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Research Article

Exploring Prospective Teachers' Awareness and Perception of Augmented Reality (AR): A Survey-Based Study

M. Karthick[1]*, Dr. P.N. Lakshmi Shanmugam[2]

[1]*Research Scholar, Department of Educational Psychology, Tamilnadu Teachers Education University, Tamilnadu, India,
Email: karthick777m@gmail.com. Orcid: 0000-0002-9276-8337
[2]Assistant Professor, Department of Educational Psychology, Tamilnadu Teachers Education University, Tamilnadu, India.

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ABSTRACT

This research delves into the preparedness of Prospective Teachers in Thajavur district to embrace Augmented Reality (AR) in education. The survey, encompassing 134 participants, aims to gauge their familiarity with AR and explore their perspectives on its potential benefits, utility, as well as the challenges and barriers associated with integrating AR into their teaching methodologies. The study provides a comprehensive overview of the awareness and attitudes of future educators towards AR, serving as a crucial compass for crafting targeted training programs. The findings reveal nuanced insights into the state of readiness among Prospective Teachers, offering a valuable resource for education policymakers and institutions. By addressing key aspects such as awareness, perceptions, and concerns, the study contributes substantively to the ongoing discourse on AR implementation in educational settings. The ultimate goal is to foster a meaningful and seamless integration of AR, enhancing the overall learning experiences of students in the contemporary digital age.

Keywords: Augmented Reality, Teacher Education, Awareness, Perception, Integration, Educational Technology.

1.0 INTRODUCTION:

In the modern era of Education has been changed from traditional classroom to digital classroom. In the Z-generation learners and teachers are utilize the digital devices in their teaching and learning process.
Through the rapid development of digital technologies within the last few years or after the COVID-19 pandemic, technologies such as Augmented Reality, Virtual Reality and Artificial Intelligence have become more widely available and are currently used in various domains. These technologies becoming increasingly important for the education sector through the development of suitable practical applications. Even though these technologies have led to lot of challenges in the education industry.
Augmented Reality (AR) boomed as a transformative technology with immense potential to revolutionize various sectors, such as Medical, Defence, Entertainment, E-commerce, Education etc. [1]. With its ability to overlay digital content onto the real world, AR offers unique opportunities to enhance learning experiences, engage students, and foster meaningful interactions in educational settings. Education sector plays a vital role shaping the future generation, understanding their awareness and perception of AR becomes crucial for integrating this innovative technology effectively.
According to azuma (1997), Augmented Reality (AR) is a variation of Virtual Environments (VE), or Virtual Reality as it is more commonly called. VE technologies completely immerse a user inside a synthetic environment. While immersed, the user cannot see the real world around him. In contrast, AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, AR supplements reality, rather than completely replacing it [2]. Over the past decade, the field of augmented reality (AR) has been established as one of the most promising areas of computer graphics.[3]. Industry 4.0 in maintenance is the use of AR to enhance the maintenance approach. AR is a technology that overlays virtual objects onto the real world, enabling operators to visualize and interact with virtual objects in real-time [1]. When any virtual object overlaid on any physical object to experience the reality in better way that is termed as Augmented Reality (AR) [4].

1.1 Review of related literature

For higher education and professional courses, it is essential to equip students for real-world scenarios. Consequently, a practical approach to teaching becomes necessary, particularly for student teachers. Utilizing mobile learning with built-in augmented reality has demonstrated superior effectiveness compared to traditional methods [5]. The integration of augmented reality into the teacher education curriculum and multimedia learning processes has yielded improved results.

