AUGMENTED REALITY IN THE LIBRARY AUTOMATION: STUDENTS' PERCEPTION

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Abstract

This study investigates students' perspectives on the library's use of Augmented Reality (AR) technology. There has been an increase in the use of new technology in academic institutions worldwide over the past few years. AR is a growing technology, as is the interest in how its use can enhance the reading and learning experiences of students. This study's objective was to investigate students' perceptions of AR in the library environment and its potential implications for library services. The design is a mixed method combining survey and interview. The participants answered demographic questions and a series of Likert-scale questions regarding their perceptions of AR before and after being exposed to AR in a library setting. The analysis of the data was conducted using descriptive statistics. The findings of this study revealed that the majority of students viewed the use of AR in the library favorably. They were enthusiastic about the potential benefits of AR, including increased engagement, enhanced search and discovery, and more interactive learning and reading experiences. However, some were concerned about the potential distraction of AR interfaces, and it was discovered that some students are hesitant to use AR technology due to a lack of familiarity with it. Overall, the study indicates that students view the use of AR in the library as a positive trend and are generally in favour of the concept. The findings provide insights that can guide future research and inform the creation of library services that incorporate AR technology. We recommended that libraries should consider incorporating AR technologies into their services. In addition, libraries training and resources to help bridge the gap between students' unfamiliarity with AR and their willingness to use it. Finally, librarians should consider developing AR-based services that correspond to the preferences and needs of students. These services could include interactive resource guides, 3D representations of library materials, and search tutorials. AR-based services could help bridge the gap between user expectations and the library's resources and capabilities if implemented correctly.

Keywords: Augmented Reality, Instructional Methods, Collaborative Learning, and Interactive Learning, Library usage, 3D, Library Resources, Library Services

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Introduction

Augmented reality (AR) leverages an extensive array of information and computer technologies, amalgamating tangible elements from the real world, such as physical objects, geographical locations, and people, with computer-generated simulations (Ivanova & Ivanov, 2011). This technology can be utilized effectively in educational contexts without the need for costly equipment. Through the use of AR applications, educational materials can engage users in innovative ways, giving them a more three-dimensional quality. When deployed successfully, AR can enhance students' motivation and concentration levels (Zhang et al., 2014). Furthermore, AR applications empower students to independently engage in the learning and reading process within the library. This not only saves time for both librarians and students, who would otherwise be searching through physical books on shelves and tables, but it also reduces the need for displaying numerous books, limiting direct contact with students. This approach fosters a personal and fulfilling reading experience, encouraging students to explore their literary interests at their own pace.

Augmented reality holds significant promise within the realms of education and training, offering a multitude of potential benefits. It simplifies the acquisition, processing, and retention of information, thus facilitating the learning process. Moreover, its integration into teaching methods can make reading more captivating and enjoyable for both educators and learners. Notably, this technology is not confined to a specific age group or educational level, as it can be effectively employed across the entire spectrum of education, from preschool to higher education and even within professional settings (Aleksandrova, 2018).

Consequently, it becomes the responsibility of researchers and educators within the academic community to explore the integration of technology within the classroom. Their goal is to cultivate a meaningful culture of learning and reading that ultimately benefits the educational community as a whole. This involves harnessing the potential of augmented reality to create engaging and effective educational experiences for students, regardless of their age or academic stage.

Theoretical Foundations

Constructivism

The educational philosophy known as constructivism places a strong emphasis on the learner's pivotal role in the acquisition of personal knowledge (Murphy, 1997). In a constructivist classroom, students are encouraged to take charge of their own learning journey by interpreting new experiences in the context of their existing knowledge. This process involves not only absorbing the information and concepts presented to them but also the active reorganization of their preexisting conceptual frameworks (Driver, 1989). Learning, in this view, is the active generation of meaning through personal experiences and interactions with the surrounding environment.

Learning, being inherently social, demands collaboration, negotiation, and active participation in community activities. Consequently, instructional approaches aligned with these principles have a higher likelihood of success. In a constructivist classroom, students collaborate, assume responsibility for their actions and choices, and work collectively to address complex problems or challenges, leveraging the abundant resources available (Mays, 2015). This approach exemplifies a typical constructivist instructional method.

