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Elevating Students' Shared Learning Experiences with Augmented Reality in a Digital Marketing Classroom

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Abstract. Educators are becoming concerned about the students' increasing dependency on diverse digital technologies in their daily lives, which creates a clear disconnection between their lifestyles and the passive teaching and learning strategies implemented in schools. Thus, contemporary research debates focus on enhancing learning environments to maintain the interests and motivation of students. Educationists have proposed strategies such as integrating immersive and engaging digital technologies into the classroom to foster shared learning experiences among students. Although augmented reality (AR) is a fascinating immersive technology, its integration into the classroom environment has been scarcely documented. With this perspective, the present study seeks to amalgamate AR technology and Kolb's Experiential Learning Model (ELM) into an enhanced experiential learning classroom by using a mixed-method research methodology. Both qualitative and quantitative approaches were used to conduct this study on undergraduate students enrolled in a digital marketing course at a Malaysian institution. Data were collected through surveys, interviews, and open-ended questions, with consideration given to the student's experience within this technologically assisted learning environment. Significant data analysis and feedback demonstrated an effective student collaboration, which improved learner interest, motivation, and engagement, thereby establishing a solid case for the integration of immersive technologies, such as AR, into the educational process to create an enhanced learning environment. Thereby, this paper presents the ARSSLE (AR-supported Shared Learning Experiences) framework, which may assist teachers in building a captivating yet collaborative and dynamic learning environment.

Keywords: Augmented Reality; Experiential Learning; Digital Technologies; Student Collaboration; Student Engagement

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1. Introduction

In the context of contemporary higher education, there are multifaceted and dynamic challenges that necessitate innovative solutions to address the evolving needs of students and the educational landscape. Students who are accustomed to interactive and engaging experiences in their daily lives have been finding it difficult to remain interested and motivated in the conventional lecture-based approach (Guppy et al., 2022). A growing divide has emerged between the conventional teaching strategies used in higher education and the ways that technological advancements are influencing students' daily lives (Nwosu et al., 2023). Educators have been facing the challenge of effectively bridging the gap between technology and societal expectations as higher education institutions work to adapt to these rapidly changing environments. The necessity for adaptable, flexible, and technologically advanced learning environments that can smoothly transition between in-person and remote modalities was further highlighted by the COVID-19 pandemic (Reshi, 2023).

These obstacles can be solved by integrating various digital technologies to maintain learners' interest and motivation. The demand for engaging technologies in higher education has been heightened by the current scenario, where students navigate a complex web of academic, professional, and personal commitments. To address these challenges, educators have been exploring innovative pedagogical approaches that incorporate interactive and immersive digital tools within the classroom. These approaches not only align with the diverse learning preferences of students but also cater to the need for adaptability in the face of unexpected disruptions, such as the shift to online learning during a pandemic (Nørgard & Hilli, 2022). Moreover, the drive for technology integration in higher education has been consistent with the overarching objectives of equipping students to meet the demands of the contemporary workforce (Obesso et al., 2022). The development of digital literacy and technological competence is viewed as a crucial component of higher education in a society where technology is progressively permeating various professions.

In summary, the incorporation of engaging and immersive technologies in higher education serves as a solution to the challenges of adapting to technological advancements, maintaining student engagement, and preparing learners for a rapidly evolving professional landscape. This incorporation represents a proactive approach to enhancing the quality and relevance of education in the face of current challenges (Sandoval-Henriquez et al., 2024). Thus, the present study explores the impact of the AR-supported learning environment on students' learning by addressing the research question, "*How does AR technology contribute towards elevating students' shared learning experiences in a classroom?*". The study's research objective is "Understanding the impact of the AR-supported learning environment in elevating students' performances with respect to their collaborations, achieved motivation and learning interest, and enhanced critical thinking skills".

2. Literature Review

2.1 Rise in the use of Immersive technologies in Education

The 2023 Education Horizon Report highlights a significant evolution in the application of digital and immersive technologies within the educational landscape. In contrast to previous practices where these technologies were predominantly used for conveying and comprehending concepts in three-dimensional (3D) formats, the contemporary educational landscape has been witnessing a paradigm shift (Birdwell et al., 2023). The current emphasis is on harnessing these technologies not only for understanding but also for project completion and the development of interactive learning experiences.

According to Magomadov (2020), Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality have emerged as prominent players in this transformative educational trend. These technologies have been gaining recognition for their unique ability to facilitate seamless interaction between the physical, real-world environment and the digital, virtual realm. The result is an immersive educational experience that goes beyond conventional teaching methods.

