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CATALYZING CHANGE: EMBEDDING EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) WITH THE SITUATED LEARNING MODEL

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ABSTRACT

In this research study, the Situated Learning Model (SLM) has been successfully applied to promote Education for Sustainable Development (ESD) within the context of a university course, specifically General Science. The study focuses on the development and evaluation of the SLM implementation in the Fall semester of the B.Ed. (Elementary Education) program, session 2022-2026, at a reputable Public Sector University in Lahore, Pakistan. A total of fifty-seven students voluntarily participated in the research. The effectiveness of the SLM as an ESD technique was assessed using pre-test and post-test experimental research methodologies, revealing a significant increase in students' knowledge of Sustainable Development Goals (SDGs). Additionally, through their participation in the SLM, students gained awareness of the benefits to the community and learned how to maintain an environmentally friendly lifestyle. This research demonstrates that the SLM teaching methodology is an increasingly valuable tool for developing both tangible and intangible competencies and promoting environmental awareness. It emphasizes that while conceptual knowledge may initially be intangible, it becomes tangible through real-life application and problem-solving, ultimately contributing to the ESD regime.

1. INTRODUCTION

Climate change plays a significant role in the field of human geography, presenting numerous concerning issues. The emergence of these issues has profoundly impacted humanity, becoming an accelerated social reality. Over the past few decades, this social reality has posed severe threats to various

ecosystems, resulting in cascading effects that have severely polluted the environment. The primary culprits behind this devastation are the rapid depletion of resources and excessive energy consumption. The prevailing economic system necessitates a shift towards situational learning and practical solutions that consider the interplay between the economy, individuals, and the environment (Khan, 2023). Unfortunately, such practices hinder progress towards sustainability and contribute to irreversible problems within our environment. However, sustainable development represents a concept aimed at combating environmental changes, preserving resources, and mitigating obstructed economic growth that would otherwise lead to the destruction of vital ecosystems.

The severe degradation of our planet's environment has consistently been a pressing global concern. Virtually every part of the world is facing challenging circumstances. In response, the United Nations (UN) has introduced Agenda 2030, a framework that outlines 17 Sustainable Development Goals (SDGs). The primary objective of Agenda 2030 is to ensure the long-term achievement of these development goals. Consequently, the educational sphere has recognized the critical importance of environmental sustainability, leading to a renewed focus on STEM subjects that contribute to this cause (science et al).

Education has played a pivotal role in connecting learners with enriching experiences and fostering a deeper understanding of their environment. Through education, individuals are equipped with the knowledge and skills to contribute to their communities and promote sustainable development. The United Nations has identified 17 Sustainable Development Goals (SDGs) comprising 169 goals, encompassing various aspects such as the economy, society, education, law and justice, and the environment.

These SDGs provide a comprehensive framework for governments to address the challenges and deficiencies within their respective countries. Governments are expected to fulfill their responsibilities by formulating well-defined policies and subsequently monitoring and measuring the effective implementation of Agenda 2030. This research article aims to explore and address specific aspects of these Agendas, focusing on the most relevant SDGs.i.e.,

- SDG No.4. Ensuring equitable and inclusive quality education that promotes lifetime learning prospects for all,
- SDG No.11. Making resilient, inclusive, safe, and geographically sustainable development, human and physical arrangements.
- SDG No.16. Promoting inclusive ecosystems for sustainable development, peaceful, that shall be available, accessible, and justice for all for building accountable, effective, inclusive institutions across all levels.