Increases students concepts particularly for difficult concepts[6],Student's better problem solving skills, Increases motivation in studying which includes satisfaction, attention, relevance, concentration [7], [8], [11], [12], Increases creativity of teachers and students [9], Increases students engagements in the topic and hence increases the overall success [16], Increase students rethinking and recalling skills [10], Increases students understanding and changes attitude towards subject [17], [7], [16], Improves enjoyment and curiosity in game based application [14]

The research shows that, changing from a traditional 'chalk and talk' method to computer technology used teaching method, cannot simply enrich class room teaching, but can also significantly improve their achievement. It implies that technology used teaching method proves to be more tangible in its effectiveness on achievement than the traditional classroom approach [21]. Traditional education relied on face-to-face instructions, with teachers organizing and delivering knowledge and learning activities. The learning materials were predominantly static, such as papers, lacking dynamic elements like motion or continuous movement. While these methods were effective at times, there is a growing interest among educators and researchers to explore more impactful approaches to enhance teaching and learning experiences.

The widespread adoption of technology in recent years has significantly influenced and revolutionized the educational landscape. The integration of technology has opened up exciting opportunities to create learning environments that are realistic, authentic, engaging, and exceptionally enjoyable [15], [13].

The universalization and sustainability of the teaching learning process are fully dependent on digital technologies. From KG to higher education the classroom environment is fully furnished by technology hardware's for its success. Also, it creates techno friendly generation in the future [22]. Certainly, the educational landscape has witnessed the integration of various technologies, including computers, multimedia, the internet, e-learning, social media, simulations, and, more recently, mobile devices. Immersive environments such as games, virtual worlds, and augmented reality have also become integral to the educational experience. Moreover, studies have demonstrated that learning in higher education using these technologies surpasses traditional modes [18].

Azuma (1997) conducted a comprehensive review of Augmented Reality (AR), where three-dimensional virtual graphics were integrated into a real-time three-dimensional environment [2]. The article highlights applications in diverse fields such as manufacturing, medicine, path planning, military operations, visualization, and entertainment. It provides insights into the characteristics of Augmented Reality frameworks, offering a specific description of optical and video mixing methods. In another study, Jerry and Aaron (2010) employed AR in science education for teaching and learning purposes [19]. The research encompassed both qualitative and quantitative analyses. Qualitative findings indicated a positive impact of AR integration on students' learning attitudes, while quantitative results demonstrated a positive influence on students' academic achievements. Wang et al. (2012) conducted a research study in the field of physics to investigate collaborative learning among students [20]. The study involved 40 participants utilizing a distinct learning strategy, with participants randomly assigned to two groups.

A considerable amount of research articles has been studied on the use of AR in education to examine the awareness and perception about AR Technology in teacher education. In the field of Teacher education there is very less studies were conducted, so that researcher plan to conduct survey among Prospective Teachers to know their awareness and perception about AR technology in Teacher education.

1.2 Problem of the Statement:

While Augmented Reality (AR) has been introduced for several years, there remains a significant gap in awareness and advancements among users of AR technology. To enhance the implementation of this technology, it is crucial to gain a deeper understanding of users' perceptions and awareness towards AR.

1.3 Objectives of the Study:

The objective of this research is to investigate the awareness and perception of benefits, Usefulness, challenges and barriers of augmented reality (AR) among Prospective Teachers. Research Questions

1. What is the level of awareness of augmented reality (AR) technology among Prospective Teachers?
2. How familiar are Prospective Teachers with specific AR applications and tools commonly used in educational settings?
3. What is the Perception of Benefits and Usefulness of Augmented Reality (AR) technology among Prospective Teachers?

2.0 METHODOLOGY:

This study employs a survey-based research design to examine the awareness and perception of augmented reality (AR) among Prospective Teachers. The survey methodology enables the collection of quantitative data, which can be analyzed using statistical methods to discern patterns, trends, and relationships. The target population for this study comprises Prospective Teachers from various educational institutions in Thanjavur Districts. A purposive sampling technique was utilized to ensure a diverse representation of participants across different programs, grade levels, and geographical locations, resulting in a sample size of 134. The survey questionnaire was developed based on a comprehensive review of existing literature concerning AR in education and teacher perceptions. It included 5-point Likert scale items, allowing participants to express their level of agreement or disagreement with provided statements. The questionnaire covered key areas such as awareness of AR, perception, and confidence in AR integration. The collected data underwent analysis using descriptive statistics, and inferential statistics, including correlation analysis, were employed to explore relationships between variables and identify predictors of awareness and perception of AR among Prospective Teachers.

