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# Extent of Adoption and Utilization of the Fourth Industrial Revolution (4r) Technologies for Effective Pedagogy in University-Based Library Schools in Rivers State

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## Abstract

The study examined the extent of adoption and utilization of the fourth industrial revolution (4R) technologies for effective pedagogy in University-Based library schools in Rivers State. Considering the nature of the study, a descriptive survey design was adopted. The population of the study comprised the entire lecturers in the three University based library schools in Rivers State which is 39 including both full-time and part-time lecturers. There was no sampling since the population size was small, accessible and manageable. A structured online questionnaire was used to collect data from the lecturers. The data from the online survey was imported to excel and then to the SPSS version 22 for final analysis. Mean and standard deviation was the major data analysis tools used. The findings revealed that the adoption of fourth industrial revolution (4R) technologies such as cloud computing services, smart technology, video animation technology and virtual reality were very poor as only social media platforms such as WhatsApp, Google meet and Zoom were fairly adopted. The findings also revealed that the extent of utilization of these technologies were very low. Major challenges are inadequate skills, lack of internet access, inadequate technological infrastructures, technophobia, and lack of policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching among others. It was recommended that lecturers should be trained on the use of Fourth industrial revolution technologies for effective pedagogy, also technological infrastructures should be acquired and installed. Also, a policy mandating lecturer to adopt and utilize Fourth industrial revolution technologies such as cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy should be formulated in the library schools.

**Keywords:** Fourth Industrial Revolution (4R), Effective Pedagogy, Library Schools, University, Smart Technology, Video Animation Technology, Virtual Reality, and Cloud Computing.

## INTRODUCTION

Library and information services has experienced technological transformation over the last centuries, which is as result of the different stages of technological advancement (1st to 4th Industrial Revolution). At each of the stages of technological advancement, library and information service delivery is altered as emerging technologies are fused into library and information service delivery so as to meet the need of the century as well as the global technological stage. For librarians to be aware and acquire the prerequisite skills to utilize the technologies of each of these stages of technological advancement, library schools, which is a training center for upcoming librarians as well as librarians who wants to

advance their knowledge of librarianship must adopt and utilize the technologies available in each of the stages of technological advancement in teaching students. This will help to equip students to be aware of these technologies and hence, adopt and utilize them for effective service delivery when employed upon graduation. This study sought to examine the extent of adoption and utilization of the fourth industrial revolution (4R) technologies for effective pedagogy in university-based library schools in Rivers State.

The phrase Fourth Industrial Revolution was first mentioned by a group of scientists developing a high-tech strategy for the German government. Klaus Schwab, executive chairman of the World Economic Forum (WEF), introduced the phrase to a wider audience in a 2015 article published by Foreign Affairs (Schwab, 2015). Fourth industrial revolution is a stage of technological advancement characterized by automation of traditional manufacturing, industrial practices and other service oriented institutions using modern smart technology, where large-scale machine-to-machine communication (M2M) and the internet of things (IoT) are integrated for increased automation, improved communication and self-monitoring, and production of smart machines that can analyze and diagnose issues without the need for human intervention (Moore, 2019). Similarly, Lund (2021) opines that fourth industrial revolution can be defined as the technological stage which is characterized by the evolution of information technology towards greater automation and interconnectedness. It includes or incorporates technological advancements such as smart technologies, artificial intelligence, cloud computing services, blockchain, advanced robotics, the Internet of Things, autonomous vehicles, virtual reality, 3D printing, nanotechnology, and quantum computing among others.

