Impact of Augmented Reality (AR) And User Education on the Utilization of Library Information Resources and Services in Academic Libraries in Imo State, Nigeria

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Abstract: *This study focuses on the impact of Augmented Reality and User Education on the utilization of library and information resources and services in Imo State University, Alvan Ikoku Federal University of Education, and Federal Polytechnic Nekede, Owerri library. Two research objectives, two research questions, and two hypotheses were adopted for this study. A total of twenty-six (26) professional library staff formed the population of the study. The study was carried out using a four-point rating scale as an instrument for data collection. The data collected was analyzed using the Pearson Product-Moment Correlation Coefficient and presented in tables. The result of this study revealed that there is a significant and positive relationship between Augmented Reality and users' utilization of information resources and services in the academic libraries studied. It was also revealed that there is a significant and strong positive relationship between User Education and users' utilization of information resources and services in the academic libraries studied. Based on the findings, it was recommended that academic libraries should integrate Augmented Reality (AR) technology to enhance the utilization of library information resources and services by developing AR-based content and experiences that showcase library resources and services. Furthermore, academic libraries should prioritize the development and dissemination of user education by educating the users on how to use the AR technologies to enhance their user experience, which can facilitate easy understanding and utilization of resources.*

Keywords: academic libraries, library information resources, library services, utilization of library resources and services, augmented reality, user education.

INTRODUCTION

Imagine stepping into an academic library where the walls come alive with stories, traditions, and histories from around the world. Augmented reality (AR) technology makes this possible, offering a unique opportunity for users to interact with the library and its resources, thereby promoting the utilization of these resources. Academic libraries are Information hubs that serve the information needs of students, faculty, and staff at a college or university. They are information-providing environments owned and incorporated into tertiary institutions such as universities, polytechnics, monotechnic, colleges of education, colleges of agriculture, colleges of technology, and research institutes (Azuike, 2021). Lui (2021) gave a similar definition that they are libraries that serve institutions of higher learning, such as colleges or universities. The academic library is a library affiliated with an institution of higher education and has the primary mission to support the teaching, research, and learning needs of its students, faculty, and staff (ACRL, 2019).

Mayombia, Nnwatimwa and Nngeje-Sichaiwe (2019) stated that the purpose of the academic library is to support the teaching, learning, and research needs of the parent institution, generate knowledge, and equip people with knowledge to serve society as well as advance the well-being of mankind. According to Smith (2020), academic libraries are dynamic, inclusive, and technology-rich environments that foster collaboration, creativity, and critical thinking. They provide access to diverse information resources, expert librarians, and innovative services that support the academic success of students, faculty, and staff. To support the integration of knowledge, information resources are made available in various formats, offering a rich mix of qualitative and quantitative information.

According to Saba, Babalola, and Udoudoh (n.d.), information resources encompass all library materials designed to meet the information needs of users. As cited in the same work, Udoudoh (2012) further defines information resources as the collective sum of various information carriers that libraries provide to cater to the diverse needs of their clientele. Information resources are essential tools that help librarians meet the information needs of patrons. According to Taiwo, Ayandare, and Olurola (2015), these resources are materials provided to users to fulfill their information wants and needs. Library services and information resources are closely linked, with resources serving as the foundation for delivering effective services to users.

Library services play a crucial role in supporting the diverse information needs of users. According to the Urban Libraries Council (2022), these services include a range of programs, services, and resources. As noted by Katz (2017), library services act as a bridge between users' needs and library resources, facilitating access, discovery, and utilization of information.

According to IFLA (2019), leveraging information resources and services is a vital part of library services, enabling individuals and organizations to access and utilize libraries, databases, and other information sources to meet their information needs. However, for the academic library to fulfil this role, technologies such as augmented reality are required.