The implication here is that teachers should recognize that abandoning a passive and authoritarian teaching style in favor of active, engaging methods is conducive to more effective learning. By involving students in interactive processes that incorporate concrete objects, real-world experiences, and augmented environments, educators can enhance the learning experience. In essence, it is paramount for teachers to understand that relinquishing a passive and authoritarian teaching style in favor of active, learner-centered methods is crucial for optimizing the learning process.

Active Learning

Learner engagement and action play a crucial role in the activity hypothesis, emphasizing their significance in the learning process. Unlike passive information absorption, learning is viewed as an active process where learners not only acquire knowledge but also actively produce it while reflecting on their own actions (Adewusi et al., 2021; Light, 2008).

On a dynamic level, it is impossible to separate the concept of activity from conscious learning since the two are intricately linked. To create effective educational activities within sociocultural and socio-historical contexts, a solid understanding of activity systems is essential. Interactions occur among the various elements within these systems, including people, tools, objects, labour divisions, communities, and norms, all of which contribute to the formation of activities and conscious learning.

Research Questions

1. How do students perceive the impact of augmented reality (AR) applications in the library on their engagement and learning experiences?
2. Are there significant gender-based variations in how male and female students perceive the utility and effectiveness of augmented reality applications in the library for enhancing their learning experiences?
3. Are there differences in the ways students with different academic qualifications utilize augmented reality in the library for educational purposes and what implications do these variations have for optimizing the use of AR technology in library services?

Methodology

Design

The research design adopts a mixed-methods approach to provide a holistic understanding of the impact of augmented reality technology on student learning experiences. This involves the concurrent collection and analysis of both quantitative and qualitative data.

Study Area

The study is conducted within a controlled environment, specifically in a library setting. This setting is chosen to facilitate focused engagement with augmented reality technology among the selected participants.

Sample and Sampling Techniques

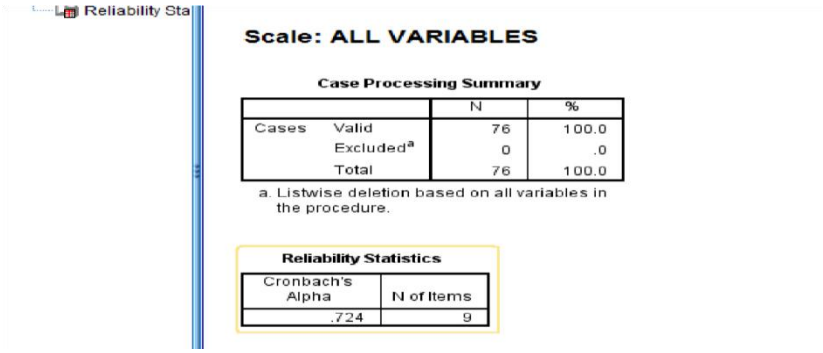
A random sampling technique is employed, resulting in a sample of 76 participants, comprising 36 males and 40 females. The random selection aims to ensure a representative and unbiased group for the study.

Instrument

Data is collected through surveys that incorporate both quantitative and qualitative aspects. The questionnaire utilizes a Likert scale with four levels (strongly agree, agree, disagree, and strongly disagree) across nine items. This instrument is designed to assess participants' perceptions of augmented reality technology in the learning context.

Validation and Reliability

To ensure the instrument's validity, it undergoes a rigorous review process involving three technology-savvy individuals and an external specialist in the field of education. The instrument demonstrates a reliability coefficient of 0.72, indicating consistent and dependable results.


Reliability Sta

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	76	100.0
	Excluded[a]	0	.0
	Total	76	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.724	9

Figure 1: Test of dependability

Data Collection Procedures

Participants are informed about the research and provide informed consent before engaging with augmented reality technology in the library. Ethical guidelines are strictly followed, and participants confirm their willingness to participate voluntarily in the study.

Data Analysis

Quantitative datasets are subjected to statistical methods to derive structured and quantifiable insights. This includes descriptive statistics, inferential statistics, and any relevant statistical tests. Qualitative datasets undergo a more subjective and open-ended analysis, emphasizing participants' perspectives and observations. The concurrent collection of both data types enables a comprehensive comparison, enriching quantitative results with qualitative insights.

Procedure

Participants are introduced to augmented reality technology in the library setting. They engage with a computer-generated artwork named ADEVLE, which is integrated with the reading of a physical book. The technology operates through a series of processes, including sensing the real world, processing data, overlaying digital content, displaying augmented content on the smartphone screen, and enabling user interaction. This immersive experience aims to explore the potential of augmented reality in enhancing the learning process.