In one way or the other, libraries have experienced and will continue to experience the fusion of these complex emerging technologies that characterizes fourth industrial revolution to transform its service delivery to meet the information needs of her user community. Advances in technologies over the years have revolutionized library and information services to the extent that users do not necessarily need to visit the library physically to enjoy her services. Even when users visit the library they don't necessarily need to meet a librarian physically to be served. The application of smart technologies has made self-service possible in the library parlance. Marwala (2019) captured libraries in the 4$^{th}$ industrial revolution by arguing that, "the future library is bigger than all the world's historical libraries combined and smaller than a book on one of those libraries shelves". The implication of this assertion is that libraries now exist more on cyberspace to meet the information needs of the 21$^{st}$ century users than in a gigantic physical structure with dusty and outdated information resources which constrains effective library and information service delivery. Also, the physical libraries are now equipped with smart technologies such as robots, self-service technologies, Radio Frequency Identification, speech and image recognition technology among others for effective service delivery. Ocholla & Ocholla (2020) stated that 4$^{th}$ industrial revolution technologies such as Internet of Things, embedded systems, cyber-physical systems, big data, cloud computing, information

management, data acquisition and handling as well as network security, amongst others, are already accessed and variably applied in some academic libraries for effective library and information service delivery. It is imperative for library schools to adopt and utilize these technologies in teaching students.

Library schools are education centers where students are trained to acquire the basic and advance knowledge and skills of effective information acquisition, processing, organization, dissemination and preservation. Library schools is an interdisciplinary training field that applies the practice, perspectives and tools of management; information technology; education and other areas of libraries; the collection, organization, preservation, and dissemination of information resources; and the political economy of information (Obim, Nwankwo & Onah, 2021). The field of library and Information science has over the last decades received transformation due to the difference technological stages. According to Abubakar (2021) it is irrefutable that technological advancements have brought about tremendous changes to the Library and Information Science (LIS) education globally. Most especially in the areas of adopting and utilizing modern technologies for teaching and learning process. According to Assefa and Wang (2018) field of LIS has progressively become inter-disciplinary with many new technological related areas being offered in addition to the traditional areas. As such emerging areas like data science, research data management, digital humanities among others are being offered to expand the frontiers of educational programs in Library schools (Assefa & Wang, 2018). Despite these emerging trends in LIS education globally, many Library schools are yet to adopt these technological changes.

Preliminary enquiry by the researchers through observation revealed that pedagogy in university-based library schools in Rivers State is still using traditional methods of white board and black marker in this era where pedagogy have transformed to hybrid or even virtual. It is imperative to take advantage of virtual technologies because the funding of universities in Nigeria is very poor which affected the availability of infrastructural resources in the universities. It is from the forgoing that this study sought to examine the extent of adoption and utilization of the fourth industrial revolution (4R) technologies for effective pedagogy in University-based library schools in Rivers State.

**Purpose of the Study**

The main purpose of the study is to examine the extent of adoption and utilization of the fourth industrial revolution (4R) technologies for effective pedagogy in University-based library schools in Rivers State. Specifically, the study sought to:

1. examined the extent of adoption of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University -based library schools in Rivers State;
2. ascertain the extent of utilization of the cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State;
3. identify the challenges associated with the adoption and utilization of cloud computing services, smart technology,

video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State;

4. suggest strategies to enhance the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State.

**Research Questions**

The following research questions guided the study:

1. What is the extent of adoption of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University -based library schools in Rivers State?
2. What is the extent of utilization of the cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State?
3. What are the challenges associated with the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State?
4. What are the strategies to enhance the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State?

**Literature Review**

Fourth Industrial Revolution is building on the third Industrial Revolution, "the digital revolution" that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. Olika-Moila and Simelane-Mnisi (2020) reported that, there is an urgent need for the development of Fourth Industrial Revolution-based and integrated pedagogical instructional activities at the South African universities. The authors furthered that and 4R technologies must be utilized to facilitate evidence-based learning for university students. According to Hrast, and Ferk-Savec (2018) the use of 4IR tools in equipping pre-service teachers is a form of inquiry-based learning (IBL), which is an active form of learning approach that can enhance student learning outcomes and develop inquiry skills that enable them to learn assimilate information about a topic through self-directed investigation by progressing through different inquiry phases. Penprase, (2018) opines that when university students are exposed to 4R technologies they will improve their concept discovering knowledge and hence, interpret concepts effectively which will enhance their skills.