AR superimposes digital objects, elements, and graphics onto the real environment and background by using sensors and markers. By contrast, VR completely immerses the learners or its users into a computer-generated virtual world. By combining AR and VR, Mixed Reality creates a hybrid immersive experience (Binytska, 2023).

Educators are increasingly leveraging AR, VR, and Mixed Reality to create engaging learning environments. Rather than merely delivering information, these technologies enable students to actively participate in projects, simulations, and interactive activities (Fitra, 2023). The shift towards project-oriented and experiential learning has been reshaping the educational landscape, offering students a more hands-on and dynamic approach to acquiring knowledge.

2.2 Defining AR

AR is a technology that overlays digital information or virtual elements onto the real-world environment, enhancing the user's perception and interaction with their surroundings. AR enhances and supplements the real world by integrating computer-generated images, sound, or other sensory inputs, whereas VR produces fully immersive digital experiences (Hlod & Doroshenko, 2021). AR applications give users an augmented view that blends the actual world with the virtual world by using various devices, including smartphones, tablets, smart glasses, and heads-up displays. Through AR, users are able to comprehend and interact with the real world better by receiving more content, interactive experiences, or contextually relevant information.

2.3 Integration of AR into Educational Practices

The integration of AR into educational practices represents the incorporation of AR technology into various aspects of teaching and learning. Instead of relying solely on conventional methods, educators have been incorporating AR to enhance the overall educational experience (Lampropoulos et al., 2022). This integration involves leveraging AR applications and tools to create a more interactive and immersive learning environment.

The practical implementation of AR into educational practices has taken various forms. One common application of AR has been in the form of overlay of digital information onto physical objects or printed materials, providing additional context or interactive elements. For example, students use AR-enabled devices, such as smartphones or tablets, to scan a textbook page and reveal supplementary multimedia content such as videos, 3D models, or interactive quizzes (Oueida et al., 2023).

Educators have also been using AR to create virtual simulations or scenarios that allow students to apply theoretical knowledge in real-world contexts (Lin & Yu, 2023). This hands-on and experiential learning approach enhances understanding and retention of complex concepts. AR is currently being utilized in disciplines such as science, history, or geography to bring static images or maps to life, leading to the exploration of historical events, geographical locations, or scientific processes more dynamically and engagingly through AR-enhanced visualizations (Sirakaya & Sirakaya, 2020).

Besides the aforementioned benefits of AR in education, the integration of AR into educational practices has been driven by a desire to make learning more interactive, engaging, and relevant to the digital age. This integration opens up new possibilities for educators to create dynamic and personalized learning experiences that cater to the diverse needs and preferences of modern learners (Iqbal et al., 2022). For instance, AR can foster collaboration among students by enabling shared AR experiences. Students can work together on a group project that involves creating AR content or solving problems in a collaborative AR environment. Further advancements in technology are expected to shape the integration of AR, providing even more innovative and effective educational solutions.

Despite the considerable acknowledgment of the benefits associated with AR, further investigation is warranted to explore its unexplored applications in the field of education. AR has been incorporated into classroom settings to offer contextually rich visual learning experiences that deepen students' grasp of ideas and support lifelong learning and memory recall. The present study addresses this research gap by using "Kolb's Experiential Learning Model (ELM) (1984)" as the cornerstone pedagogy to integrate AR technology within an experiential learning setting.

Through a framework for immersive classrooms, this study answers the research question, "*How does AR technology contribute towards elevating students' shared learning experiences in a classroom?*". To fully utilize AR in education, this study investigates the effects of AR on the development of memorable and long-lasting learning experiences that go beyond conventional teaching techniques. Through adherence to Kolb's ELM, the study creates a unified and efficient strategy for incorporating AR into the classroom, encouraging not only student involvement but also a more profound understanding of the learning material.

3. Theoretical Underpinning

In response to the identified challenges in teaching and learning, this study embarked on the development of an improved, constructive, and experiential learning environment involving the integration of AR technology with ELM.