AR is the technology that aims to digitally integrate and expand the physical environment or the user's world, in real time, by adding layers of digital information. This integration can be applied to various display technologies capable of overlaying or combining information (numbers, letters, symbols, audio, video, graphics) with the user's view of the real world (Arena, Collota, Pau & Termine, 2022). Augmented reality (AR) seamlessly merges the physical and digital worlds, overlaying virtual information onto real-world environments. Augmented reality (AR) is revolutionizing the way libraries provide access to information resources and services. By integrating AR technology, libraries can create interactive and immersive experiences that enhance learning, engagement, and exploration for users of all ages. The integration of Augmented Reality (AR) in the library can be seamlessly facilitated through dynamic and explicit user education services.

User education, also known as library instruction or information literacy instruction, refers to the process of teaching users how to effectively locate, evaluate, and use information resources and services provided by a library or information center. Uwakwe, Onyeneke and Njoku (2016), stated that user education is a process whereby potential users are made to learn how to make efficient and effective use of library resources through the acquisition of knowledge, skills in identification, location, retrieval, and exploitation of information. User education is an integral part of the educational process, empowering students to become independent learners and critical thinkers (ACRL, 2016).

Statement of the Problem

Academic libraries are the embodiment of knowledge, designed to support the academic goals of students and lecturers by providing a wide range of information resources. Despite their relevance, these libraries and their resources often remain underutilized, with users only visiting during exams or when it's convenient to benefit from the peaceful environment. The underutilization persists despite the vast array of materials and services offered. This study explores the impact of Augmented reality (AR) and user education on the utilization of library resources, seeking to understand the relationship between these innovative approaches and user engagement. By examining the correlation between AR, user education, and library utilization, this research aims to contribute to the existing literature on library innovation, providing practical insights for librarians and information scientists to develop effective strategies that enhance resource use and user experience.

Purpose of the Study

The general purpose of this study is to ascertain the impact of Augmented reality (AR) and User education on the utilization of academic library information resources and services in academic libraries in Imo State. Specifically, its objectives are to:

1. Determine the extent of the relationship between Augmented Reality (AR) and the utilization of information resources and services in the libraries studied.
2. Ascertain the extent of the relationship between User Education and the utilization of information resources and services in the academic libraries studied.

Research Questions

In line with the stated objectives of the study, the following research questions were formulated to serve as a guide to the study on the impact of Augmented reality (AR) and User education on the utilization of academic library information resources and services in academic libraries in Imo State

1. What is the extent of the relationship between Augmented Reality and students' utilization of information resources and services in the academic libraries studied?
2. What is the extent of the relationship between User Education and students' utilization of information resources and services in the academic libraries studied?

Hypotheses

The following hypotheses were formulated for the study and tested at 0.05 levels of significance.

Ho_1: There is no significant coefficient of relationship between Augmented Reality and the utilization of library resources and services in the university libraries studied.

Ho_2: There is no significant coefficient of relationship between User Education and utilization of library resources and services in the university libraries studied.

LITERATURE REVIEW

Academic libraries

Academic libraries play a pivotal role in supporting the goals of universities by fostering community engagement, research productivity, and student learning outcomes. As noted by Youngkin (2014), these libraries serve as incubators for innovative teaching and learning tools. By providing access to information resources, instructional environments, and research support services, academic libraries become hubs for creativity, intellectual curiosity, and innovation.

Key Functions and Responsibilities

Academic libraries have several key functions and responsibilities, including:

1. Supporting academic programs: Providing relevant information resources to facilitate research, teaching, and learning (American Library Association, 2020).

2. Developing and maintaining collections: Curating collections that support the curriculum and research needs of the institution (Association of College and Research Libraries, 2019).

3. Information literacy and research skills: Offering instruction and training to users (IFLA, 2018).

4. Reference and research services: Providing support to students, faculty, and staff.

5. Fostering collaboration and community engagement: Promoting a culture of collaboration and community engagement (Urban Libraries Council, 2022). Academic libraries are essential to the advancement of society and intellectual growth, as emphasized by the Librarian Registration Council of Nigeria (LRCN) (2020). Studies have shown that libraries play a critical role in improving academic performance and research quality (Olatunji & Olubukola, 2018; Ilori, 2019). By providing high-quality intellectual resources, academic libraries foster user engagement, promote academic excellence, and add value to the institution (Onyekweodiri & Agbo, 2015). Ilori (2019) emphasizes the vital role of academic libraries in supporting the academic and research endeavors of undergraduate students, researchers, and other users within an institution. Similarly, Onyekweodiri and Agbo (2015) highlighted the academic library's responsibility to provide and maintain high-quality intellectual resources that foster users' engagement, promote academic excellence, and add value to the institution. By fulfilling this role, academic libraries become an indispensable institutional component, driving intellectual growth and advancement.