In an effort to ensure that university students acquire the required skills to handle and utilize 4R technologies upon graduation in their workplace, educational institutions globally are enhancing their programmes to adopt and implement 4R enabled environment and well equipped with emerging technological infrastructures for their students to acquire and improve their skills (Gleason, 2018). These

technologies offer many exciting and distinct features in educational settings, and if effective in education, they can make an immense difference (Rihtaršič and Avsec, 2019). Another scholar, postulated that, the only way for pre-service teachers to adapt to the 4R is for the lecturers to integrate 4IR tools into the teaching and learning activities (Penprase, 2018).

Some challenges affecting the utilization of 4R technologies such as cloud computing services, smart technologies, virtual realties and animation video are inadequate skills, inadequate infrastructures, lack of policy on the adoption and utilization of 4R technologies in teaching among others. In an empirical study, Olika-Moila & Simelane-Mnisi (2020) reported that, university students faced challenges in acquiring the skills needed to utilize 4R technologies because these technologies were not included and integrated into teaching-learning process in the university. Although the 4R technologies are intended to embrace all the emerging cutting-edge technology, which utilizing it innovatively and creatively can enhance evidence-based pedagogy, it is problematic for the education institutions in developing countries to adequately integrate 4R due to many factors, some of which are inadequate infrastructures and skills (Roberts, 2015). Similarly, Bernstein, Brits, Ketley, Mela, Mogadime, Naidoo, Qabazi, Schoeman, and Warpenaar (2017) found out that, many universities in South Africa have not introduced 4R technologies into their pedagogical activities, due to poor fundings. According to Ahmat & Hanipah (2018) library schools organizational behavior and structure can pose challenges if not flexile to change.

To enhance the adoption and utilization of 4R technologies in library schools, the management should first and foremost formulate and implement policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching, then constant electric power supply should be adequately provided provision, functional ICT laboratory should be established in library schools, inculcating proactive attitude among lecturers towards adopting and utilizing 4R technologies for teaching, and provision of stable internet access in library schools among others. Penprase, (2018) recommended that, Lecturers in the fourth industrial revolution are expected to integrate technology into teaching and learning environments. Conducive work environment should also be provided for lecturers to function proactively. It is also important for university-based library schools to employ more digital natives who are technology savvy. Hussain (2019) states that universities have been hugely impacted by the fourth industrial revolution and that their continued existence is dependent on their ability to align with the design principles of the fourth industrial revolution Research Method

## METHODOLOGY

This quantitative research adopted survey design of descriptive nature as the research design. Descriptive survey is a research design that seeks to establish a consensus of opinions from the representative sample of the population. This design according to Nworgu (2015) aims at collecting data on a particular research topic and describing in a systematic manner, the characteristics, features or facts about a given population. The descriptive survey was considered appropriate because this

study seeks to collect, describe and summarize data on the extent of adoption and utilization of the fourth industrial revolution (4R) technologies (cloud computing services, smart technology, video animation technology and virtual reality) for effective pedagogy in University-based library schools in Rivers State. This quantitative research is not interested in testing the casual relationship between variables, thus descriptive survey design is considered the most suitable design. The population of the study comprised the entire lecturers in the three University based library schools in Rivers State which is including both full-time and part-time lecturers. Where University of Port Harcourt, library schools have 7 full time and 8 part time lecturers. Ignatius Ajuru University, library schools have 8 full time and 3 part time lecturers, while Rivers State University of Science and Technology have 8 fulltime and 5 part-time lecturers. There was no sampling since the population size was small, accessible and manageable, which is in agreement with Mole (2019) sample size recommendations.