3.1 Kolb's ELM Model

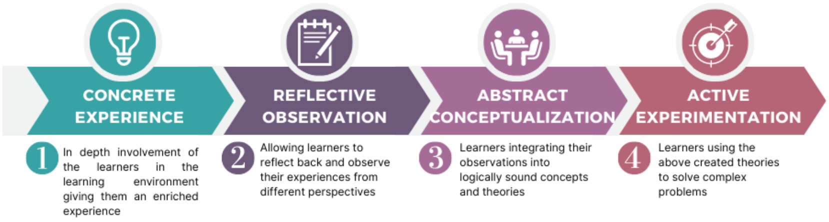

Figure 1: David Kolb's Experiential Learning Model (ELM; Kolb, 1984)

This study is based on ELM (Figure 1), which was first introduced by the well-known educational theorist David Kolb in 1984. The paradigm, comprising four consecutive steps, directs the process of learning through experiential engagement and results in significant knowledge development. The four consecutive steps are as follows: "Concrete Experience (CE)", "Reflective Observation (RO)", "Abstract Conceptualization (AC)", and "Active Experimentation (AE)" (Motta & Galina, 2023).

In the "Concrete Experience" phase, learners engage directly with real-world experiences, gaining first-hand exposure to concepts or situations. Subsequently, the learners engaged in the "Reflective Observation" stage, during which they analyze and reflect upon their experiences, considering the implications and extracting meaningful insights. The subsequent "Abstract Conceptualization" phase involves synthesizing and conceptualizing the observed experiences, forming a theoretical framework or understanding. Finally, in the "Active Experimentation" phase, learners apply their newly acquired knowledge by experimenting with different approaches and solutions (Leal-Rodriguez & Albort-Morant, 2019).

3.2 Benefits of ELM in Education

The widespread adoption of ELM in education can be attributed to its proven effectiveness in facilitating knowledge transfer and retention. This approach not only creates a dynamic and engaging learning environment but also nurtures a constructivist atmosphere (Radovic et al., 2021). The ELM paradigm places a strong emphasis on self-directed learning, transforming the conventional role of a teacher from an instructor to a facilitator. Consequently, the classroom becomes a space where students take center stage, actively participating in their learning experiences (Jamison et al., 2022).

The experiential learning cycle, as defined using ELM, involves recognizing real-world scenarios or problems, reflecting on prior knowledge, applying solutions, and experimenting with those solutions (Fang & O'Toole, 2023). The tangible benefits of embracing this pedagogical strategy are manifold. Learners exposed to experiential learning consistently demonstrate heightened motivation, engagement, and interest in the subject matter. Additionally, ELM contributes to the development of critical thinking skills and enhanced problem-solving abilities among students (Chen, 2021). This holistic and student-centered approach not only enriches the learning process but also empowers individuals to actively participate in shaping their educational journey.

David Kolb's ELM is well-regarded for its effectiveness in promoting active and participatory learning. By incorporating this model into the study, the study provides a structured and comprehensive framework for understanding how experiential learning, guided using ELM, can be augmented through the integration of AR technology. This combination creates an immersive and engaging learning environment that aligns with the principles of experiential learning, fostering deeper understanding and knowledge retention.

Considering these perspectives, the present study uses the ELM theory, coupled with the integration of AR, to develop an AR application. This app sought to impart a dynamic and immersive learning environment that encourages students' active involvement and passion by fusing AR technology with ELM principles, thus supporting enhanced students' collaboration, motivation, and interest in the classroom.

4. Methodology

4.1 Research Design

The present study meticulously aligned the four learning components of ELM with the distinctive features of the learning environment (Table 1). This strategic mapping achieved a seamless integration of theoretical concepts and real-world applications throughout the learning journey. By aligning the stages of the experiential learning cycle with the AR-supported educational environment, this mapping sought to create a synergistic experience that seamlessly blended theoretical knowledge with practical, hands-on application. This approach was carefully designed to enhance the effectiveness of the learning process for the participating students.

Table 1: Four ELM elements were mapped to the learning environment

"Experiential Learning Elements (Kolb, 1984)"	**Enhanced Classroom Learning**
"Concrete Experience"	"Students grouped in teams of 4-5 to explore, visualize, and understand the basic concepts of the subject using real-world scenarios in AR."
"Reflective Observation"	"Based on the experience of concept understanding, students made to reflect on their learning with the use of formative assessments/riddles in AR to help them connect their new understanding with the prior knowledge."
"Abstract Conceptualization"	"Lecturer, who is now the facilitator, evaluated the students based on their performance score in riddles and gave them perspectives and guidance which was required to re-evaluate their conceptual understanding."

"Active Experimentation"	"On the basis of a real brand-based riddle (depicting real-world challenge), students made to test and give relevance to their understanding of basic concepts by building another real brand within AR application."

