

# Virtual reality library services: A global vision for university libraries in Delta and Edo states, Nigeria

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## Abstract

*Rationale of Study* – Virtual reality is a universal technological phenomenon that has made a tremendous impact on a wide range of professions, including medicine, engineering, aviation, military, and, more lately, librarianship, among others. It is worrisome that libraries in Delta and Edo states, Nigeria are yet to deploy virtual reality services. This study investigated virtual reality services in university libraries in Delta and Edo States, Nigeria.

*Methodology* – A descriptive survey research method was adopted for the study using a population of 116 librarians from the 15 university libraries in Delta and Edo States, Nigeria. The total enumeration sampling technique was utilised for the research because of the small population size. A structured questionnaire to collect data from the respondents face to face.

*Findings* – The findings revealed that librarians' willingness to implement virtual reality technologies in university libraries in Delta and Edo States, Nigeria is high. The study further revealed that the respondents agreed that information literacy service, library orientation service, and user education service, among others, can be done via virtual reality technologies in university libraries. However, the respondents were not aware of virtual reality technologies to adopt.

*Implications* – This study recommends that library management should allocate funds for the acquisition of virtual reality technologies for university libraries. Training on virtual reality should also be organised for librarians in university libraries in Nigeria.

*Originality* – The study was an original research conducted on the potential use of virtual reality library services in Delta and Edo States, Nigeria.

## Keywords

Virtual reality, augmented reality, university libraries, Delta State, Edo State, Nigeria

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## 1 Introduction

Virtual Reality (VR) is a universal technological sensation that has had a significant impact on professionals in a wide range of professions, including medicine, engineering, aviation, military, and, more lately, librarianship, among others. Nowak (2020) dates the birth of augmented and virtual reality to 1838, when the stereoscope, a gadget that allows users to observe an item in what appears to be three dimensions (3D), was invented. Mistchell (2020) described VR as a computer-generated simulation in which a person can engage with an artificial 3D environment through the use of technological devices such as special eyewear with a screen or sensors-equipped gloves. Unlike other traditional user interfaces, VR immerses the user in an experience rather than simply viewing screens which are often confusing and time-consuming to comprehend (Bardi, 2020). With the advent of information communication technologies (ICT), libraries are no longer places where users go to read-only print books (Kwanya, Stillwell & Underwood, 2013). ICT is now increasingly being deployed to aid effective service delivery and learning; interactive learning spaces like Makerspace and Virtual Reality Spaces for practical learning; as well as swift comprehension and gaming for entertainment (Kwanya, Stilwell & Underwood, 2012). Virtual reality has gained a significant level of attention from university libraries especially those that reside in advanced nations of the world. Indeed, virtual reality content is blossoming in all areas of human endeavours (Figueroa, 2018; Ocholla et al., 2021).

Many scholars have highlighted ways VR can be deployed in libraries. Stimpson (2009) affirmed that an online Virtual Reality, known as Second Life, can provide orientation, outreach, tour, and other user education needs in libraries. Also, self-guided podcasts and iPod application tours have been used to provide virtual excursions and orientations for libraries (Mikelle & Davidson, 2011). Also, the University of Illinois library researchers worked on the HoloBook Project which created VR technology e-book reading experiences. The technology enabled library patrons to research and read e-books from virtual environments (Head & Isenberg, 2009). Virtual reality can also be used for data visualisation, curation, and storytelling to keep users engaged, satisfied, and willing to visit the library to meet their diverse information needs.

Despite the aforementioned prospects of the deployment of VR in libraries, information on librarians' willingness to implement and use them in university libraries in Delta and Edo states in Nigeria is still very scanty. The current research was inspired by this

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knowledge gap. Therefore, this research investigated the current state of librarians' willingness to deploy VR to transform university library services. The specific objectives of the study were to discover the extent to which librarians are willing to implement VR technologies in university libraries in Delta and Edo States; determine the services which can be provided in university libraries using virtual reality technology; ascertain the VR facilities to be deployed in the university libraries if adopted; and identify the likely factors that may militate against the deployment and use of VR technologies in university libraries.

## **2 Literature Review**

The study of Oyelude (2018) showed that libraries, museums, and archives are eager to include virtual reality into their offerings to users since they are trendy, amusing, and increases user engagement. Pope (2018) investigated the need for creating special spaces within the library for VR technologies. It was reported in the study that libraries are increasingly implementing virtual reality as educational and exploratory tools. Greene and Groenendyk (2021) reviewed virtual and augmented reality services available in university libraries. The research showed that a large proportion of Association of College and Research Libraries (ACRL) member libraries do provide access to VR. However, the use of augmented reality (AR) was far less common. As revealed in the research, there was a greater desire to implement VR than AR. Cook, Lischer-Katz, Hall, Hardesty, Johnson, McDonald, and Carlisle (2019) found that academic libraries are to a high extent willing to implement VR technology for a wide range of educational purposes, including improving access to digital collections, providing recent research techniques, and creating new engaging learning environments for students. Figueroa (2018) posited that most people, including library staff, find VR to be an amazing experience and have been wishing to incorporate VR into their libraries' offerings and programming because it enhances users' engagement and experience.