Online Structured online questionnaire titled: Extent of Adoption and Utilization of the Fourth Industrial Revolution (4R) Technologies for Effective Pedagogy in University-Based Library Schools Questionnaire (EAU4RTEPUBLSQ) was used to collect data from the lecturers. The researcher's constructed instrument consists of 52 items. The first cluster sought to examine the Extent of Adoption of Cloud Computing Services, Smart Technology, Video Animation Technology and Virtual Reality for Effective Pedagogy in University-Based Library Schools in Rivers State, with 17 items. Cluster 2 focuses on the Extent of utilization of the cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State, with 17 items also. The third cluster with 9 items seeks to identify the Challenges Associated with the Adoption and Utilization of Cloud Computing Services, smart technology, video animation technology and virtual reality for effective pedagogy in University-Based Library Schools in Rivers State. while, the last cluster have 9 items to suggest Strategies to enhance the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in university-based library schools in Rivers State. in terms of the response options, Four-point Likert scale was used to rank the response of the respondents. The data from the online survey was imported to excel and then to the SPSS version 22 for final analysis. Mean and standard deviation was the major data analysis tools used. The decision rule for acceptance or rejection of the idea covered by an item, on the basis of the mean score of respondents was a benchmark of '2.50'. This implies that a respondents' mean score of 2.49 and below in an item, indicates disagreement/rejection of the view of an item, while a mean score of '2.50' and above implied acceptance/agreement of the said item.

**RESULT**

**Research Question 1:** What is the extent of adoption of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State?

**Table 1:: Responses of Lecturers on the Extent of Adoption of Cloud Computing Services, Smart Technology, Video Animation Technology and Virtual Reality for Effective Pedagogy in University-Based Library Schools in Rivers State**

| S/N | Cloud computing Service | VHE | HE | LE | VLE | Mean | St. | R |
|---|---|---|---|---|---|---|---|---|
| 1 | WhatsApp | 10 | 16 | 5 | 1 | 3.09 | 0.78 | **A** |
| 2 | Facebook | 8 | 9 | 12 | 1 | 2.69 | 0.97 | **A** |
| 3 | Google Meet | 2 | 11 | 12 | 9 | 2.25 | 0.88 | **R** |
| 4 | Google Classroom | 2 | 5 | 23 | 10 | 2.22 | 0.66 | **R** |
| 5 | Zoom | 5 | 7 | 10 | 4 | 2.22 | 1.07 | **A** |
| 6 | Telegram | 0 | 0 | 3 | 7 | 1.09 | 0.30 | **R** |
| 7 | Email | 4 | 5 | 2 | 5 | 1.75 | 1.14 | **R** |
| 8 | Online public Access Catalogue (OPAC) | 0 | 0 | 24 | 29 | 1.75 | 0.44 | **R** |
| 9 | YouTube Videos | 0 | 0 | 3 | 28 | 1.09 | 0.30 | **R** |
| | **Smart Technology** | | | | | | | |
| 10 | Radio Frequency Identification (RFID) | 0 | 0 | 10 | 11 | 1.31 | 0.47 | **R** |
| 11 | Speech and image recognition technology | 0 | 0 | 19 | 28 | 1.59 | 0.50 | **R** |
| 12 | Robots | 0 | 0 | 3 | 10 | 1.09 | 0.30 | **R** |
| | **Video Animation** | | | | | | | |
| 13 | 2D animated educational videos | 0 | 0 | 0 | 5 | 1.00 | 0.00 | **R** |
| 14 | 3D animated educational videos | 0 | 0 | 12 | 24 | 1.38 | 0.49 | **R** |
| 15 | 4D animated educational videos | 0 | 0 | 14 | 19 | 1.44 | 0.50 | **R** |
| | **Virtual Reality** | | | | | | | |
| 16 | Virtual Robot | 1 | 6 | 15 | 10 | 1.94 | 0.80 | **R** |
| 17 | Virtual laboratory | 1 | 6 | 15 | 10 | 1.94 | 0.80 | **R** |
| 18 | 3D virtual printing | 2 | 6 | 16 | 8 | 2.06 | 0.84 | **R** |
| | **Grand Mean & S.D** | | | | | **1.94** | **0.75** | **R** |

