains in the data collected and responses gathered. Unlike quantitative studies, where data is gathered and runs through either software or some formula where human experiences and insights are difficult to gather, qualitative study has the advantage over the earlier one (Mwita, 2022). For this research, we gathered comments and post-gathering comments, and the authors applied the netnography tool for data analysis. The subsequent section reveals the theme that emerged from data analysis about experiential learning and its impact on learning outcomes.

4. Findings

Comments gathered and downloaded from various social media platforms like Facebook, Twitter, and Instagram mainly comprised engineering students. As mentioned in the methodology section, 7546 comments were taken for the next level of coding and analysis. Authors first followed the principle of netnography while collecting the comments which is the most scientific approach to digital ethnography since commenters and data collectors have no direct contact with each other, which eliminates the chances of any biases during the research or data collection

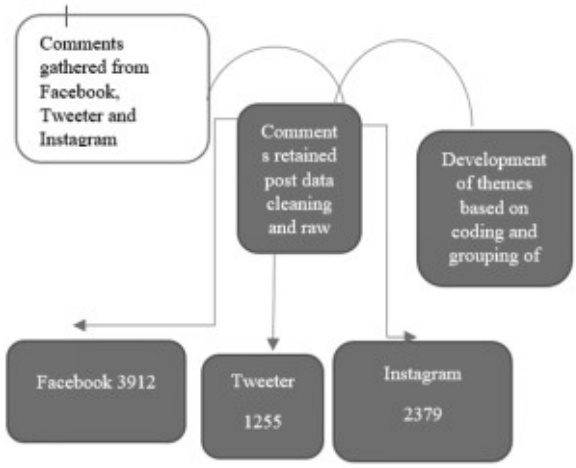

Fig. : 2 Process of Coding

The following themes emerged after the deductive coding (DeLyser et al., 2013) of comments received from various platforms.

1) Cooperative learning:

Commenters through online platforms on various social media mentioned cooperative learning. The assistance of a facilitator in addition to faculty, query resolving on time, and learning by observation are some of the comment threads leading to theme cooperative learning. Engineering students seek to review and assessment of the EL assigned to them.

The finding reveals that students seek active mentor roles throughout the experiential learning setup, be it a project, an assignment, or even fieldwork. Commenters mentioned that most of them had pre-knowledge issues when they started experiential learning. They were aware of the outcome of the experiential learning, but there was mental resistance to carrying out the task without the faculty's support. A cooperative learning environment will make them more confident and improve their learning outcomes. Comments like ' we need mentor assigned from the respective field for clarification during or mid assignment. 'Comments like ' we cannot understand everything from the rubrics' indicate learner-centric feedback—emphasis on cooperative learning hence given through the data analysis.

2) Consistency

The commenter mentioned the consistency in EL assignments or learning setup. Analysis of comments on the timelines and EL consistency. Engineering students mentioned timelines and gaps appearing during assignments in their discussion forums. There are some assignments of experiential learning which make a precursor for internship. Many commenters mentioned that only some ELs have a sequel or extended version. One commenter mentioned that 'due to semester timelines, we forget important learning outcomes from the assignment, and we would like to redo it with a different application.

There is mention of attached EL assignments along with integrated and connected work. Many students from the electronic engineering field stressed that the project work assignment could have different evaluations along with some teaching interventions.

'I wanted to revisit that assignment, and after my fifth semester, I think I can put a better application in that project'.

Comments are also directed to the volume of assignments. The mention of inquiry-based EL was highlighted in the comments section. Students expected some pre-read, pause, then execution. Such comments signify the significance of consistency.

3) Relevance

Another theme authors could gather from the coding of comments gathered is 'relevance. 'Engineering students mentioned in the discussion forum that EL tasks have well-designed rubrics that should be supported by their context with industry, employment, or skill development. Students' learning outcomes are majorly dependent. Students mentioned that considering motivation level and expected delivery relevance is the key to managing both. A commenter mentioned outdated assignments, repetitive and predictable questions, and unchallenging, monotonous tasks. Students seek more skill-oriented and challenging assignments where they can place classroom learning to application. One commenter mentioned 'over an online platform that I had yet to learn what I was supposed to contribute and its relevance to my long-term learning; hence I did it but not with the heart'. Another commenter mentioned that EL of project-based learning was so learning-oriented that it left a long-term impact on him.

4) Simulation:

Students from engineering backgrounds mentioned in comments about the more of simulating EL assignments. Commenters reflected that simulation leaves more tangible learning than simple assignments. Roleplay and capstones are some highlighting words that appeared in downloaded comments. Students mentioned there is tremendous learning in learning by doing. Resemblance to workplace scenarios can trigger more critical thinking, which was mentioned by one of the commenters. Comments findings reveal that the interest and excitement of students would be high in the practical learning related to the simulation environment. They mentioned that such simulation invokes professional values in the classroom. There was mention of peer-to-peer learning through a simulation like a capstone and roleplay.

5) Transparency

Comments like evaluation, timelines, and modality-related questions always remain for any EL learning coding to the theme of transparency. Commenters mentioned clarification in communication, timely email with all rubrics mentioned in it, facilitator and resources related information is desired from the side of students. Transparency related to how EL is having an impact on their thinking skill, analytical skills, and problem-solving skills will make them better prepared. There was mention of formative assessment also. If the feedback mechanism for learners and facilitator is

transparent, it leads to impactful EL. One commenter mentioned that 'I wanted feedback about my performance when I participated in EL about where exactly I was lacking'. Feedback and clarity through transparency can build lifelong learning; one more commenter wrote this.