4.2 Research Locale and Respondents

A group of 58 undergraduate students who had enrolled in a digital marketing course at a Malaysian institution actively participated in an innovative educational initiative: an AR-supported Experiential Learning Environment application. To maintain the integrity of the data collection process, we approached the students with transparency, and their participation was entirely voluntary after obtaining their prior consent. Their participation ensured a genuine and willing engagement with the AR-supported educational experience.

4.3 Research Mode and Instruments

This study used a mixed-method research methodology throughout a 14-week trimester within the AR-supported Experiential Learning Environment. This approach incorporated a diverse set of data collection tools to ensure a thorough understanding of the student's responses. This methodology was chosen to capture a rich array of insights, allowing for a comprehensive evaluation of the impact and effectiveness of the AR experience on the participants over the duration of the trimester.

The methodology seamlessly blended various techniques, including surveys and open-ended questions, to provide a nuanced and multifaceted perspective on the student's engagement with the AR-supported learning environment. The survey comprised 20 statements to which the students were asked to respond, and SPSS was used to calculate Cronbach's Alpha, which indicates the validity of your survey instrument. The items in the survey were adapted from (Leal-Rodriguez, 2019; Walker & Rocconi, 2021).

4.4 Data gathering

Figure 2 illustrates the implementation of ELM's four elements within the AR app.

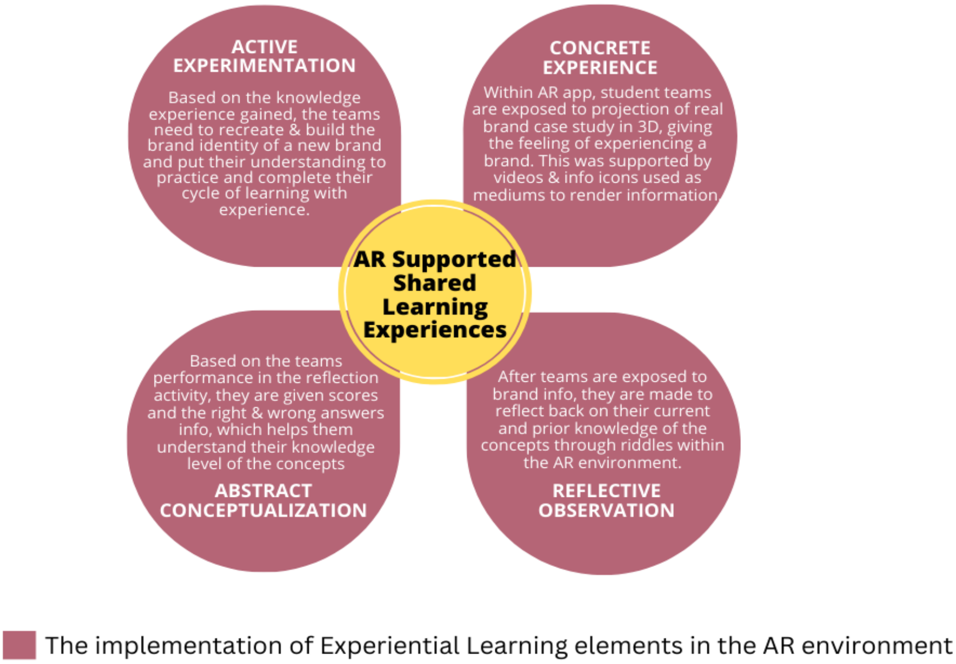

Figure 2: Implementation of ELM's four elements through the AR app in class

Figures 3 and 4 depict the implementation of ELM's four elements within the AR app, whereas Figure 5 depicts the students' use of the AR app within the learning environment.

Figure 3: Implementation of ELM's Concrete Experience and Reflective Observation in the AR app

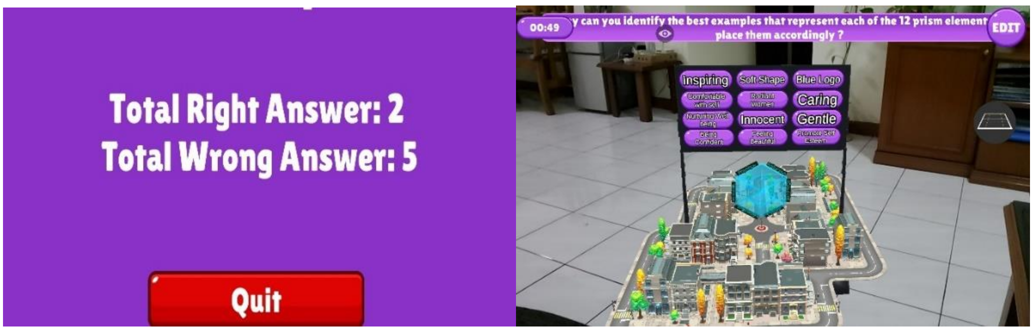

Figure 4: Implementation of ELM's Abstract Conceptualization and Active Experimentation in the AR app