**Field Survey. A- Accepted, R- Rejected**

Results of table 1 shows the responses of lecturers in university-based library schools in Rivers state on their extent of adoption of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy. From the results, only WhatsApp and Facebook with 3.09 and 2.69 mean score respectively were accepted among the lecturers as the major 4R technologies adopted for effective pedagogy. Though, Google meet, Google classroom, Zoom and 3D virtual printing with 2.25, 2.22, 2.22 and 2.06 mean score respectively were rejected for not obtaining up to 2.50 criterion mean, they are fairly adopted as each of the technology obtained above 2.00 mean score which is the average mean. On the other hand, 4R technologies such as Radio Frequency Identification (RFID), Speech and image recognition technology, Robots, 2D animated educational videos, 3D animated educational videos, 5D animated educational videos, Virtual robot, Virtual laboratory, and 3D virtual printing with 1.31, 1.59, 1.09, 1.00, 1.38, 1.44, 1.94, and 1.94 mean score respectively were rejected as the 4R technologies adopted.

**Research Question 2:** What is the extent of utilization of the cloud computing services, smart technology, video animation technology

and virtual reality for effective pedagogy in University-based library schools in Rivers State?

**Table 2: Extent of utilization of the cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy**

| S/N | Cloud computing Service | VHE | HE | LE | VLE | Mean | St. | R |
|---|---|---|---|---|---|---|---|---|
| 1 | Whatsapp | 8 | 15 | 7 | 2 | 2.91 | 0.86 | **A** |
| 2 | Facebook | 5 | 14 | 12 | 1 | 1.81 | 0.77 | **A** |
| 3 | Google Meet | 2 | 5 | 16 | 9 | 2.56 | 0.84 | **R** |
| 4 | Google Classroom | 1 | 2 | 19 | 10 | 2.00 | 0.69 | **R** |
| 5 | Zoom | 5 | 12 | 11 | 4 | 2.31 | 0.91 | **A** |
| 6 | Telegram | 1 | 5 | 19 | 7 | 1.16 | 0.72 | **R** |
| 7 | Email | 3 | 9 | 15 | 5 | 1.25 | 0.86 | **R** |
| 8 | Online public Access Catalogue (OPAC) | 0 | 2 | 1 | 29 | 1.72 | 0.51 | **R** |
| 9 | YouTube Videos | 0 | 2 | 2 | 28 | 1.25 | 0.76 | **R** |
| | **Smart Technology** | | | | | | | |
| 10 | Radio Frequency Identification (RFID) | 0 | 2 | 19 | 11 | 1.72 | 0.58 | **R** |
| 11 | Speech and image recognition technology | 0 | 2 | 2 | 28 | 1.25 | 0.76 | **R** |
| 12 | Robots | 1 | 2 | 19 | 10 | 1.81 | 0.69 | **R** |
| | **Video Animation** | | | | | | | |
| 13 | 2D animated educational videos | 1 | 1 | 25 | 5 | 1.94 | 0.56 | **R** |
| 14 | 3D animated educational videos | 0 | 4 | 4 | 24 | 1.38 | 0.71 | **R** |
| 15 | 4D animated educational videos | 0 | 3 | 10 | 19 | 1.50 | 0.67 | **R** |
| | **Virtual Reality** | | | | | | | |
| 16 | Virtual Robot | 1 | 1 | 12 | 18 | 1.53 | 0.72 | **R** |
| 17 | Virtual laboratory | 1 | 1 | 17 | 13 | 1.69 | 0.69 | **R** |
| 18 | 3D virtual printing | 2 | 5 | 16 | 9 | 2.00 | 0.84 | **R** |
| | **Grand Mean & S.D** | | | | | **1.94** | **0.75** | **R** |

Key: **A- Accepted, R- Rejected**

Results from table 2 shows lecturers' responses on the extent of utilization of the cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools. From the results, WhatsApp, Facebook, and Zoom with 2.91, 2.75 and 2.56 mean score respectively were utilized to an average extent, while Telegram, Google meet, email, and 3D virtual printing with 2.00, 2.00, 2.31, a3D virtual printing 2.00 mean score respectively were fairly utilized. On the contrary, Radio Frequency Identification (RFID), Speech and image recognition technology, Robots, 2D animated educational videos, 3D animated educational videos, 4D animated educational videos, Virtual robot, Virtual laboratory and 3D virtual printing with 1.72, 1.25, 1.81, 1.94, 1.38, 1.50, 1.53, and 1.69 mean score respectively were utilized to a very low extent.