Educational Process

The research aims to foster creative thinking and active engagement among participants through the educational process. The objective is to spark interest in the use of augmented reality technology, positioning it as a valuable tool for learning. ADEVLE serves as a means to combine traditional physical books with digital elements, enhancing the overall learning experience.

YouTube Demonstration

To provide a visual representation of the technology integration, a video demonstration is available on the researcher's YouTube Channel (@Dr_Michael_Adelani_Adewusi). The video showcases the practical application of augmented computer graphics with the reading of a book, offering an additional layer of understanding for the audience.

Results and Discussion

Table 1: Demographic information

Sex	No.
Male	40
Female	36

The investigation was conducted in a suitable atmosphere with 76 students, 36 males and 40 females.

How do students perceive the impact of augmented reality (AR) applications in the library on their engagement and learning experiences?

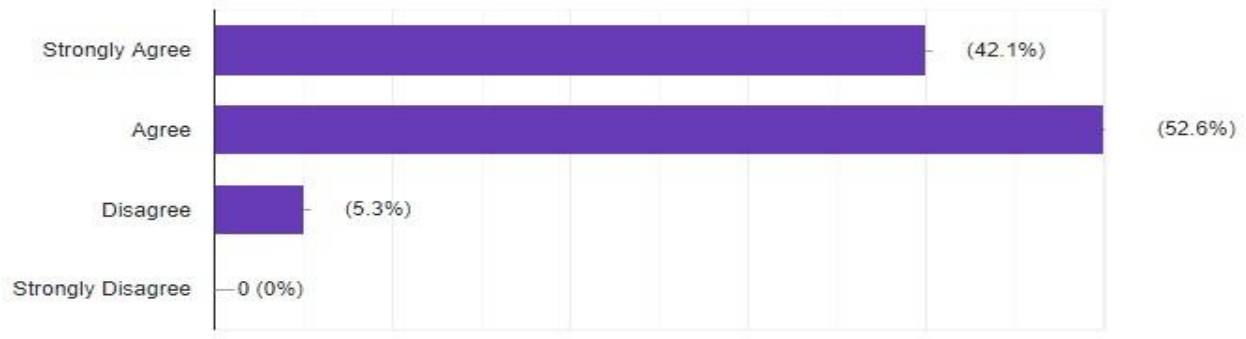


Figure 2: Level of Agreeing to AR communicating better instruction

The findings indicate that over ninety percent of respondents believed that supplementary materials, when used, could be employed for teaching purposes (refer to Figure 2). This aligns with a similar discovery made by Bower, Howe, and McCredie in their 2014 study.

In a 2014 study conducted by Robinson and Grover, the "learning by design" approach using Augmented Reality in a secondary school setting was explored. This research focused on the subject of visual art and revealed that the AR approach fostered independent thinking, creativity, and critical analysis among students. Adedoja's 2016 study further supported the idea that students can effectively use technology devices to engage in verbal debates and share ideas with their peers. Intrapersonal learners, who are inclined towards self-reflection and a deep understanding of what they learn, can utilize Web 2.0 applications on their mobile

devices to communicate their thoughts and ideas with instructors and fellow students in the classroom.

One significant aspect of this study is the revelation that students exhibit a positive attitude towards integrating AR into their academic instruction through the use of mobile technology (Papakostas et al., 2021). The ubiquity of mobile phones in modern society is a key contributor to this phenomenon. Mobile devices have become indispensable tools, regardless of a person's socioeconomic status or reading proficiency (Chee, 2023). They are used for critical tasks across various aspects of daily life, creating a level of familiarity and ease of use with technology (Kitsios et al., 2021). These devices enhance mobility and accessibility, a boon to educational institutions and students alike. It is clear that AR's alignment with these prevalent technologies enhances its appeal (AlGerafi et al., 2023).

Recognizing that no single technological application or device can fully develop all aspects of a student's intelligence in a learning environment, the adoption of argumentation technology for educational purposes is seen as a significant step towards nurturing multiple intelligences.