Virtual reality technologies can be used in university libraries to provide a variety of services. In an academic or research library setting, Santos and Esposito-Betan (2017) investigated the benefits and drawbacks of adopting augmented reality for library orientations. The findings of the study showed that employing augmented reality in academic or research libraries is beneficial since it may be utilised for library orientation and to keep users informed. The equipment can be lent to users for a while; librarians can use augmented reality to overlay additional information by using it in library

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brochures, manuals, and posters. Kannegiser (2021) conducted a study to see how an augmented reality library orientation affected anxiety and self-efficacy. The research findings indicated that using augmented reality boosted students' insights into the library, enhances their ability to navigate the library, improved students' confidence level in regard to library utilisation, and increased user engagement. Massis (2015) investigated the application of virtual and augmented reality in libraries. The findings show that Aurasma, which is a VR App, can be utilised for live exhibitions in the library. The technology can also be used to boost students' information literacy level and their grasp of how to use the library. Dempsey (2018) investigated the use of virtual reality to aid students in their learning of information literacy. The study concluded that virtual reality has demonstrated a great potential as the technology librarians can utilise to help students of all ages to learn how to use geographic information (Demsey, 2018). Gamification improves learning in this field by providing a more immersive 3D learning environment. Virtual reality can also provide library education for university libraries with minimal staffing (Beheshti, 2012; Chen & Tsai, 2012).

Virtual reality facilities deployed in university libraries include HTC VIVE, Google Cardboard, the Oculus Rift developed by Facebook, GearVR developed by Samsung, and PlayStation Virtual Reality developed by Sony, to mention just a few (Pope, 2018; Howard, Serpanchy & Lewin, 2018). According to Frost, Goates, Cheng, and Johnston (2020), the Brigham Young University Library has an HTC VIVE VR system that could be either reserved or accessed by library users. As affirmed by the Illinois University Library (2017), the Grainger Engineering Library's IDEA Lab Virtual Reality Lounge contains a work area for communities using VR and AR systems such as HTC Vive Pro with Wireless Kit, Oculus Go, Oculus Quest, Oculus Rift (loanable kits available for check out at Grainger Circulation Desk), Valve Index, and Microsoft HoloLens VR workstations with software like steam, unity, unreal, Mixed Reality Portal. The University of Florida affirmed that it has Virtual Reality facilities like Oculus Rift with Touch Controller, HTC Vive, Samsung Gear, Google Daydream, plus Microsoft HoloLens which are all available for loan to users (The University of Florida, 2021). As revealed by the Connecticut State Library (2021), patrons can be transferred into a variety of real-world and imaginary situations using VR tools such as the HTC Vive, Oculus Rift, or Google Cardboard, such as flying in the air and walking on the sea. Sundermann-Zinger of the Maryland State Library purchased OSVR headsets in 2014, while Bishop of the Carroll County Public Library acquired the HTC VIVETM in 2016 and then added the

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Oculus Rift+Touch in 2017 (Waite, 2018). According to Figueroa (2018), 360-degree video, which records a complete scene and allows the user to see up, down, and around, has exploded in popularity because of products like Google Cardboard.

Despite the prospects in the deployment of VR/ AR technologies in university libraries, there may be some challenges militating against their deployment. Ghuloum and Al-lamki (2020) investigated the opportunities and threats of Interactive Applications (such as Virtual Reality, Augmented Reality, and Mixed Reality) in university libraries. The research indicated that high cost, security and privacy, network issues, substantial time commitment, lack of 3D design interface, user acceptance, and motion sickness are some of the factors militating against the full adoption of VR in university libraries. Santos and Esposito-Betan (2017) investigated the benefits and drawbacks of adopting Virtual Reality for library orientations in academic and research libraries. Some of the drawbacks identified are difficulty in implementing the technology, dependence on Internet speed, usage by youngsters only, and the need for specialised devices. Cook, Lischer-Katz, Hall, Hardesty, Johnson, McDonald, and Carlisle (2019) investigated the challenges and solutions for academic virtual reality. The challenges identified included simulator sickness often resulting in a frequent disconnect between what the eyes and ear perceive, accessibility barriers, high cost of VR equipment, physical constraint to user movements due to the wiring that connects the VR headset to the PC, and risk of disruptive or damaging reactions from users. Saleh, Salami, Soheili, and Ziaei (2021) investigated VR tools in medical school libraries, identifying applications, benefits, and problems, and offering a model. The challenges mentioned were economic, technical, and cultural stumbling blocks. Kirsch (2019) confirmed that using virtual reality headsets has health hazards for some people, including motion sickness, dizziness, and, in some cases, epileptic seizures. It is key to communicate this to students before they check out the equipment to boost their awareness to stop using it right away if they have a negative reaction.