**Research Question 3**: What are the challenges associated with the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State?

**Table 3: Challenges associated with the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State**

| S/N | Items statement | SA | A | D | SD | Mean | St. D | R |
|---|---|---|---|---|---|---|---|---|
| 1 | Inadequate skills among lecturers | 10 | 17 | 3 | 2 | 3.09 | 0.82 | A |
| 2 | lack of internet access in library schools | 14 | 13 | 5 | | 3.28 | 0.73 | A |
| 3 | Inadequate technological infrastructures in library schools | 18 | 9 | 3 | 2 | 3.34 | 0.90 | A |
| 4 | Technophobia among lecturers | 16 | 8 | 6 | 2 | 3.19 | 0.97 | A |
| 5 | lack of policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching | 17 | 12 | 1 | 2 | 3.38 | 0.83 | A |
| 6 | Erratic electric power supply | 9 | 17 | 5 | 1 | 3.06 | 0.76 | A |
| 7 | Inadequate funding | 11 | 11 | 7 | 3 | 2.94 | 0.98 | A |
| 8 | Lack of functional ICT laboratory in library Schools | 14 | 11 | 5 | 2 | 3.16 | 0.92 | A |
| 9 | Non-challant attitude of lecturers towards adopting and utilizing 4R technologies | 12 | 14 | 5 | 1 | 3.16 | 0.81 | A |

Results from table 3 shows the lecturers' responses on the challenges hindering them from adopting and utilizing 4R technologies such as cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in university-based library schools in Rivers state. From the results, major challenges are lack of policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching, Inadequate technological infrastructures in library schools, lack of internet access in library schools, Technophobia among lecturers and Lack of functional ICT laboratory in library schools, with 3.38, 3.34, 3.28, 3.19 and 3.16 mean scores respectively.

**Research Question 4:** What are the strategies to enhance the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in University-based library schools in Rivers State?

**Table 4**: **strategies to enhance the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy**

| S/N | Strategies | SA | A | D | SD | Mean | St. D | R |
|---|---|---|---|---|---|---|---|---|
| 1 | Training of lecturer to acquire adequate skills of utilizing 4R technologies in teaching | 9 | 14 | 4 | 5 | 2.84 | 1.02 | A |
| 2 | Provision of stable internet access in library schools | 12 | 16 | 3 | 1 | 3.22 | 0.75 | A |
| 3 | Acquisition and installation of adequate Technological infrastructures in library schools | 9 | 14 | 3 | 6 | 2.81 | 1.06 | A |
| 4 | Cultivating positive attitude towards adopting and utilizing fourth industrial revolution technologies in Teaching | 20 | 3 | 6 | 3 | 3.25 | 1.08 | A |
| 5 | Formulation and implementation of policy mandating lecturers to adopt and utilize Fourth Industrial Revolution (4R) technologies in teaching | 31 | 1 | 0 | 0 | 3.97 | 0.18 | A |
| 6 | Provision of constant electric power supply | 31 | 1 | 0 | 0 | 3.53 | 0.18 | A |
| 6 | adequate funding of library schools | 20 | 10 | 1 | 1 | 3.53 | 0.72 | A |
| 7 | Provision of functional ICT laboratory in library schools | 25 | 4 | 3 | 0 | 3.34 | 0.64 | A |
| 8 | Inculcating proactive attitude among lecturers towards adopting and utilizing 4R technologies for teaching | 17 | 10 | 4 | 1 | 3.34 | 0.83 | A |
| | **Grand Mean and S.D** | | | | | **3.40** | **0.70** | |

Results from table 4 shows the responses of lecturers on the strategies to enhance the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in university-based library schools in Rivers State. From the results, Formulation and implementation of policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching, provision of constant electric power supply, provision of functional ICT laboratory in library schools, inculcating proactive attitude among lecturers towards adopting and utilizing 4r technologies for teaching, cultivating positive attitude towards adopting and utilizing emerging technologies among lecturers, and provision of stable internet access in library schools, with 3.97, 3,97, 3.69, 3.53, 3.34, 3.25, and 3.22 mean score respectively.