Respondents asserted the following to bolster the figure 2 claim via interview:

Student 1, Male, B.Sc "*By introducing me to more information about how technology might transcend the physical world and enter the digital realm, it enrich my understanding*"

Student 2, Male, Med. "*Improved and realism of workplace technology. I am able to comprehend what I am studying*"

Student 3, Female, B.Sc "*To see learning from a new angle, given that we have control over the reality and augmented experiment. I had a great time and the communication was clear*".

Student 4, Female, MEd. "*It has streamlined the learning process because the communication is straightforward and allows for repeated play*"

Student 5, Male, B.Sc "*I have never encountered such a novel and pleasant approach in education. The video lecture and the communication are crystal clear*"

Student 6, Male, MEd. "*In a few seconds, this experiment will see technology transcend the physical world and enter the digital realm. It actually conveyed the lecture well and nicely*"

The findings of this study align with the research conducted by Martin-Gonzalez, Chi-Poot and Uc-Cetina, (2016), who evaluated the usability of an augmented reality system for teaching Euclidean vectors. Their conclusions were consistent with the current study, highlighting that augmented reality (AR), as a cutting-edge technology, serves as a valuable tool for enhancing learning strategies. Additionally, a majority of users expressed enthusiasm for using AR systems for educational purposes.

Moreover, Turan et al., (2000) study found that AR had a moderate impact on students' academic performance but did not significantly affect their self-efficacy perceptions. The research also revealed that students in the experimental group were satisfied with the use of augmented reality in their classrooms and expressed a desire to utilize this technology for

future courses and fields of study, as indicated by the results of interviews with students in that group.

Furthermore, concerning the exploration of whether augmented reality contributes to content creation while learning concepts, a substantial number of students expressed their appreciation for the updated materials (refer to Figure 2). This observation is consistent with the findings of Alakarppa et al., (2017), who concluded that the combination of educational elements and physical activity in an outdoor setting holds promising potential. Educators also believed that the use of natural materials could enhance the overall educational experience for students. Students reported heightened engagement levels, indicating that the learning experience captivated their attention, piqued their curiosity, and facilitated focused concentration on the core elements of the learning content, as articulated by Adi Badiozaman et al., (2021).

Are there significant gender-based variations in how male and female students perceive the utility and effectiveness of augmented reality applications in the library for enhancing their learning experiences?

Table 2: Gender descriptive statistics

Gender	N	Mean	Std. Deviation
Female	40	29.35	3.13
Male	36	28.67	2.52
Total	76	29.03	2.86

The descriptive statistics (see Table 2) suggested that female students (N = 40, Mean = 29.35, StD = 3.13) had a more favourable attitude towards the use of augmented reality than male students (N = 40, Mean = 29.35, StD = 3.13).

The findings also resonate with the research conducted by Saleem et al., (2021), highlighting that the perceived utility, ease of use, and enjoyment of AR directly influence students' attitudes and intentions to use the technology. This observation is particularly relevant in an era where technology's integration into education is gaining momentum. The study underscores the importance of considering gender-specific preferences and usage patterns when implementing AR in educational strategies. While it does not imply that one gender is more inclined to AR, it emphasizes that gender-specific considerations are essential to ensure inclusive and effective educational strategies.

When examining the impact of AR on learning and knowledge acquisition, the study reveals its potential to enhance engagement and content creation. AR's ability to merge digital materials with educational content offers an exciting approach to enriching the learning process. Swargiary and Roy, (2023), this innovation empowers students to interact with educational content in a more dynamic and immersive manner, a feature highly conducive to improved understanding and retention.

In the context of library services, AR emerges as a transformative tool with the power to revolutionize the traditional library experience. Students can access three-dimensional and interactive learning environments that foster more dynamic and engaging learning cultures. Isa, (2023), this is particularly valuable in a time where traditional libraries are evolving to

meet the demands of the digital age. AR offers libraries the opportunity to engage students and patrons in a manner that aligns with contemporary learning styles and preferences.

Are there differences in the ways students with different academic qualifications utilize augmented reality in the library for educational purposes, and what implications do these variations have for optimizing the use of AR technology in library services?

Table 3: Mean of educational attainment

	N	MEAN	STD. DEVIATION
BEd./BSc./HND./BTech	56	28.98	3.03
MEd./MSc	20	29.15	2.37
Total	76	29.03	2.86

BEd./BSc./HND./BTech (N = 56, Mean = 28.98, StD = 3.03) and MEd./MSc (N = 20, Mean = 29.15, StD = 2.37) but the later had a more favourable attitude regarding the application of augmented reality, as demonstrated by descriptive data in Table 3.