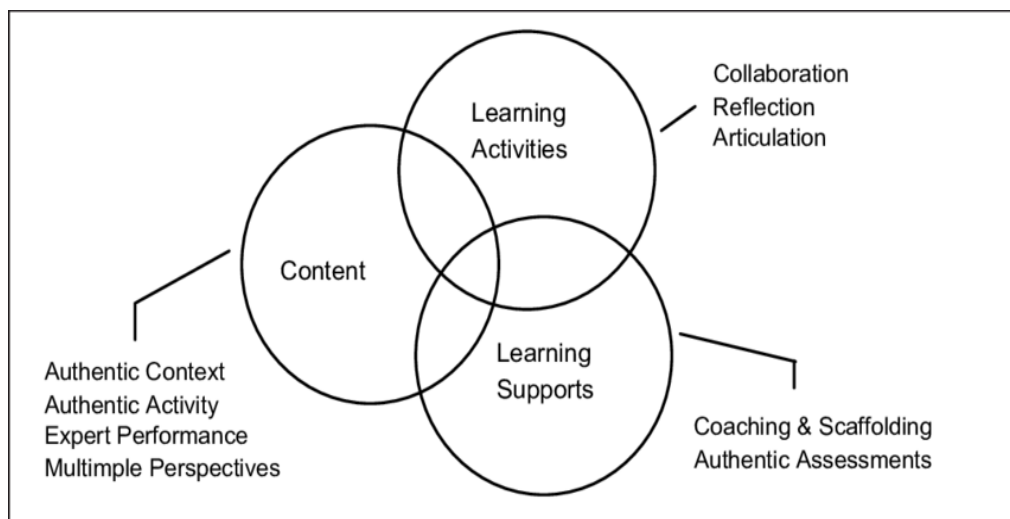
A. Background, Situated Learning and Experiential Practices.

The basic tool for sustainable development is awareness to common people from the early year's education. Jickling and Wals (2023) have pointed out the grave challenge for teachers who needs to find a diverse way of teaching their learners. Suppose we look at methodologies and strategies that have connected

interests with motivation among learners who have been aspiring for meaningful learning. In this sense, Situated Learning Model (SLM) is an important strategy to resolve the issues when it annexes with the experiential process of learning, which is regarded as a service for communal benefits. Direct or indirect involvement of students in their community services has been provided through neighborhood/municipalities, which acts as a platform of their own educational choice. Interpersonal and social incentives have increased the probability of positive reciprocity, mindfulness, and pragmatism.

In Bazgha's (2023) study, the Situated Learning model is discussed within a conceptual framework that encompasses various definitions and methodologies, offering pedagogical techniques to enhance students' understanding of academic excellence and its societal impact through skills and knowledge acquisition. The multidimensional and interdisciplinary nature of the Situated Learning Model adds complexity to this concept. Consequently, an educational mindset is fostered, promoting qualities such as determination, awareness, diligence, social and moral engagement, and blended learning, all for the betterment of the community. Over the years, numerous situational learning strategies have been developed and implemented, enabling educators to broaden their knowledge in the realm of experiential learning within the educational landscape. Notably, transitional steps have been taken to facilitate the integration of practices, transitioning from the Situated Learning Model to instructional design, ensuring a balanced approach that combines both formative and summative learning outcomes through community co-teaching activities.

Many other educational incentives raise learners' awareness about environmental disruptions. In this way, commitment, awareness, mindfulness, actions, and gestures presented by the learners have led to real-life participation. It has recognized the relationship between processes, i.e., the Situated Learning Model and Experiential Learning. Adaptation is an initiative that is the most commonly used tool in academia for writing a bibliography, which helps in differentiating between Situated Learning activities and experiential practices (role plays, fieldwork, demos, volunteering, etc.). Educational practices are of four types, conceptually clarified by following these steps. Each step has turned experiential demands into SL demands. (Solffitri et al., 2013).



B. Situated Learning Model Implication in the Study of Science

The implication of the Situated Learning Model in the study of science has garnered considerable interest among university students in recent years. Conversely, there has been a notable decline in interest recorded for other disciplines. This lack of interest in alternative fields can be attributed to a multitude of factors, indicating that the complex nature of this phenomenon is influenced by various social considerations and teaching practices associated with science. This has posed challenges in effectively imparting proven knowledge and ensuring scientific literacy among all citizens, ultimately enabling their active participation in scientific endeavors worldwide. The responsibility to address this issue lies with the education system, which can play a vital role in regulating such circumstances by supporting and advocating for faculties that effectively engage students within their learning environment. The National Science Education Standards (NSES) stress the importance of active participation in public discourse for all students, specifically addressing significant issues in General Science and Technology. In recent years, several Situated Learning Models have been proposed, designed, and implemented to achieve this goal. Consequently, it becomes essential to establish a balance between curricular learning and academic activities by integrating community services. This new form of intelligence, focused on responsible citizenship, emerges as university graduates embody philanthropic qualities rooted in individualistic interdependence. Achieving this balance necessitates a harmonious blend of community-based services and practical academia.