### **3 Methodology**

The study adopted a descriptive survey research design. The target population comprised librarians working in university libraries in Edo and Delta states in Nigeria. The total population of the study was 116 librarians working in the 15 university libraries in the two states in Nigeria. The entire population was sampled using the total enumeration sampling technique because of the small size of the population. Hence, the sample size

of the study was 116 librarians. A structured questionnaire was utilised to collect data. The questionnaire was distributed to respondents in their workplaces with the help of two research assistants. Of the 116 questionnaires administered, 112 were completed and determined to be suitable for the study. As a result, the response rate was 97%. Dulle, Majanja, and Cloete (2010) affirmed that the accepted return ratio for most researches is 60%. Therefore, the response rate for this study was considered as excellent. The data elicited from the respondents was analysed using descriptive statistics. The criterion mean was set at 2.50.

#### 4 Data Analysis and Presentation of Results

Table 1 shows the response rate of the questionnaire distributed for the study.

Table 1: Summary of Response Rate

<b>Librarians in University Libraries</b>	No. of Questionnaire Distributed	No. of Questionnaire Returned	Percentage (%) of the Returned Questionnaire
<b>Total</b>	<b>116</b>	<b>112</b>	<b>97%</b>

Table 2: Gender Distribution of the Respondents

<b>Gender</b>	<b>No. of Respondents</b>	<b>Percentage (%)</b>
Male	68	61%
Female	44	39%
<b>Total</b>	<b>112</b>	<b>100%</b>

The data in Table 2 shows that male respondents made up 61%, while female respondents made up 39%. In this survey, there are more males than females.

Table 3: Respondents' Educational Levels

<b>Qualification</b>	<b>No. of Respondents</b>	<b>Percentage (%)</b>
B.Sc./ B.Ed.	52	46%
M.Sc./ M.Ed.	48	43%
PhD	12	11%
<b>Total</b>	<b>112</b>	<b>100%</b>

Table 3 shows that 52 (46%) of the respondents had a B.Sc. or B.Ed. degrees, 48 (43%) had an M.Sc. or M.Ed. degrees and 12 (11%) have PhD degrees. As a result, the majority

of librarians working in university libraries in Nigeria's Delta and Edo states were first-degree holders.

**Research Question 1:** To what extent are librarians willing to implement VR technologies in your Library?

Table 4 revealed the level of librarians' willingness to implement VR in university libraries. With an aggregate mean of 3.41 which is higher than the criterion mean of 2.50, it can be concluded that librarians' willingness to implement VR technologies in university libraries in Delta and Edo states, Nigeria was high. The librarians expressly revealed that they are willing to incorporate VR into library services, create space for VR use in the university library, educate VR users on how to understand VR concepts, and encourage the use of VR to increase librarian and faculty collaboration in terms of improving students' practical knowledge, suggest to management that VR technology be approved for usage in the library and that VR be used to attract patrons who are primarily digital natives.

Table 4: Librarians Willingness to Implement VR Technologies

Items	VHE	HE	LE	VLE	Mean
I will like to incorporate VR into library services	82	16	8	6	3.48
I am willing to create space for VR use in my university library	74	26	4	8	3.48
I am willing to propose to my university management to approve VR implementation	76	18	12	6	3.20
I will educate users to know the VR concepts	64	32	9	7	3.37
I will implement VR to attract users who are mainly digital natives	68	28	8	8	3.39
I will encourage the use of VR in view of increasing librarians and faculty collaboration in terms of enhancing students practical knowledge	56	32	16	8	3.54
Aggregate Mean					3.41

**Criterion Mean**

**Note: VHE: Very High Extent; HE: High Extent; LE: Low Extent; VLE: Very Low Extent**

**Research Question 2:** What library services can be provided by virtual reality technologies?

As revealed in Table 5, the librarians agreed to deploy library orientation service 96(85.71%), information literacy service 94(83.93%), user education service- 86(76.79%), library exhibition service to showcase resources 72(64.29%), current awareness services 66(58.93%), and user engagement service 58(51.79%). Library orientation, information

literacy, user education, library exhibition, current awareness services, and users' engagement services were among the services that could be offered via VR technology at university libraries in Delta and Edo states.