2.1 Measures:

Table 1: Demographic Profile of the Participants

Measures	Items	Frequency (N=134)	Percentage
Gender	Male	56	41.8
	Female	78	58.2
Locale	Urban	46	34.3
	Semi Urban	65	48.5
	Rural	23	17.2
Family Type	Nuclear	65	48.5
	Joint Family	69	51.5

Table 2: Reliability Test

S.no	Domain	Cronbach's Alpha
1	General Awareness about AR Technology (GA)	0.843
2	Perception about Augmented Reality (PB)	0.772
3	Confidence in integrating AR into their future teaching practices	0.733

2.2 Analysis of Data

Reporting of the findings is organized according to the research questions.

Research Question 1:
What is the level of awareness of augmented reality (AR) technology among Prospective Teachers?

Table 3

S. No	Statement	SD	D	N	A	SA
		F (%)	**F (%)**	**F (%)**	**F (%)**	**F (%)**
1	I have heard of Augmented Reality (AR) before.	**6 (4.48)**	**9 (6.72)**	**25 (18.66)**	**53 39.55)**	**41 (30.60)**
2	I understand the basic concept of Augmented Reality (AR).	**4 (2.99)**	**9 (6.72)**	**37 (27.61)**	**46 (34.33)**	**38 (28.36)**
3	I am familiar with the applications and potential uses of Augmented Reality (AR) in education.	**7 (5.22)**	**9 (6.72)**	**32 (23.88)**	**59 (44.03)**	**27 (20.15)**
4	I actively seek information about the latest developments in Augmented Reality (AR) technologies.	**3 (2.24)**	**17 (12.69)**	**29 (21.64)**	**50 (37.31)**	**35 (26.12)**
5	I have prior experience using Augmented Reality (AR) technologies.	**3 (2.24)**	**11 (8.21)**	**26 (19.40)**	**42 (31.34)**	**52 (38.81)**
6	I follow professional organizations, conferences, or forums related to Augmented Reality (AR) in education.	**3 (2.24)**	**23 (17.16)**	**24 (17.91)**	**37 (27.61)**	**47 (35.07)**

7	I have discussed Augmented Reality (AR) with my teacher educators or instructors during my teacher education program.	**0 (0)**	**3 (2.24)**	**36 (26.87)**	**67 (50.0)**	**28 (20.90)**
8	I stay updated on research studies and publications discussing the effectiveness of Augmented Reality (AR) in education.	**0 (0)**	**3 (2.24)**	**11 (8.21)**	**60 (44.78)**	**60 (44.78)**
9	I feel confident in explaining the concept of Augmented Reality (AR) to others.	**0 (0)**	**7 (5.22)**	**31 (23.13)**	**45 (33.58)**	**51 (38.06)**
10	I believe that Augmented Reality (AR) has the potential to enhance the teaching and learning experience.	**0 (0)**	**8 (5.97)**	**16 (11.94)**	**59 (44.03)**	**51 (38.06)**

Question 1: I have heard of Augmented Reality (AR) before.
70% of respondents indicated they had heard of AR before, it suggesting that the majority of participants were aware of AR technology. This finding advocates that AR has gained a reasonable level of recognition among the surveyed participants, but there is still a small percentage who have not encountered it. This could be due to varying exposure to technology or differences in educational backgrounds.

Question 2: I understand the basic concept of Augmented Reality (AR).
Nearly 63% of respondents felt that they have a basic understanding of AR, among those 28.36% feeling very confident in their understanding. This indicates that a significant portion of participants possess a basic understanding of AR. However, there is a substantial number who may require more information or training to grasp the concept fully.

Question 3: I am familiar with the applications and potential uses of Augmented Reality (AR) in education.
64% of respondents indicated that they were familiar with the applications and potential uses of AR in education. This result suggests that a substantial number of participants have some knowledge of AR's educational applications. However, there is still a noteworthy portion (23.88%) who may not be fully aware of its potential in education.