The Situated Learning Model typically fosters strong connections that sustain knowledge and skills in the long run, offering a platform to align theatrical directives and theoretical approaches with talent, conciseness, and creativity. Such social commitment requires the embodiment of knowledge, a series of practiced skills, and a sustainable curriculum at every educational level.

C. University Level: SLM

The absence of motivation poses a significant challenge for university teachers, creating difficulties for both learners and hindering students' goal-oriented behavior. Implementing the correct teaching methodology is crucial to overcoming this challenge. How can this be achieved? Which teaching method should be adopted to effectively combine content and methodology with practicality, thereby fostering the development of skills and training necessary for future professional careers? Enhancing motivation can be accomplished by aligning theoretical content with practical, real-life situations, aiming to engage individuals and encourage active participation to enhance knowledge retention. (Bertucci, 2023).

According to Saleem (2022), assignments based on students' interests hold value, leading to heightened cognitive involvement. The situated learning methodology contributes significantly to transforming theoretical content into practical execution. This connection is established between professional reality and the curriculum, and the use of the Situated Learning Model has shown

positive outcomes, with students expressing satisfaction as they experience and appreciate its multifaceted advantages, such as skill development, professional competence, and training sessions. (Venn, 2017).

Furthermore, the characteristics of the Situated Learning Model and its impact on students' practical approach have garnered attention from the community. The academic community is expanding its horizons by bridging the gap between theoretical content and real-world applications, thus creating new opportunities for recent post-graduate students and society as a whole. This approach broadens professional competencies and expands cognitive horizons. (Bibi, 2012).

D. The problem with the Statement

Let's examine the issue with the statement that revolves around the application of the Situated Learning Model (SLM) as an interventional teaching method and its subsequent quantitative evaluation of Education for Sustainable Development (ESD) knowledge. The problem lies within the phrase ", Catalyzing Change: Embedding Education for Sustainable Development (ESD) with the Situated Learning Model" where it states that the SLM serves as an agent for change in promoting Education for Sustainable Development (ESD) in a university course, specifically General Science. The aim of sustainable education is to achieve the Sustainable Development Goals (SDGs) through active participation in Situated Learning (SL) projects. The adopted SLM teaching strategy places particular emphasis on various developmental activities.

E. Research Hypothesis

Likewise, the hypotheses of the present study are as under:

H¹: Participation through Situated Learning Model permits plausible uses of this method toward Sustainable Education among students.

H²: Knowledge about SDGs increases when students participate while using Situated Learning Model.

I. RESEARCH METHOD AND RESEARCH SAMPLE

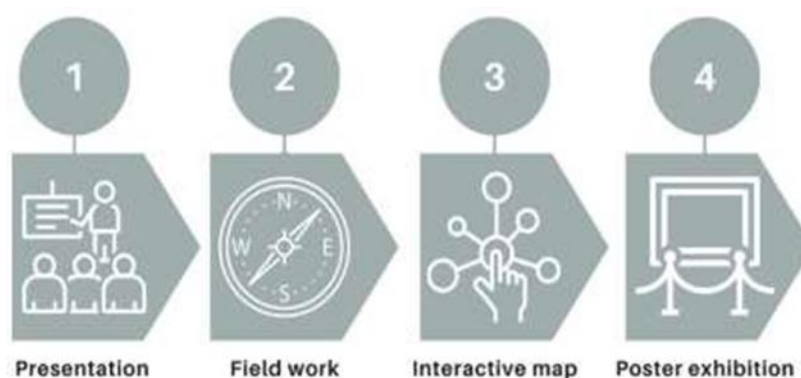
This article presents an evaluation and development of the Situated Learning Model (SLM) and its implementation in the subject of General Science during the Fall semester of the B.Ed. (Elementary Education) program, session 2022-2026, at a prestigious Public Sector University in Lahore, Pakistan. A total of fifty-seven students voluntarily participated in this educational research study, with an age range of 19-30 years (mean value: 20.21 years), with a higher proportion of female participants compared to males. All 57 students willingly participated in the research study. Pretest and posttest experimental research methodologies were utilized to assess the suitability of the SLM and its effectiveness as an Education for Sustainable Development (ESD) strategy, resulting in a notable improvement in knowledge related to Sustainable Development Goals (SDGs).