Information Resources

Information resources are the vital components of a library, enabling it to support learning, research, and decision-making. In-fact they are the oil that lubricates the library, without them, what is the point of calling a room a library. According to various authors, these resources encompass a broad range of materials and formats, including texts, images, sounds, and data. They can be in print or digital formats, such as books, journals, databases, websites, and online resources.

Kaur and Rani (2007) view information resources as instruments used by librarians to assist patrons, while Taiwo, Ayandare, and Olusita (2015) emphasize the importance of assessing their suitability for users' needs. The American Library Association (2020), the Association of College and Research Libraries (2019), and IFLA (2018) also highlight the significance of information resources in supporting various needs. These resources are crucial for the effectiveness of an academic library, and their adequacy, along with a team of trained information professionals, is essential (Popoola and Haliso, as cited in Buhari, 2016). Maxwell (2018) notes that information resources are the backbone of teaching, learning, and research in any discipline. The Urban Libraries Council (2022) and Katz (2017) also emphasize the importance of information resources in providing access to information and supporting research, learning, and decision-making.

Library Services

The quality and effectiveness of academic libraries depend on various factors, including services, products, staff, facilities, and space (Pindlowa, 2002). According to Ugah (2011), quality in libraries is closely tied to the quality of service, which is crucial for a library's survival and effectiveness. In essence, delivering high-quality services is essential for academic libraries to thrive.

Libraries offer various services to support users' information needs, including:

1. Circulation Services: Providing access to library materials (Hernon & Altman, 2019)

2. Reference Services: Research assistance and guiding users to relevant resources

3. Information Literacy: Teaching users to locate, evaluate, and use information effectively

4. Digital Services: Access to e-books, online databases, and digital media

5. Programs and Events: Author talks, book clubs, workshops, and other events

6. Reprography Services: Reproduction of library materials (Uwa, 2014)

7. Indexing and Abstracting Services: Facilitating searching and retrieval of information (Uwa, 2014)

8. Document Delivery Services: Obtaining and delivering materials not available in the library's collection (Uwa, 2014)

9. Library Orientation: Introducing users to library resources, services, and facilities

10. Selective Dissemination of Information (SDI) Services: Providing users with up-to-date information (Anyanlola, 2019)

11. Current Awareness Services (CAS): Informing researchers about recent publications (Anyanlola, 2019)

Utilization of Information Resources and Services

The utilization of information resources and services involves the effective use of libraries, databases, and other information sources to meet the information needs of individuals or organizations (IFLA, 2019). It encompasses various components, including information access, information literacy, information use, and user engagement.

According to Tenopir, Christiansen, and Kaufeldt (2020), utilization involves information seeking, retrieval, evaluation, and use. To ensure effective utilization, libraries should develop user-centered services, provide access to diverse information resources, offer information literacy programs, and foster partnerships and collaborations. However, A study at Ashesi University in Ghana found that while students, faculty, and staff frequently used general internet resources, their utilization of scholarly databases was relatively low (Dadzie, 2005). The low usage was attributed to a lack of awareness about the existence of these databases. To further boost utilization, academic libraries in Imo State can focus on continuous assessment and evaluation of their services, embracing cutting-edge digital technologies,

curating inclusive collections, and prioritizing professional development for staff. By adopting this multifaceted approach, libraries can effectively cater to the diverse needs of their community, foster informed decision-making, and ultimately drive academic success.