5. Discussion

The corporate world does not expect a walking encyclopedia to join their firm, and they need candidates with a critical thinking approach who can apply technical knowledge to practical things. The above themes mention the experiential learning assignment considering Kolb's learning model. The authors collected data from the online forum and downloaded more than seven thousand comments to run the findings. Authors immersed themselves into the community pages in disguise and collected the responses for netnography analysis. Our findings reveal that five themes have been captured from the comments downloaded: cooperative learning, consistency, simulation, relevancy, and transparency. What motivates the students is very significant while designing EL. The main objective of EL, as described in Kolb's model, are experiencing, reflecting, thinking, and doing. The facilitator must understand that EL is a process and it will take time in reflecting learning after doing. It may not be immediate—themes supporting this argument like consistency and relevance (Chan, 2012a). While higher education institutions widely adopt experiential learning, running the EL scientifically is imperative. (Chan, 2012b). Cooperative learning is the essence of EL (Dr. et al., 2020). Earlier studies support our findings related to bringing relevance while conducting the (Kong, 2021), where authors mentioned that engaging EL in day-to-day classes and learning-centric is more beneficial. The facilitator or faculty must ensure that the learner is gaining knowledge and factual training from the assignment.

Tasks assigned under EL must represent some association with the content of the syllabus to make it more meaningful. Assignments in a more scientific way result in hand on learning objectively. EL must be designed to keep the motivation of the students in mind. Once the students are motivated to take up any EL, their relative competencies will also be developed. Kolb (1984) also supports this argument that learning through experience is enduring. Students should be allowed to learn various learning experiences by trying them out, i.e., through simulation. When a student is given enough time to have the hands-on experiment, they can self-evaluate what they are lacking and how they can improvise (Andresen et al., 2020). EL attempts to develop industry-ready skills as a precursor to the actual experiment. Engineering stream. Critical thinking developed through EL makes lifelong learning. A simulation like roleplay or capstone can be designed in a more scientific way than a technical one. One should not make the simulation more complicated by putting so many rubrics. Instead, let students experiment with it in the form of beyond the experience of the book. Assisting students during the EL has great importance. There must be some query window they can always rely on to bring consistency to the assignment. A knowledge and application base environment will encourage students to have more practical learning than ever before. Mechanical, electrical, or even Data science and IT domain students from the engineering stream highlighted the knowledge-based environment. Most of the commenters reflected that EL is affecting their learning outcomes but what type of EL is introduced is essential. One of the themes mentioned about transparency, comments, and feedback should be encouraging and constructive. EL makes students more employable than standard classroom teaching. EL breaks the monotony and rot memory tradition working for many years. (Garnjost & Lawter, 2019). EL results in classroom engagement through motivation. EL has been part of teaching and pedagogy for a long, but there are a couple of challenges each facilitator faces in introducing and executing it (Radović et al., 2021); findings of this study will bring some clarity among the faculty and facilitators teaching the courses in Engineering stream. The experiential learning environment is also significant (Radović et al., 2021) for making learning productive and impactful. Learning outcomes associated with EL techniques can be measurable if the rubrics are clear and consistent. We observed that the comment section related to clarification and relevance of the EL has more critical comments. Feedback from EL can improvise this challenge. Faculty members accordingly can set or alter the pattern post the student feedback. International and well-known universities like Harvard and Sandford to Indian top-ranked universities like IIMs to IITs use experiential learning as a part of teaching pedagogy (Evans et al., 2020. In order to make the EL task more successful, the themes presented above will be a guiding tool for the faculty members.

6. Conclusion and Implications

Present thematic analysis through netnography provides a clear understanding of implementing scientific, experiential learning techniques for improved learning outcomes. Rather than just explaining the benefits of experiential learning (Chan, 2012b), we presented the thematic view of the first-hand user of experiential learning. Stakeholders in the education field still need to be interconnected, and as a result, students do not get the expected learning outcomes due to insufficient pedagogy or unscientific techniques. India has one of the highest numbers of engineering students passing out every year. Their employability and skill mapping has an essential impact on the performance of higher education institutions. Our study will have substantial practical implications not only for Indian engineering institutions but also across the world. The world is moving towards technical and digital transformation. Hence, the more extensive comments gathered through digital ethnography, netnography is a guiding tool for future research agendas. Through this study, the fundamental theoretical Kolb's model also broadened the horizon significantly. Application of learning would be more effective for higher education institution students if they have applied EL pedagogy in their learning outcomes. Identified themes can be empirically tested as a future research scope by applying quantitative techniques. The themes identified were cooperative learning, consistency, simulation, relevance, and transparency.

7. Limitations

Our study has used engineering student backgrounds only for scope. In addition, this study has used netnography as a qualitative tool for gathering and analyzing data. We have collected data from engineering students posting comments on platforms like Facebook, Instagram, and Twitter. The study could capture broader scope than any other regular qualitative study can do. However, the human interface and face-to-face expression could have been captured in more detail if the traditional ethnography tool had been used.

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Conflict of interest: The Authors declare no conflict of interest.

Data Availability: The data set used for this research is confidential as taken from social media website, but at the request of reader it can be shared on disguise not disclosing commenter details.

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