Question 4: I actively seek information about the latest developments in Augmented Reality (AR) technologies.
Around 63% of respondents reported actively seeking information about the latest developments in AR technologies. This finding shows a strong interest among participants in staying updated on AR technology, which is crucial in the rapidly evolving field of AR.

Question 5: I have prior experience using Augmented Reality (AR) technologies.
A significant percentage (70%) of respondents reported having prior experience with AR technologies. This high percentage indicates that a substantial number of participants have hands-on experience with AR, suggesting that they may have used AR applications or tools in various contexts.

Question 6: I follow professional organizations, conferences, or forums related to Augmented Reality (AR) in education.
A notable number (62%) of respondents agreed that they follow professional organizations, conferences, or forums related to AR in education. This suggests that a segment of participants is actively engaged in the professional community related to AR in education, indicating a commitment to staying informed and connected in the field.

Question 7: I have discussed Augmented Reality (AR) with my teacher educators **or instructors during my teacher education program.**
70% of the participants reported discussing AR with their teacher educators or instructors during their teacher education program. This result indicates that a significant proportion of participants had conversations about AR during their teacher education, which can contribute to the dissemination of knowledge and ideas related to AR.

Question 8: I stay updated on research studies and publications discussing the effectiveness of Augmented Reality (AR) in education.

Majority of respondents (89%) indicated that they highly updated themselves on research studies and publications about the effectiveness of AR in education. This result postulates that a significant proportion of participants have very much interest to know about AR related updates in education.

Question 9: I feel confident in explaining the concept of Augmented Reality (AR) to others.

71% percentage of respondents felt confident in explaining the concept of AR to others. This high level of confidence among participants suggests that they are well-prepared to share their knowledge and insights about AR with peers and learners.

Question 10: I believe that Augmented Reality (AR) has the potential to enhance the teaching and learning experience.

The majority of respondents (82.09%) strongly believe that AR has the potential to enhance the teaching and learning experience. This overwhelming belief in the potential of AR in education underscores its perceived value among the participants, indicating optimism about its future impact.

Research Question 2:

How familiar are Prospective Teachers with specific AR applications and tools commonly used in educational settings?

Table 4

Teachers Use of AR Technology in Classroom	No. Of Prospective Teachers	Percentage `(%)
Regularly	44	32.83
Occasionally	65	48.50
Not at all	25	18.65

The provided data reveals the familiarity of Prospective Teachers with specific Augmented Reality (AR) applications and tools commonly used in educational settings, but with a focus on their usage in the classroom. The analysis of this data is as follows:

44 Prospective Teachers (32.83%) reported that AR technology is regularly used in the classroom. 65 Prospective Teachers (48.50%) indicated that AR technology is occasionally used in the classroom. 25 Prospective Teachers (18.65%) reported that AR technology is not used at all in the classroom. This indicates that a significant portion of the students in the sample is familiar with the usage of AR technology in educational settings, albeit to varying degrees.

The results indicates a significant and positive level of AR technology usage in the classroom among Prospective Teachers. The fact that 32.83% of students reported its regular usage it advocates that AR is already integrated into some educational practices. The "Occasionally" category reflects that a substantial portion (48.50%) of students encounters AR technology in educational settings from time to time. This may indicate that AR is being introduced in various educational contexts but is not yet a daily practice for all.

Research Question 3:

What is the Perception of Benefits and Usefulness of Augmented Reality (AR) technology among Prospective Teachers?