Table 5: Services that can be deployed via VR/AR Technologies in university libraries

<b>Library Services</b>	<b>Agree</b>	<b>disagree</b>	<b>Total</b>
Library orientation service	96(85.71%)	16(14.29%)	112(100%)
VR equipment loaning service	18(16.07%)	94(83.93%)	112(100%)
For overlaying additional information about library service	48(42.86%)	64(57.14%)	112(100%)
User engagement Service	58(51.79%)	54(48.21%)	112(100%)
User education service	86(76.79%)	26(23.21%)	112(100%)
Current awareness services	66(58.93%)	46(41.07%)	112(100%)
Library exhibition service to showcase resources	72(64.29%)	40(35.71%)	112(100%)
Information literacy service	94(83.93%)	18(16.07%)	112(100%)

**Research Question 3:** What VR facilities can be deployed in the University libraries if adopted?

Table 6: VR facilities to be deployed in the University libraries if adopted

<b>VR Facilities</b>	<b>Frequency</b>	<b>Percentage</b>
Head Sets	112	100%
HTC VIVE/ PRO	22	20%
Google Cardboard	32	29%
Oculus Rift/GO/Quest	18	16%
Gear VR	24	21%
Wireless Kit	58	52%
Valve Index	12	11%
Microsoft HoloLens	28	25%
Swift Internet Connectivity	86	77%



Table 6 showed the VR facilities to be deployed in the university libraries if adopted. From the table, all the respondents specified headsets 112(100%) and 86(77%) indicated swift Internet connectivity. Also, 58(52%) indicated wireless kits. Only a few respondents indicated Google Cardboard, Microsoft Hololens, Gear VR, HTC Vive/Pro, Oculus Rift/GO/Quest, and Valve Index.

**Research Question 4:** What are the likely factors that may militate against the deployment of VR technologies?

Table 7: Factors that may militate against the Deployment of VR Technologies in University Libraries

<b>Factors</b>	<b>Agree</b>	<b>Disagree</b>	<b>Total</b>
Cost of purchasing VR facilities	98(87.5%)	14(12.5%)	112(100%)
Security and privacy issues	34(30.36%)	78(69.64%)	112(100%)
Inadequate knowledge of VR technology and uses of concept for libraries	88(78.57%)	24(21.43%)	112(100%)
Substantial time commitment	18(16.07%)	94(83.93%)	112(100%)
Inadequate 3D designs Interface	82(73.21%)	30(26.79%)	112(100%)
User acceptance issues	20(13.70%)	92(86.30%)	112(100%)
Motion sickness	80(71.43%)	32(28.57%)	112(100%)
Difficulty in implementing the technology into library services	78(69.64%)	34(30.36%)	112(100%)
Poor internet connectivity	68(60.71%)	44(39.29%)	112(100%)
VR cannot be accessed without a device	28(25%)	84(75%)	112(100%)
Physical constraint to user movements due to the wiring that connects the VR headset to the PC.	48(42.86%)	64(57.14%)	112(100%)
Health-related issues like dizziness, and, in some cases epileptic seizures	92(82.14%)	20(17.86%)	112(100%)

Table 7 revealed the factors that may militate against the deployment of VR technologies in university libraries. From the table, the respondents agreed on the cost of purchasing VR facilities 98(87.5%); health-related issues like dizziness, and, in some cases epileptic seizures 92(82.14%); inadequate knowledge of VR technology concept for libraries 88(78.57%); inadequate 3D designs interface 82(73.21); motion sickness 80(71.43%); difficulty in implementing the technology into library services 78(69.64%); and poor Internet connectivity 68(60.71%). It can be concluded that the likely factors that may militate against the deployment of VR technologies in university libraries in Delta and Edo states in Nigeria are the cost of purchasing VR facilities, health-related issues like dizziness, and, in some cases epileptic seizures, lack of adequate knowledge of VR technology and uses of concept for libraries, lack of adequate 3D designs interface,

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motion sickness, difficulty in implementing the technology into library services and poor Internet connectivity.

## **5 Discussions of results**

Virtual reality services were envisioned for university libraries in Nigeria's Edo and Delta states. Male respondents took part in the study in greater numbers than females. The results revealed that the majority of the participants in this study had a B.Sc. or B.Ed. degrees followed by those who had an M.Sc. or M.Ed. degrees. The research makes it clear that librarians were to a high extent willing to implement VR technologies in their libraries. This findings agree with the research of Greene and Groenendyk (2021) that a large proportion of ACRL-member libraries do provide access to virtual reality technology and many more are still willing to implement the technology. The findings also concur with the study of Cook, Lischer-Katz, Hall, Hardesty, Johnson, McDonald, and Carlisle (2019) which revealed that academic libraries are increasingly willing to implement virtual reality (VR) technology for a wide array of research and teaching purposes.