Considering the background of the participants, a larger number of students had a science background as compared to those from social sciences.

2. *Research Intervention: SLM Activities*

The Situated Learning Model (SLM) was introduced and implemented in the teaching of General Science, a compulsory subject for the B.Ed. (Elementary Education) program at a Public Sector University in Lahore, Pakistan. The purpose of teaching General Science was to equip pre-service science teachers with sustainable and productive concepts related to human and material resources in an enabling environment. These concepts were applied in training and teaching strategies for elementary-level students. The present article provides a comprehensive description of the utilization, implications, and evaluation of the Situated Learning Model within the framework of Educational Sustainable Development.

The study focused on pre-service science teachers enrolled in the Elementary program. The Situated Learning Model teaching approach was incorporated into a specific module of the General Science subject. The implementation of SLM activities spanned a period of four months, during which various engaging activities such as presentations, fieldwork, interactive maps, and poster exhibitions were designed and executed. The sequencing of these activities was aligned with the learners' progress and acquired knowledge. The SLM activities were implemented in diverse forms to enhance the students' learning experience and engagement. as shown in the following sequence Figure 2.



Phases of the SLM followed these steps:

Phase No.I: How to present activities through using SLM;

Phase No.II: Fieldwork in historical town related to Sustainable Development Goals(SDGs);

Phase No.III: All gathered information will help students to build their service-learning goals;

Phase No.IV: Finally, the discussion and results will be presented.

Phase I: In the initial stage, SLM (Situated Learning Methodology) was introduced, highlighting its key distinctions from other teaching approaches. This was accompanied by a broad timeline of the Sustainable Development Goals (SDGs) to provide context. A detailed activity was conducted to

demonstrate SLM to the entire group of participants. Students were encouraged to engage as a collective of learners and were exposed to real-life activities that further enhanced their understanding. The participants also provided feedback on their individual activities, which was documented as reflections.

Phase II: During this phase, students embarked on an inquiry-based task by visiting nearby communities in the city. Through these visits, they learned about the local ecology, significant landmarks, and prevailing situations in relation to the SDGs. Interactive activities were carried out in heterogeneous groups, where students worked together. Each group identified diversification and issues within the city and brainstormed ideas on executing small community-related projects. These projects were approached using Situated Learning in primary education, enabling learners to acquire additional knowledge for future teachings (Bruner, 2022).

Phase III: Reflecting on the work of our group, we focused on the old city of Lahore. In collaboration with the Walled City Consortium and the Town Hall, an interactive map (Figure 3) was created. The purpose of this map was to raise awareness, mindfulness, and appreciation for our home district, while also discouraging any potential threats. The map was widely circulated to reach a larger audience.

To sustain the interactive activities, students continued working in cohesive groups, creating a series of logos, features, theaters, videos, and more. These creations were then uploaded and shared on various social media platforms such as Facebook Messenger, WhatsApp Messenger, and Google Meet. Through these apps, each group was able to showcase their videos, thus evaluating their understanding of the SDGs as acquired through SLM. Furthermore, an interactive map was developed and distributed through social networking channels to expand its reach.



Figure 3: Interactive map of Lahore. Its location has an interactive video of students participating in an SLM fieldwork which has explained the relevance of this city's historical landmarks and preservation.

Phase Four: At last, students were judged by different panelists, who disseminated information regarding costs involved in maintaining the city of Lahore and its problems. This caused vandalism of this city due to the poor management system. These panels were placed throughout the university so they might come close to opportunities and necessities related to community-based projects and their sustenance.

III. Research Instrument

To gather data from the group of learners, a questionnaire was employed as a research tool. The design of this instrument took into consideration the knowledge and interest of the working group in the teaching methodology, aiming to collect their self-assessments. Throughout the implementation of the questionnaire, it was crucial to ensure that it aligned with the principles of the Situated Learning Model and reflected the learners' understanding and perception of the SDGs, as well as their subsequent implementation.

The questionnaire consisted of three subsets. The first subset focused on collecting demographic information from the participants. The second subset aimed to assess the participants' knowledge of active teaching methods and their practical application. This section included a total of eleven items, which were evaluated using a 5-Point Likert Scale, ranging from "Strongly disagree" to "Strongly agree."