Table 5

S. No	Statement	SD	D	N	A	SA
		F (%)	F (%)	F (%)	F (%)	F (%)
1	Augmented Reality (AR) can make learning more engaging for students.	0 (0)	5 (3.73)	15 (11.19)	68 (50.75)	46 (34.33)
2	Augmented Reality (AR) can enhance students' understanding of complex concepts.	0 (0)	12 (8.96)	22 (16.42)	39 (29.10)	61 (45.52)
3	Augmented Reality (AR) can provide opportunities for interactive and hands-on learning experiences.	0 (0)	16 (11.94)	28 (20.90)	51 (38.06)	39 (29.10)
4	Augmented Reality (AR) can help students to develop problem-solving and critical thinking skills.	1 (0.75)	12 (8.96)	25 (18.66)	63 (47.01)	33 (24.63)
5	Augmented Reality (AR) can improve student motivation to learn.	12 (8.96)	28 (20.90)	27 (20.15)	38 (28.36)	29 (21.64)
6	Augmented Reality (AR) can support personalized learning experiences for	4 (2.99)	11 (8.21)	9 (6.72)	45 (33.58	65 (48.51

	students.				)	)
7	Augmented Reality (AR) can enhance collaboration and communication among students.	**10 (7.46)**	**11 (8.21)**	**28 (20.90)**	**45 (33.58)**	**40 (29.85)**
8	Augmented Reality (AR) can increase student retention of course material.	**3 (2.24)**	**5 (3.73)**	**8 (5.97)**	**22 (16.42)**	**96 (71.64)**
9	Augmented Reality (AR) can facilitate the exploration of real-world scenarios and simulations.	**4 (2.99)**	**10 (7.46)**	**26 (19.40)**	**61 (45.52)**	**33 (24.63)**
10	Augmented Reality (AR) can help students develop digital literacy and technological skills.	**6 (4.48)**	**11 (8.21)**	**43 (32.09)**	**44 (32.84)**	**30 (22.39)**

Question 1: Augmented Reality (AR) can make learning more engaging for students.
Majority of respondents (50.75%) agreed, with an additional 34.33% strongly agreeing, that AR can make learning more engaging for students. Only a small percentage (11.19%) remained neutral, with almost no disagreement. This strong agreement suggests a consensus among participants regarding AR's potential to enhance student engagement, highlighting its role in creating captivating learning experiences.

Question 2: Augmented Reality (AR) can enhance students' understanding of complex concepts.
Majority of respondents (45.52%) strongly agreed that AR can enhance students' understanding of complex concepts, with an additional 29.10% in agreement. Only a small percentage (8.96%) disagreed. This overwhelming agreement indicates a belief in AR's capacity to improve students' comprehension of intricate subjects, emphasizing its educational value.

Question 3: Augmented Reality (AR) can provide opportunities for interactive and hands-on learning experiences.
The majority of respondents (38.06%) agreed, with an additional 29.10% strongly agreeing, that AR can provide opportunities for interactive and hands-on learning experiences. Few respondents expressed disagreement (11.94%). This high level of agreement underscores the role of AR in facilitating active and interactive learning, which is increasingly recognized as an effective pedagogical approach.

Question 4: Augmented Reality (AR) can help students to develop problem-solving and critical thinking skills.
While a significant portion (47.01%) agreed, a substantial number (24.63%) also disagreed or strongly disagreed with the statement. This mixed response suggests that while many participants acknowledge AR's potential to enhance problem-solving and critical thinking, some remain sceptical.

Question 5: Augmented Reality (AR) can improve student motivation to learn.
A combined 57.32% of respondents agreed or strongly agreed that AR can improve student motivation to learn, whereas 28.36% remained neutral or disagreed. While the majority believes in AR's motivational impact, a significant minority appears to have reservations or remains undecided.

Question 6: Augmented Reality (AR) can support personalized learning experiences for students.
Majority (48.51%) strongly agreed that AR can support personalized learning experiences, with an additional 33.58% in agreement. This strong agreement reflects a positive perception of AR's role in tailoring learning experiences to individual student needs and preferences.

Question 7: Augmented Reality (AR) can enhance collaboration and communication among students.
Nearly half (45.52%) of the respondents agreed, with an additional 29.85% in agreement, that AR can enhance collaboration and communication among students. This suggests a recognition of AR's potential to foster collaboration, which is an essential skill in today's interconnected world.