Augmented Reality and the Utilization of library information resources and services

Augmented Reality (AR) is a technology that overlays virtual objects onto real-world environments, allowing users to view them through a device's screen (Vergara et al., 2016). This technology blends the physical and digital worlds, enhancing the user's experience. AR superimposes contextual data without altering reality. As a result, AR systems enable the user to examine the physical world while additional object information is presented on the screen of a technological device (Barraza et al., 2015). Augmented Reality (AR) enhances the real world by overlaying digital content, allowing users to interact with it through devices such as smartphones, tablets, or AR glasses. This technology seamlessly blends the physical and digital worlds, creating a more immersive experience. (Barman, 2023)

According to Jung & Tom (2017), AR has several key characteristics that define its functionality and user experience. AR provides partial immersion, augmenting the real-world scene and allowing users to maintain a sense of presence in the real world. This characteristic enables users to interact with both the physical and digital environments simultaneously. Augmented Reality requires a mechanism for recording the real world. This mechanism is essential for capturing the user's surroundings and superimposing digital content onto them. The process of recording both real and virtual elements is complex. This complexity arises from the need to seamlessly integrate the digital and physical worlds, ensuring a smooth and intuitive user experience. In terms of computing power, AR requires fewer computational resources compared to other technologies. This aspect makes AR more accessible and feasible for a wider range of devices and applications.

Furthermore, AR requires very realistic images to create an immersive and engaging experience. The quality of digital content is crucial in enhancing the user's perception of the real world.

High-accuracy tracking is also necessary for effective AR experiences. This tracking enables the AR system to accurately superimpose digital content onto the real world, ensuring a seamless interaction between the user and the library. AR can be supported by less complex technological devices. This characteristic makes AR more accessible to a broader audience, as users can experience AR through a variety of devices, including smartphones and tablets.

AR's characteristics, as outlined by Jung & Tom (2017), highlight its potential to enhance user experiences by providing interactive and immersive environments. By understanding these characteristics, developers and users can better appreciate the capabilities and limitations of AR technology.

IFLA (2023) stated that AR technology can transform libraries by offering interactive experiences that enrich user engagement and utilization of information resources and services. Some potential

applications include: Interactive displays that provide additional information and multimedia content related to library collections, virtual reconstructions of historical scenes or objects, access to supplementary multimedia content linked to e-books or articles, interactive library tours and virtual maps, educational games and quizzes, and virtual assistance or chatbots for real-time support.

Hussain (2022) asserted that AR technology enhances learning within libraries by providing engaging and interactive tools that make education more accessible and effective. Augmented Reality (AR) can enhance library experiences by providing interactive features like virtual tours, maps, educational games, and quizzes. Additionally, AR can power virtual assistants or chatbots, enabling users to receive instant answers to their queries.(IFLA, 2023). According to Chang & Hanwen (2023), AR provides users with seamless access to a wealth of multimedia resources, including audiovisual content and digital exhibits. This technology enriches the user's experience, making it more engaging and immersive. One of the key benefits of AR is its ability to offer personalized content recommendations. By leveraging AR, users can access relevant information that is tailored to their interests and needs. This personalized approach enhances the overall user experience, making it more enjoyable and informative. Furthermore, Augmented Reality (AR) broadens the scope of information resources, merging physical and digital content to create a more vibrant and interactive experience.

By integrating multimedia resources into the user's surroundings, AR enables libraries to provide immersive experiences that boost user engagement and facilitate access to information. This technology has the potential to revolutionize the way libraries deliver information, making it more accessible and engaging for users.

User Education and the Utilization of library information resources and services

User education aims to empower users with the skills and knowledge needed to identify information needs, locate and access relevant resources, evaluate information quality and credibility, use information effectively and ethically, and develop critical thinking and problem-solving skills. It has a symbiotic relationship with the use of information resources.(Association of College and Research Libraries, 2016) and as such includes: library orientation and tours, database and catalog training, research skills workshops, information literacy classes, one-on-one consultations, and online tutorials and guides. Users benefit a lot from user education organized in the library. It informs and influences their opinions and attitudes towards library usage and also inspires their quest for knowledge, which is essential for the advancement of individuals and societies (Liu, Lo & Isumura, 2016).