Similarly, the third subset of the questionnaire explored the participants' knowledge and perception of the SDGs and their functions. This section also comprised ten items, evaluated using the same 5-Point Likert Scale.

Before initiating the activities during class time, the intervention and purpose of the questionnaire were explained to the participants. Their participation in the questionnaire was voluntary, and their consent was obtained prior to the commencement of the activity. To ensure anonymity, no personal information was collected from the participants.

The questionnaire was validated by a panel of subject matter experts before its implementation. Additionally, the reliability of the questionnaire was assessed by calculating the mean Cronbach alpha score. The summarized items used for the second and third sections of the questionnaire are presented in Table Work 2.

Table 2: Instrument was used for the collection of data from participants for Knowledge of Methodology (KM) and Knowledge for SDG (KSDG) in this research.

Knowledge about methodology		KSDG Items Questionnaire	
KM-1	I knew well about Situated Learning Model and its method.	SDG-1	How much familiarity do you retain with the SDGs concept?

KM-2	I knew how to design any such educational model with interactive methods.	SDG-2	Have you possessed a strong interest in learning SDGs?
KM-3	I have sufficient teaching aids and their operation.	SDG-3	Do you know the literal meaning of SDGs?
KM-4	I always get motivation through diverse tasks, which I used to carry out in teaching-learning training at university.	SDG-4	Do you recognize SDG's importance and necessity for our earth's preservation?
KM-5	I always perform such interactive activities which are beneficial for the community.	SDG-5	Do you understand environment-related confusion which may damage the heritage within us community?
KM-6	I am confident in presenting my skills publicly.	SDG-6	Are you equally responsible for earthly disruptions around us?
KM-7	I have great respect for my city Lahore.	SDG-7	Do you participate in activities (e.g., lectures, debates, seminars, demonstrations & awareness campaigns) regarding sustenance and preservation of heritage?
KM-8	I am aware of the historical and cultural knowledge of my city.	SDG-8	Do you believe that caring earth and its environment secures culture & heritage at very low-cost maintenance from public administrations?
KM-9	Through academic training, I have learned much about the heritage and history of my city.	SDG-9	Do you take like Lahore's cultural and environmental heritage?
KM-10	I have an anticipation for better learning and teaching ecosystem.	SDG-10	Do you have a prompt care factor for your cultural footing?
KM-11	I fully contribute my respect & care toward my native city.	SDG-11	Do you contribute your sincere efforts & attachment to the betterment of my vicinity?

A. *Statistical Procedure and Data Analysis*

This study was conducted as a descriptive analysis, aiming to characterize and describe a sample of participants as a representation of the larger population. Before proceeding to the next step, it was important to ensure homogeneity within the sample. The collected research material was subjected to the Shapiro-Wilk test to determine if the data followed a normal distribution. The analysis revealed that the data exhibited a normal distribution.

To evaluate the reliability of each instrument used, parametric tests were employed. Cronbach's alpha was calculated as a measure of reliability, yielding values of 0.779 and 0.833 for the second and third parts of the instrument, respectively. Based on these results, the instrument was considered to be reliable.

In order to assess the impact of the provided instructions, a Situated Learning Model was designed, incorporating various variables. The implementation of this model was evaluated using a t-test, and the results were found to be statistically significant. Additionally, the effect size, measured by Cohen's *d*, was recorded.

IV. RESEARCH RESULTS

A. *Knowledge of SLM & Interactive Methods*

In earlier research analysis of the SLM, the degree of knowledge among participants is revealed while using interactive teaching methods, in general, and for SLM. The internal reliability of the instrument was found consistent on KM Scale all over global score. It was recorded as summative scores from the second part of the instrument.

All individual items from this section were ($KM_{Total} = \sum_{i=1}^{11} KM_i$). Figure 4 has represented total scores i.e., before intervention and after intervention of scores of the students. SLM has increased after implementation, the mean value of KM, total KM & total was 44.8 (std. dev = 5.98). In contrast, value of mean KM, Total before completing the SLM implementation was 37.0 (std dev = 5.59).

Learners has shown t-test that difference between both values were significant, i.e., $t(82) = 6.34, p < 0.001, d = 1.35$, which has suggested we implement SLM, students have shown a genuine difference in gaining knowledge through interactive learning methods and SLM. Effect Size has also denoted ($d = 1.35$), which was very high.