Figure 5: Marketing Students' use of ELM-supported AR app in class

After the students' exposure to the AR-supported learning environment, the impact was evaluated using a 5-point Likert scale survey questionnaire. The values between 5 (Strongly Agree) and 1 (Strongly Disagree) were intermediate values that represent different levels of agreement or disagreement (4 = Agree, 3 = Undecided, and 2 = Disagree). Along with the survey, the students were also asked some open-ended questions to know their thoughts and opinions.

5. Analysis and Results

The present study sought to answer the following research question: "*How does AR technology contribute towards elevating students' shared learning experiences in a classroom?*". From this research question, we investigated the impact of the AR-supported learning environment on students learning, collaboration, and interest in learning, motivation, and critical thinking. The results are shown in Tables 2–6.

The collected quantitative data were analyzed thoroughly by using SPSS, and Cronbach's Alpha was also analyzed to further authenticate the validity of the survey instrument.

5.1 Impact of the AR-supported learning environment on the overall students learning

Table 2 presents the survey results in descending order, including the means, standard deviation, and combined %responses of the students who agreed and strongly agreed.

Table 2: Survey results (ranked)

Item (N = 16) **Cronbach's Alpha = .983 (n = 58)**	**Mean (M)**	**Std. Dev (SD)**	**% (p)**
1. "The collaboration while learning helped me and my team in assisting each other in mutual knowledge exchange and problem-solving."	4.16	.670	87.93
2. "I was able to reflect on my level of understanding through the guided assignments and activities."	4.10	.765	84.48
3. "Overall, the experience of implementing the learning on real projects was quite interesting and insightful."	4.07	.722	86.21
4. "I feel the addition of various technologies in a learning process makes the experience more engaging."	4.05	.736	82.76
5. "I am able to relate to the idea of working in the real world through collaborations in this learning environment."	3.98	.783	81.03
6. "I have a better understanding of the approaches that must be undertaken towards real-world business problems."	3.98	.783	77.59
7. "I am able to understand the benefits of learning through concept formation and testing."	3.98	.761	82.76
8. "I was able to maintain my attention while learning the required content."	3.97	.772	81.03
9. "I observed internal changes in confidence level and knowledge."	3.97	.858	74.14
10. "I was able to actively test my ideas to craft different solutions."	3.97	.837	75.86
11. "I would like to experience more of such collaborations through technologies in the future."	3.95	.736	79.31
12. "I would like to have more of my course subjects studied through interactive	3.95	.782	82.76

experiences."			
13 "I feel like crafting more authentic solutions to real life-based problems posed."	3.93	.814	72.42
14. "The projects, activities, and tasks were challenging, making me come up with interesting and authentic solutions."	3.93	.769	79.31
15. "The experience of collaborating through online applications and immersive technologies was quite interesting."	3.91	.756	75.87
16. "I feel motivated after going through such a deep experience of learning."	3.88	.751	68.97
17. "The learning process gave me a feeling of deep personal satisfaction."	3.88	.796	70.69
18. "I felt the course challenged my understanding levels."	3.88	.796	72.41
19. "I feel empowered and more confident to work in a team."	3.84	.875	75.87
20. "I was able to generate interesting assignment/project outputs through the use of online tools and immersive applications that we were exposed to."	3.83	.798	70.69

All items on the questionnaire received favorable ratings on the Likert scale (Table 2), surpassing a score of 3.8. Based on the survey responses, the items in Table 2 could be categorized into these four constructs: 1) Collaboration, 2) Learning Interest, 3) Motivation, and 4) Critical Thinking.

5.2 Impact of the AR-supported learning environment on students' collaboration

Starting with the first construct, i.e., Collaboration (Table 3.), 87.93% (mean = 4.16) of the students expressed that the collaborations (shared learning) helped them and their teammates in solving the challenges well, leading to the exchange of substantial knowledge and understanding. Meanwhile, 81.03% (mean = 3.98) of the students were able to relate to the idea of working and facing challenges in the real world through this learning environment, whereas 79.31% (mean = 3.95) of them would like to experience more such shared learning experiences through technologies ahead and 75.87% (mean = 3.91) of them found these experiences to be quite interesting. Together with student comments, the results demonstrated that the students successfully collaborated in this learning environment, supported by immersive technology such as AR, as suggested by (Lin & Yu, 2023; Sirakaya & Sirakaya, 2020) in their research.