Esse and Ugwumba (2014) emphasized that user education is essential to facilitate a meaningful connection between users and library resources, as it empowers users to navigate and utilize materials and tools, they may be unfamiliar with. A study conducted by Uwakwe, Onyeneke and Njoku (2016), on the effect of a user education program on Law students' use of the library, revealed that the course user education positively affected the law students at Imo State University, Owerri, thereby ensuring that the students can effectively and efficiently use the library resources. Ogunsheye, as cited by Monye (2016), posited that user education triggers transformative changes in individuals, evident in their attitude towards knowledge acquisition and library usage. Agyen-Gyasi (2010), as cited by Monye (2016) stated that the influence of user education on the effective utilization of the library by students cannot be overemphasized as it enables library resources, services, and facilities to be adequately and effectively used, with little or no direct assistance from library staff.

By acquiring library skills through user education, students are expected to undergo a behavioral shift in their approach to learning, cultivating a curious mindset and a habit of seeking knowledge. A study by Ojo-Ade and Jagboro (2010), as cited by Monye (2016), revealed that students who received user education were proficient and versatile in utilizing library resources, services, and facilities, including the library catalog. Notably, these students demonstrated a high success rate in searching and retrieving information, which was attributed to their knowledge of library usage gained through user education.

METHODOLOGY

The study adopted a correlation research design. It was carried out in Imo State University, Alvan Ikoku Federal University of Technology and Federal Polytechnic Nekede, Owerri Library. The population consists of 26 professional librarians from the three libraries studied. The census enumeration method was adopted due to the small population. The instrument used for this study is a rating scale. The instruments were filled and returned. Data collected for this study were analyzed using the Pearson Product-Moment Correlation coefficient. The Pearson correlation coefficient (r) ranges from +1 to -1, indicating: - Positive association (r > 0): Variables increase together,

- Negative association (r < 0): One variable increases as the other decreases, - No association (r = 0): No relationship between variables. Hypotheses were tested using a t-test with a 0.05 significance level. Decision rule: - Reject null hypothesis (H0) if p-value ≤ 0.05 or t-calculated > t-table, - Uphold alternate hypothesis (HA) if null hypothesis is rejected.

Presentation of Data Analysis

Table 1

Summary Table for the Extent of Relationship between Augmented Reality and the Utilization of Library Resources and Services

Group	n	r	r^2	Decision
Utilization of Res & Serv Augmented Reality	26	0.934	0.872	Positive And a strong relationship

Table 1 summarizes the analysis for this question, with a correlation coefficient of r = 0.934 indicating a strong positive relationship between Augmented Reality and resource utilization. The coefficient of determination r^2 = 0.872, suggests that 87.2% of the variance in resource utilization can be explained by advertising.

Hypothesis One: There is no significant relationship between Augmented Reality and the utilization of library resources and services in the university libraries under study

Table 2

Summary t-test Statistics for Testing Hypothesis Four

n	df	t_Cal	p	t_Crit	α	Decision
26	24	12.807	<0.001	2.064	0.05	Reject H_04

Table 2 shows the t-test results, with a t-value t_{Cal} = 12.807 that is significantly higher than the critical t-value t_{Crit} = 2.064. The p-value is less than 0.001, leading to the rejection of the null hypothesis H_{04}. This confirms a significant relationship between Augmented Reality and the utilization of library resources and services.

Result of Data Analysis and Tests for Research Question Two and Hypothesis Two

Table 3

Summary Table for the Extent of Relationship between User Education and the Utilization of Library Resources and Services

Group	n	r	r^2	Decision
Utilization of **Res & Serv** User Education	26	0.875	0.766	Positive and strong relationship

Table 3 provides the analysis for this question, with a correlation coefficient of r = 0.875 indicating a strong positive relationship between User Education and the utilization of library resources. The coefficient of determination r^2 = 0.766 means that 76.6% of the variance in resource utilization can be explained by User Education.

Hypothesis Two: There is no significant coefficient of relationship existing between the publicity strategies and the utilization of library resources and services in the academic libraries under

Table 4

Summary t-test Statistics for Testing Hypothesis Five

n	df	t_Cal	p	t_Crit	α	Decision
26	24	8.854	<0.001	2.064	0.05	Reject H_{05}

As shown in Table 4, the t-test results give a t-value t_{Cal} = 8.854, which is significantly higher than the critical t-value t_{Crit} = 2.064. With a p-value less than 0.001, the null hypothesis H_{05} is rejected, indicating a significant relationship between user education and the utilization of library resources and services.