Knowledge of SDGs

From another perspective, it is worth noticing, as shown in Figure.5, where the degree of familiarization with the SDGs of participants is reflected. It has summarized results from participants assessed regarding their knowledge of SDGs. As is keenly observed in the figure. 5; where the participants from all

sorts of such cases reveal the extent of their knowledge. It tells about whether participants have the know-how of SDGs, which is increased after exposure to SLM. Summative scores of all participants on individual items of the scale were calculated as,

$$(SDG\ Total = \sum_{i=1}^{i=10} SDGi).$$

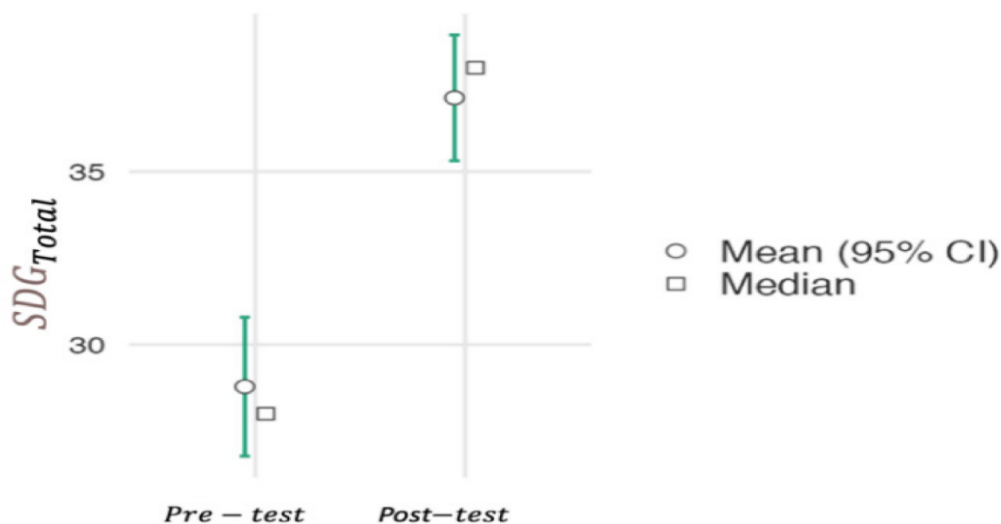


Figure 5: Total scores for the knowledge of SDGs among participants who took part before pre-test & after post-test, SLM implementation.

In light of these results, the SDGs mean table value was 28.90, acquired after exposure to SLM interactive activities, wherein the standard deviation was recorded as 6.96. since the mean value of SDGs in respect of the total before exposing SLM was recorded as 37.10 along with standard deviation, i.e., 5.71. t-test has shown the difference between both t-values, which were recorded as significant $t(82)=5.94$ & $p<0.001$ and $d=1.31$ that has recommended the beneficial application of the SLM which has made genuine difference about SDGs knowledge along with high Size Effect i.e., $d=1.31$ which was denoted very high.

V. DISCUSSION PART OF A RESEARCH ARTICLE

The ongoing environmental changes have led to severe consequences for our planet's climate, societal attitudes, and the overall fabric of our society. It is imperative to address this urgent issue comprehensively. Education, as a catalyst for sustainable change, plays a vital role in this era of global technology, dispelling misconceptions and tackling emerging challenges. Community-based learning has been recognized worldwide as an effective approach with targeted impacts.

International organizations and programs like USAID, UNESCO, and UNEP have emphasized purposeful intervention and engagement across educational platforms. Therefore, Education for Sustainable Development (ESD) must be integrated into all levels of education to empower individuals to actively participate in sustainable practices. This approach will nurture core values and

attitudes, fostering sustainability and equity within every segment of society (Water, 2019).

Teaching methodologies like Situated Learning Methodology (SLM) hold great value in connecting students with society and addressing community-based services such as water and sanitation, healthcare, transportation to local markets, mosque duties, and more. Situated Learning has emerged as an effective tool for sustainability, fostering intrinsic motivation among contributors, students, learners, novice teachers, and community members. Through interactive, active, real-life, and comprehensive engagement, Situated Learning practices contribute significantly to sustainable development across various educational platforms.