Question 8: Augmented Reality (AR) can increase student retention of course material.
An overwhelming majority (88.38%) agreed or strongly agreed that AR can increase student retention of course material. This strong agreement highlights AR's perceived efficacy in helping students retain what they have learned, which is a significant benefit in educational contexts.

Question 9: Augmented Reality (AR) can facilitate the exploration of real-world scenarios and simulations.

Majority (70.15%) agreed or strongly agreed that AR can facilitate the exploration of real-world scenarios and simulations. This strong agreement underscores AR's potential in creating immersive learning experiences that mimic real-world situations.

Question 10: Augmented Reality (AR) can help students develop digital literacy and technological skills.

Responses were fairly evenly distributed, with no strong agreement or disagreement. The majority (32.09%) remained neutral, indicating uncertainty. This mixed response suggests a lack of consensus regarding AR's role in developing digital literacy and technological skills among students, indicating a need for further exploration and clarification.

In summary, the responses in this table demonstrate a generally positive perception of AR's potential to enhance student learning experiences, with strong agreement on several aspects, such as engagement, understanding of complex concepts, and personalized learning. However, some statements, such as those related to problem-solving skills and digital literacy, received more mixed responses, indicating varying levels of belief in AR's impact in these areas.

3.0 LIMITATIONS:

It is important to acknowledge potential limitations of the study. The sample may not represent the entire population of Prospective Teachers, and generalizability of findings may be limited. The reliance on self-reported data through surveys may introduce response bias. Additionally, the study's cross-sectional nature may limit the ability to establish causality or capture changes over time.

By employing a survey-based research design and following a systematic methodology, this study aims to provide valuable insights into the awareness, perception and willing of implementing AR in teaching among Prospective Teachers , contributing to the understanding of their readiness to integrate AR into their future teaching practices.

3.1 Suggestions for Future Research:

Conducting longitudinal studies that follow Prospective Teachers over an extended period can provide valuable insights into the changes in their awareness and perception of AR. While this study employed a survey-based approach, future research could incorporate qualitative methods such as interviews or focus groups to gain a more nuanced understanding of the experiences, beliefs, and challenges faced by Prospective Teachers regarding AR. Qualitative research can provide in-depth insights into the lived experiences and perspectives of participants, allowing for a richer analysis of their awareness and perception of AR.

Comparing the awareness and perception of AR among Prospective Teachers from different institutions, programs, or geographical regions could provide valuable insights into the impact of contextual factors on their perceptions.

4.0 CONCLUSION:

This study aimed to investigate the awareness and perception of augmented reality (AR) among Prospective Teachers through a survey-based research approach. By examining participants' familiarity with AR, understanding of its potential benefits and challenges, perceptions of its suitability for different subjects and grade levels, and confidence in integrating AR into their future teaching practices, valuable insights were gained regarding the preparedness and attitudes of future educators towards AR integration.

The findings of this study revealed several key insights. Firstly, it was observed that Prospective Teachers demonstrated a moderate level of awareness of AR technology. While many participants had some knowledge of AR, there were variations in their understanding of its capabilities and potential applications in education. This highlights the importance of incorporating AR-related content and training in Teacher Education programs to ensure that future educators are well-informed about the possibilities offered by this innovative technology.

Furthermore, the study shed light on the perceived benefits and challenges of implementing AR in educational settings. Prospective Teachers recognized the potential of AR to enhance student engagement, foster active learning, and facilitate visualization of abstract concepts. However, concerns were also raised, including technical limitations, access to suitable resources, and the need for additional training to effectively integrate AR into instructional practices. Addressing these challenges is essential to promote successful AR implementation and maximize its potential benefits in classrooms.

The study assessed participants' confidence in integrating AR into their future teaching practices. The results indicated a mixed level of confidence, with some participants expressing enthusiasm and a strong belief in the value of AR, while others felt hesitant or lacked the necessary skills and knowledge to incorporate AR seamlessly. This underscores the importance of providing targeted professional development programs and support to ensure that future educator’s feel empowered and equipped to leverage AR as an instructional tool.

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