Table 3: Survey results on Improved Collaboration

"Improved Collaboration"			
Items	**Mean (M)**	**Std. Dev (SD)**	**% (p)**
1. "The collaboration while learning helped me and my team in assisting each other in mutual knowledge exchange and problem-solving."	4.16	.670	87.93
2. "I am able to relate to the idea of working in the real world through collaborations in this learning environment."	3.98	.783	81.03
3. "I would like to experience more of such collaborations through technologies in the future."	3.95	.736	79.31
4. "The experience of collaborating through online applications and immersive technologies was quite interesting."	3.91	.756	75.87
5. "I feel empowered and more confident to work in a team."	3.84	.875	75.87

The interviews with the participating students yielded the following four major observations:

1) *"My team was able to collaborate well with the tools and technologies that were provided."*
2) *"Yes, we were able to collaborate using the technologies, and it was easy to customize, create solutions, and apply them to our projects."*
3) *"My team and I can have a good division of labor and assign who is suitable and capable in which area."*
4) *"Working with the group really helps me personally in terms of brainstorming, ideation, and more."*

5.3 Impact of the AR-supported learning environment on students' interest in learning

Moving to the next construct, i.e., Enhanced Learner Interest, the data in Table 4 provided strong evidence that 86.21% (mean = 4.07) and 82.76% (mean = 4.05) of the participants expressed a sense of interest and engagement, respectively, in the learning process. Additionally, 81.03% (mean = 3.97) of the students demonstrated sustained attention while comprehending course content. Moreover, 82.76% (mean = 3.95) of the respondents indicated their inclination to complete assignments involving technology, whereas 70.69% (mean = 3.83) of them cited the ability to produce compelling outputs in this class. These outcomes, supported by comments, align closely with the findings in previous studies (Oueida et al., 2023; Ali et al., 2022).

Table 4: Survey results on the Enhanced Learner Interest

"Enhanced Learner Interest"			
Items	**Mean (M)**	**Std. Dev (SD)**	**% (p)**
1. "Overall, the experience of implementing the learning on real projects was quite interesting and insightful."	4.07	.722	86.21
2. "I feel the addition of various technologies in a learning process makes the experience more engaging."	4.05	.736	82.76
3. "I was able to maintain my attention while learning the required content."	3.97	.772	81.03
4. "I would like to have more of my course subjects studied through interactive experiences."	3.95	.782	82.76
5. "I was able to generate interesting assignment/project outputs through the use of online tools and immersive applications that we were exposed to."	3.83	.798	70.69

Following the interview, the students' common expressions were as follows:

1) *"The use of AR for learning activities helped me maintain my interest and interact with my teammates in understanding and discussing."*
2) *"The overall experience had me engaged through the course filled with activities and case studies that I hope I can apply to my future work."*
3) *"The interactions helped me and others in sharing our knowledge and experiences."*

5.4 Impact of the AR-supported learning environment on students' motivation

Moving onto the next construct, i.e., Motivation (Table 5.), 82.76% (mean = 3.98) of the students witnessed the benefits of learning through the way of concept formation and testing, while 74.14% (mean = 3.97) of them felt motivated, and 68.97% (mean = 3.88) of them were confident in their level of understanding after going through such deep experiences of learning. However, 70.69% (mean = 3.88) had felt deep personal satisfaction in this learning environment, 72.42% (mean = 3.93) felt that it gave them the motivation to craft more relevant solutions to the professional world-based challenges posed to them. These findings indicate an increased motivation among students while experiencing the learning of certain concepts using AR, which is consistent with the results of (Iqbal et al., 2022; Yadav & Gupta, 2023).