In addition, the majority of highly qualified students (Med./MSc) stated:

Student 1, Male. "*Because I have encountered numerous similar technologies though this seems different, but I'm proficient with them*"

Student 2, Male. "*The working reality of technology. I comprehend its technological nature*"

Student 3, Female. "*Because of my academic background, I believe I can flow with the procedures*"

Student 4, Male. "*In a few seconds, this experiment will see technology transcend the physical world and enter the digital realm. Although I was exposed to something similar in school, it was not as comprehensive as this*"

Student 5, Male. "*I had seen similar material during my graduate studies*"

The outcomes of this study support Adedoja's (2016) argument that participants' educational levels play a pivotal role in determining the effectiveness of technology in supporting instructional delivery. This might be attributed to the fact that individuals advancing in their education tend to amass more knowledge and skills related to teaching complexities and the potential of technology in facilitating learning as they pursue their educational objectives.

For instance, someone who has obtained a Master's degree in contemporary instructional strategies and methods likely had greater exposure to and hands-on experience with educational practices and the digital technology available in the twenty-first century. This exposure would have enabled them to recognize the substantial benefits technology can bring to the learning process, equipping them with a strong technological foundation. Furthermore, as Ebner (2015) notes, devices offer an unprecedented level of reach, scope, and immediacy that traditional classroom settings cannot match. The key lies in crafting a well-thought-out didactical plan built on an effective learning strategy. The insights gained from this study underscore the promising potential of AR in educational settings, especially within libraries (Deuchar, 2022; Okebukola et al., 2021). The technology's ability to engage students, enhance content delivery, and cater to individual preferences marks a significant step forward

in the evolution of modern education. As technology continues to advance, the synergy between AR and learning is poised to reshape the educational landscape, creating opportunities for enriched, immersive, and more personalized learning experiences. Educational institutions must seize this potential and adapt to the changing dynamics of education in the twenty-first century.

Conclusion

In conclusion, this study on Augmented Reality (AR) in the library setting has unveiled several pivotal findings, shedding light on its potential to revolutionize education. It has shown that AR has the capacity to engage students in novel and interactive ways, merging digital elements seamlessly with the physical world, thereby stimulating curiosity and enhancing the learning experience. These findings align with previous research by Robinson and Grover (2014) and Adedoja (2016), which also recognized AR's potential to foster independent thinking, creativity, and critical analysis among students. Furthermore, the study indicates that students exhibit a positive attitude towards integrating AR into their academic instruction through mobile technology. This receptivity can be attributed to the widespread use of mobile phones across all societal strata, where these devices have become indispensable for various tasks in contemporary life. In education, mobile technology enhances mobility and accessibility, thus serving as a versatile tool for key stakeholders.

The educational background and experience of students significantly shape their perceptions of AR. Those with higher educational levels, as seen in this study, tend to appreciate the advantages of technology in learning, emphasizing the role of familiarity and exposure in establishing a strong technological foundation (Adewusi et al., 2021). Additionally, the research aligns with the findings of Saleem et al., (2021), emphasizing that perceived utility, ease of use, and enjoyment of AR directly impact an individual's attitude and intention to use. This observation is particularly relevant in an era where technology's integration into education is on the rise. The study highlights the importance of considering gender-specific preferences and usage patterns when implementing AR in educational strategies.

Regarding AR's impact on learning and knowledge acquisition, this study reveals its potential to enhance engagement and content creation, offering an exciting pathway for improved learning experiences. AR, as a transformative tool, empowers users to access dynamic, interactive learning environments in libraries, fostering more engaging learning cultures. To summarize, this study underscores the promising potential of Augmented Reality in educational settings, particularly within libraries. It engages students, enriches content delivery, and caters to individual preferences, marking a significant advancement in modern education. As technology evolves, the synergy between AR and learning is poised to reshape education, offering immersive, personalized learning experiences. Educational institutions must seize this potential, adapting to the evolving dynamics of twenty-first-century education.

Finally, this research contributes to the existing body of work on AR's impact in education, emphasizing the need for longer-term inquiries to mitigate novelty effects. While it underscores the potential of AR, it acknowledges that significant portions of AR-related research are still in their early stages, necessitating further exploration to determine the specific educational activities that will benefit most from AR technology.

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