Another finding showed that library orientation, information literacy, user education, library exhibition, current awareness services, and users' engagement services are the services that can be deployed via VR technologies in Nigeria. These findings agree with the study of Demsey (2018) which revealed that VR can be effective for teaching students information literacy. The study similarly agrees with the study of Santos and Esposito-Betan (2017) which revealed that AR is suitable for library orientation to equip users with library use skills. As revealed in the survey, the respondents were still not yet conversant with how to do loaning of VR facilities and overlaying of additional information. This finding implies that librarians in Delta and Edo states, Nigeria were not familiar with some services that they could render via VR technologies. This further implies that for VR technologies to be fully implemented in university libraries in Delta and Edo states, further training is imperative to boost the librarians' knowledge of how to fully incorporate the technology into their services and yield maximum results.

Yet another finding showed that headsets, swift Internet connectivity, and wireless kit were the VR facilities to be deployed if the technology was to be adopted in their university libraries in Delta and Edo states, Nigeria. Only a few respondents indicated Google Cardboard, Microsoft HoloLens, Gear VR, HTC Vive/Pro, Oculus Rift/GO/Quest, and Valve Index. This finding disagrees with most studies that show

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that university libraries are acquiring a wide range of facilities for the VR/AR technology space of their libraries (Frost, Goates, Cheng, & Johnston, 2020; The University of Florida, 2021). It may be that librarians in Edo and Delta states have inadequate knowledge of VR facilities to be deployed in their university libraries. As a result, there is still a lot of work to be done in terms of educating librarians about virtual reality facilities that can be used in libraries. Finally, the research found that cost of purchasing VR facilities, health-related issues such as dizziness and, in some cases, epileptic seizures, lack of adequate knowledge of VR technology and uses of concept for libraries, lack of adequate 3D designs interface, motion sickness, and difficulty in imitating are all factors that may work against the deployment of VR technologies. The respondents disagreed that substantial time commitment, user acceptance issue, the fact that VR cannot be accessed without a device, security and privacy issues, and physical constraint to user movements due to the wiring that connects the VR headset to the PC can militate against their deployment and use of VR/AR technologies in their university libraries. This finding corroborates to the study of Kirsch (2019) which found that using virtual reality headsets has health risks for some persons, including motion sickness, dizziness, and, in some cases, epileptic seizures. The finding also aligns with the study of Ghuloum and Al-lamki (2020) which pointed out cost-related issues as an impediment to the implementation of VR technology in libraries. This finding implies that health-related issues as a result of VR usage, cost of the VR equipment, poor Internet connectivity issues, and lack of adequate knowledge of the technology could hamper the full deployment and use of VR in university libraries in Delta and Edo states in Nigeria.

## **6 Conclusion**

Virtual reality is fast gaining prominence for imparting practical knowledge to library users of all ages as what they see with their eyes and hear with their ears will remain with them for a very long time. The deployment of the technology in libraries can enhance user engagement and experience with library services, products, spaces and staff. Libraries can use the technology to teach information literacy, conduct user orientation, take users on a virtual tour, as well as offer user education and current awareness services, to mention only but a few. The study has served as an eye-opener that before implementation, a lot still has to be done in regard to orientating librarians on the VR facilities to acquire to achieve maximum results. Also, the likely challenges revealed in the study which are health-related, cost-related, and acquaintance of the concept of VR should be adequately looked into before the adoption of the technology in university

libraries. It is evident that VR will be a valuable toolset to university libraries because of its enormous benefits.

## 7 Recommendations

Based on the study findings, the researcher recommends that:

1. University/library administrators should set aside funding for the purchase of virtual reality technology in university libraries.
2. University librarians should be trained on how to use virtual reality for library exhibitions and information overlays.
3. Orientation sessions for librarians on the best VR facilities for their university library budget, size, and setting should be conducted.
4. Services such as loaning of VR equipment and overlaying of additional information about library services should be explored if VR services are to be adopted in the libraries.
5. VR facilities such as Google Cardboard, Microsoft Hololens, Gear VR, HTC Vive/Pro, Oculus Rift/GO/Quest, and Valve Index should be considered when deploying the technology in the libraries.
6. University library management should adequately mitigate all health-related risks associated with VR usage before full implementation of the technology.

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