Table 5: Survey results on the Increased Motivation

"Increased Motivation"			
Items	**Mean (M)**	**Std. Dev (SD)**	**% (p)**
1. "I am able to understand the benefits of learning through the way of concept formation and testing."	3.98	.761	82.76
2. "I observed internal changes in confidence level and knowledge."	3.97	.858	74.14
3. "I feel like crafting more authentic solutions to real life-based problems posed."	3.93	.814	72.42
4. "I feel motivated after going through such a deep experience of learning."	3.88	.751	68.97
5. "The learning process gave me a feeling of deep personal satisfaction."	3.88	.796	70.69

Furthermore, the following comments were obtained from the students during interviews:

1) *"I am confident enough to apply all these new ideas I got from the course. It helps give a new kind of perspective for marketing and advertising."*
2) *"I think very well. I was able to apply new knowledge to stuff. I always wanted to try AR."*
3) *"More confident to experiment with the engagement from the audience."*

5.5 Impact of the AR-supported learning environment on students' critical thinking

The analysis extended to the construct of Critical Thinking, as outlined in Table 6. A significant portion (84.48%; mean = 4.10) of the students indicated their ability to reflect on their level of knowledge and understanding. Moreover, 77.59% (mean = 3.98) of them reported an enhanced comprehension of viable solutions to real-world problems, and 79.31% (mean = 3.93) of them found the activities and tasks, particularly the AR app riddles, to be challenging in generating authentic solutions. Furthermore, 72.41% (mean = 3.88) of the respondents showed that the course learning environment stimulated challenges that prompted them to reassess their understanding levels. These outcomes, coupled with supporting comments, signify a positive experience in approaching and resolving intricate problems and activities through the utilization of immersive technologies. This finding aligns well with the findings of (Perifanou et al., 2022; Iatsyshyn, 2020).

Table 6: Survey results on the Enhanced Critical Thinking

"Enhanced Critical Thinking"			
Items	**Mean (M)**	**Std. Dev (SD)**	**% (p)**
1. "I was able to reflect on my level of understanding through the guided assignments and activities."	4.10	.765	84.48
2. "I have a better understanding of the approaches that need to be undertaken towards real-world business problems."	3.98	.783	77.59
3. "The projects, activities, and tasks were challenging, making me come up with interesting and authentic solutions."	3.93	.769	79.31
4. "I felt the course challenged my understanding levels."	3.88	.796	72.41
5. "I was able to actively test my ideas to craft different solutions."	3.97	.837	75.86

The following statements were the common expressions or comments from the students who are exposed to the AR-supported learning environment.

1) *"I think I am able to generate ideas from the new collective knowledge, and this can be done through brainstorming, looking for connections between different sources of information, and experimenting with different ideas."*
2) *"I did pretty well to generate ideas, but it took some time for certain ideas to be completed, and I was pretty satisfied with the output."*
3) *"Yes, when my ideas get objected, I will receive feedback on why it won't go well. With that, I can analyze it critically."*

6. Discussion

The data analysis and subsequent results revealed a significant and positive influence on the experiential learning environment when using Kolb's (1984) ELM, augmented by AR. The noteworthy collaboration, interest, and motivation reported by the students in their comments align substantially with the quantitative findings. Thus, the results of this study highlighted a number of important findings in response to the research question, "*How does AR technology contribute towards elevating students' shared learning experiences in a classroom?"*.

These include:

1) Significant observations included enhanced collaboration among students, particularly when utilizing AR to learn, reflect, and create engaging outputs. Thus, students provided positive feedback, expressing a desire for more collaborative experiences through group-based activities in their future learning endeavors. This observation aligns with prior research on AR conducted by (Lin & Yu, 2023; Lampropoulos et al., 2022; Sirakaya & Sirakaya, 2020).

2) The learning process, which entails experiencing real-world applications of AR-supported concepts, effectively sustains learner interest and engagement. This approach provided students with first-hand experience regarding the integration of AR into their daily lives, reinforcing the benefits of AR in education as outlined in (Oueida et al., 2023; Ali et al., 2022; Magomadov, 2020).

3) The improvement of motivation was another noteworthy discovery from the study and the student's remarks, which highlight the interesting, engaging, and realistic nature of their experiences. These favorable experiences bolstered the students' confidence in their educational journeys. This result is consistent with the findings in (Yadav & Gupta, 2023; Iqbal et al., 2022; Garzon et al., 2020).

4) As students worked on case studies, examined different strategies, and tackled challenging assignments, their Critical Thinking showed a noticeable improvement. The project outcomes were finally implemented through AR representations. This finding aligns with the conclusions by (Perifanou et al., 2022; Iatsyshyn, 2020).

5) The data analysis and students' feedback further indicated positive reinforcement for the utilization of "David Kolb's ELM" as a foundational pedagogy, supported using AR and similar immersive technologies, in constructing enriched learning environments.

6) This study clearly indicates the importance of enriching the learning experiences of the students so that the concepts are retained in their minds for a longer time. The use of current technology, combined with a powerful and grounded pedagogy, can go a long way in giving a fulfilling learning experience.