Summary of Findings

From the results of data analyses presented in this chapter, the following findings were made.

1. There is a significant and positive relationship between Virtual Reality and users' utilization of information resources and services in the academic libraries studied.
2. The study found a significant and strong positive relationship between the library website users' utilization of information resources and services in the academic libraries studied.

Educational Implication.

The introduction of augmented reality has profound implications for educational institutions. Augmented Reality (AR) technology can change the learning experience in libraries by creating interactive and immersive experiences that engage students with library resources and services. AR enables students to explore complex concepts and resources more dynamically, making learning more enjoyable and effective. By leveraging AR, students can access digital resources, such as e-books, articles, and multimedia materials, more interactively and engagingly. Additionally, AR helps students discover new resources and services in the library, encouraging exploration and utilization, and ultimately promoting a more comprehensive learning experience.

The positive impact of user education programs on library resource utilization highlights the importance of information literacy education in schools and universities. Educational institutions should implement comprehensive user education programs that teach students how to effectively locate, evaluate, and use information resources. These programs can include workshops, orientations, online tutorials, and one-on-one consultations, tailored to meet the diverse needs of students. For librarians, this finding emphasizes the need for continuous professional development in information literacy instruction. Effective user education programs can empower students to become proficient researchers, critical thinkers, and lifelong learners. By fostering these skills, educational institutions can enhance students' academic performance and prepare them for future professional and academic endeavors

CONCLUSION

This study investigated the impact of Augmented Reality (AR) and User Education on the utilization of library information resources and services in academic libraries in Imo State. The findings revealed that the integration of AR technology and a well-designed user education program significantly enhances users' utilization of library resources. The study highlights the potential of AR to provide immersive learning experiences and the importance of user education in enhancing the utilization of information resources and services in academic libraries.

By leveraging these technologies, academic libraries can maximize users' engagement and ensure that users effectively utilize the wealth of resources available to them.

Recommendation

Based on the findings of the study on the impact of AR and User Education on the utilization of library information resources and services in academic libraries in Imo State, the following recommendations were made

1. Academic libraries should integrate Augmented Reality (AR) technology to enhance the utilization of library information resources and services. This can be achieved by: developing AR-based content, create interactive and engaging AR experiences that showcase library resources and services, invest in necessary hardware and software to support AR experiences that showcase library resources and services, providing AR equipment and training for students and librarians, and collaborating with faculty to integrate AR into the curriculum and research.

    Furthermore, Academic libraries can conduct a needs assessment by identifying specific areas where AR can enhance the learning experience and resource utilization. They can also develop a strategic plan: outline goals, objectives, and timelines for AR implementation. In situations where there is no funding, exploring potential funding sources, such as grants, partnerships, or institutional support becomes necessary.

2. Academic libraries should prioritize user education. This can be achieved by providing regular updates on resources and services, remote access, designing educational programs with user experience in mind, educating the users on how to use the AR technologies to enhance their user experience, and facilitating easy understanding and utilization of resources. Academic libraries can go further in developing resources that provide step-by-step instructions on using AR technology and accessing library resources, raise awareness about AR services and resources among users through various marketing channels and ensure continuous evaluation and assessment of the effectiveness of AR technology and user education programs. By prioritizing user education, academic libraries can empower users to effectively utilize resources and services, enhancing their overall learning experience. These recommendations aim to leverage AR technology and library websites to promote the utilization of library resources and services, enhancing the overall academic experience.

Suggestion for Further Studies

1. Future studies could expand the scope beyond Imo State to include academic libraries in other states or regions within Nigeria. This would allow for a more comprehensive understanding of the impact of augmented reality on library resource utilization across different geographical areas and educational contexts.

2. Further research could employ a longitudinal design to examine the challenges facing the use of AR and user education on the utilization of information resources and services.

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