The findings of this research study demonstrate the significant impact of implementing SLM. The study focused on various research variables, highlighting the importance of in-depth SLM knowledge and interactive teaching methods. The observed effect size was not only significant but also large ($d = 1.31$). These results validate that the intervention of SLM, along with the active participation of participants in individual tasks, is a suitable strategy for preservice teachers to effectively teach science subjects. The goal is to engage students through continuous learning. Additionally, the results suggest that active learning methods, including community-based activities, theatrical skills, attitude formation, and mind-mapping skills through fieldwork, can enhance the learning experience.

Establishing a strong connection between students, teachers, and their community has proven to be demanding, motivating, and highly effective. According to Castro et al. (2022), different perspectives of Situated Learning have focused on enhancing students' skills for the purpose of creating a sustainable society. The research study concluded that a higher level of intervention corresponds to a greater degree of satisfaction among all participants. Conversely, when students are not provided with interventive teaching, they experience a higher degree of failure.

The Situated Learning Model is a relevant and powerful teaching tool that promotes active participation in various interactive activities, fostering student motivation. Its impact on social development and transformation is highly significant. SLM empowers learners to understand and address the pressing needs of their communities. Previous studies have reported that university students who engage in Situated Learning show increased knowledge and concern for their community-based work.

Despite the efforts of administrations to promote the Sustainable Development Goals (SDGs) outlined in the 2030 Agenda, the reality is that active participation by individuals allows them to better understand the needs of their communities. Education for Sustainable Development (ESD) has become an integral part of global sustainable development by providing information and cultivating sustainable competences to fulfill the goals of the SDGs. Consequently, participating in Situated Learning significantly expands participants' interest in acquiring knowledge about the SDGs, as highlighted by

the statistically significant results of the research study. The effect size was also very high ($d = 1.31$), emphasizing the substantial impact of Situated Learning on students' engagement with the SDGs.

VI. CONCLUSION

It has been concluded that the primary objective of this study was to integrate sustainable education standards into the science curriculum of an educational institution through a collaborative community project using the Situated Learning Model (SLM). The study aimed to assess participants' knowledge of implementing innovative activities for teaching Educational Sustainable Development, specifically community-based real-life learning, after its implementation (Anyagh, 2023).

Hypothesis 1 (H1): It was hypothesized that participation in the Situated Learning Model would lead to effective utilization of this approach for Sustainable Education among students.

Hypothesis 2 (H2): It was hypothesized that students' knowledge of the Sustainable Development Goals (SDGs) would increase when they participate in learning activities using the Situated Learning Model. The study implemented the Situated Learning Model with pre-service science teachers enrolled in the Bachelor in Education (Hons.) program at a public sector university affiliated with the University of Indiana, USA (Flowers, 2023).

VII. CONCLUSION:

The development of interactive projects using the Situated Learning Model (SLM) aimed to enhance teachers' understanding and awareness of the Sustainable Development Goals (SDGs) as future educators and enable them to apply these concepts within their own communities. The implementation of the Education for Sustainable Development (ESD) platform necessitates the use of innovative learning techniques. The application of SLM in this study involved four steps: an initial presentation to the participants, fieldwork related to the SDGs and their historical city of Lahore, the collection of evidence to establish the Situated Learning Model, and finally, the presentation of the debate and outcomes in the conclusive phase. To assess the effectiveness of the Situated Learning Model, a pre- and posttest technique was extensively employed.

According to Almala (2020), students' participation in community-based initiatives, designed and implemented with SLM in mind, resulted in significant scores in ESD. The study revealed that students gained a greater understanding of creative teaching techniques applicable to ESD. It was also demonstrated that students' involvement in the planning and execution of the Situated Learning project increased their knowledge of the proposed methodology and enhanced their learning motivation. Therefore, the use of the Situated Learning approach in addressing ESD proves to be highly beneficial, particularly in a university context and for aspiring teachers. This approach not only allows participants to benefit from the methodology as students but also aids in the development of their teaching skills.

A significant limitation of this research study was that the sample characteristics prevented the comparison of results with other methods, as no control group was utilized. Additionally, the sample size and limited additional information somewhat constrained the results, but they still demonstrated the potential of SLM as an educational strategy within the context of ESD (Voughus, 2021)

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