A suggested learning framework known as the AR-Supported Shared Learning Experiences (ARSSLE) is introduced in light of the data analysis, findings, and discussions in this study (Figure 6). This framework is strengthened by the incorporation of AR and is based on ELM. It is advised as a guiding principle for teachers looking to enhance their learning environments in the classroom by using technology such as AR to give their students more immersive, interesting, engaging, motivating, and shared learning experiences. Other than AR, researchers, educationists, and facilitators can also build their classrooms with ARSSLE as the grounding platform while using different digital technologies and pedagogy combinations to create engaging and interactive shared learning environments.

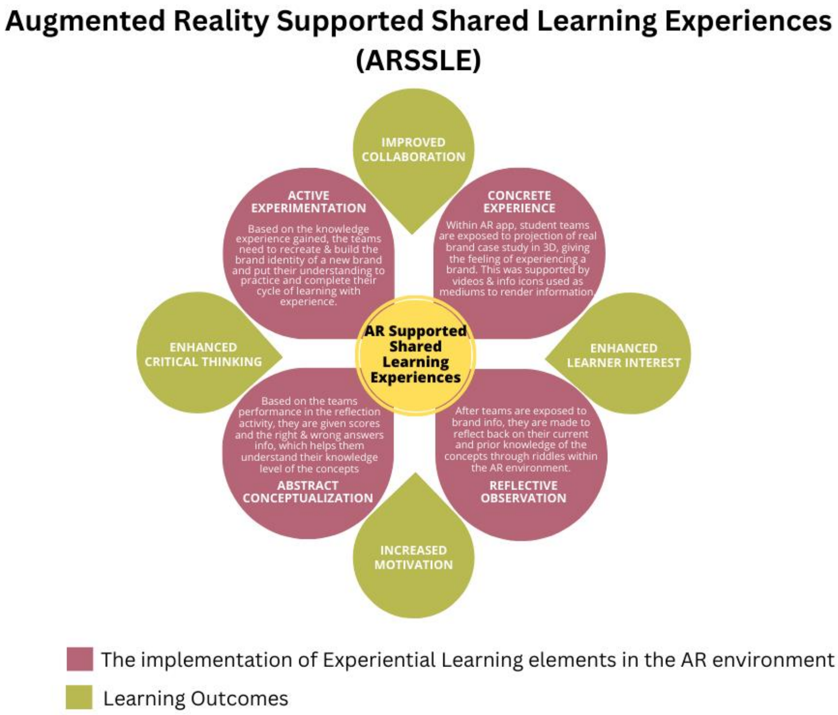

Figure 6: The ARSSLE framework for AR-supported Shared Learning experiences

7. Conclusion

This study bridged the gap between students' technologically savvy lifestyles and the limited integration of technology in their educational experiences. With increasing recognition of the need for engaging learning environments, this study endeavored to create a classroom setting grounded in Kolb's ELM but enhanced with the immersive capabilities of AR. Despite AR's presence in education, its effective pedagogical integration has remained largely unexplored, particularly in fostering deep, shared learning experiences among students. The central inquiry of this study revolves around the research question, "*How does AR technology contribute towards elevating students' shared learning experiences in a classroom?*". This question was addressed by immersing a group of 58 digital marketing students in an AR-supported experiential learning application. Data collection methods included surveys and open-ended comments to capture the nuanced responses of participants. The study's findings shed light on the transformative potential of AR technology in education. The students reported increased collaboration, motivation, and interest in learning, as well as enhanced critical thinking skills. The students gained confidence because of their exposure to real-life scenarios, coupled with the opportunity to reflect, conceptualize, and experiment with their learnings through an AR learning environment. These outcomes align with prior research in the field, highlighting the promising role of AR in shaping the future of education. The framework developed through this research, known as the ARSSLE, offers valuable insights and practical guidance for educators looking to harness the power of AR to enrich their teaching practices and create more immersive learning environments.

8. Limitations and Future Recommendations

This study demonstrated some prominent results and output with regard to the integration of AR, along with David Kolb's ELM (1984), into the learning environment. Despite the successful attainment of its intended results, the study's exclusive focus on Marketing Design students remains a potential limitation. Also, the study spanned only 14 weeks during the trimester.

The study concluded that the presented final framework (ARSSLE) has the potential to be integrated into varied subject classrooms, especially science and business, and be conducted for a minimum of one year. This integration will authenticate its credibility and also improve it and add more dimensions to it. Other than this, the integration of AR into the learning environment can also be done using other pedagogies and other AR applications to leverage more experience in learning.

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