**Discussion of Findings**

The findings of the study revealed that, the adoption of fourth industrial revolution (4R) technologies such as smart technologies, video animation technologies and virtual reality were very low as only cloud computing services such as WhatsApp and Facebook were adopted to a high extent, while Google meet, google classroom and Zoom were fairly adopted. This implies that the extent of adoption of fourth industrial revolution (4R) technologies for effective pedagogy is very low among lecturers in university-based library schools in Rivers State. The finding is in accordance with that of Olika-Moila & Simelane-Mnisi (2020) who found out in their earlier study that fourth industrial revolution technologies have not fully been integrated in some universities in south African. The agreement between the findings of these two studies might be as a result of the fact

that both studies was conducted in developing countries.

The findings revealed that the extent of utilization of fourth industrial revolution (4R) technologies such as cloud computing services, smart technology, video animation technology and virtual reality among lecturers for effective pedagogy in university-based library schools is very low except for WhatsApp, Facebook and Zoom which are fairly utilized. This finding further validates that of Bernstein, et al., (2017) who found out that, many universities in South Africa are not utilizing fourth industrial revolution technologies into their pedagogical activities. The findings also corresponds with that of Olika-Moila & Simelane-Mnisi (2020) who reported that, university students faced challenges in acquiring the skills needed to utilize 4R technologies because these technologies were not included and integrated into teaching-learning process in the university.
The findings revealed that the major challenges hindering lecturers from adopting and utilizing 4R technologies such as cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in university-based library schools in Rivers state are lack of policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching, inadequate technological infrastructures in library schools, lack of internet access in library schools,
Technophobia among lecturers and Lack of functional ICT laboratory in library schools. This finding is in accordance with that of Roberts (2015) who reported that, Although the 4R technologies are intended to embrace all the emerging cutting-edge technology, it is problematic for the education institutions in developing countries to adequately integrate 4R due to many factors, some of which are inadequate infrastructures and skills.
It was also revealed by the findings that the major strategies to enhance the adoption and utilization of cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in university-based library schools in Rivers State are formulation and implementation of policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching, provision of constant electric power supply, provision of functional ICT laboratory in library schools, inculcating proactive attitude among lecturers towards adopting and utilizing 4r technologies for teaching, cultivating positive attitude towards adopting and utilizing emerging technologies among lecturers, and provision of stable internet access in library schools. This is in agreement with Penprase, (2018) who recommended that, Lecturers in the fourth industrial revolution are expected to integrate technology into teaching and learning environments. The fidigs also further validates the assertion of Abubakar (2021) who argued that, it is irrefutable that technological advancements have brought about tremendous changes to the Library and Information Science (LIS) education globally. Most especially in the areas of adopting and utilizing modern technologies for teaching and learning process.

## CONCLUSION

The study examined the extent of adoption and utilization of the fourth industrial revolution (4R) technologies for effective pedagogy in university-based library schools in Rivers State. Based on the findings, the study concluded that, the extent of adoption of fourth industrial

revolution (4R) technologies such as cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in university-based library schools in Rivers State is very low, which also led to low utilization. The major challenges hindering lecturers from adopting and utilizing 4R technologies such as cloud computing services, smart technology, video animation technology and virtual reality for effective pedagogy in university-based library schools in Rivers state are lack of policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching, inadequate technological infrastructures in library schools, lack of internet access in library schools, Technophobia among lecturers and Lack of functional ICT laboratory in library schools.

**RECOMMENDATIONS**

The following recommendations were suggested by the researchers:

1. The library school management should formulate and proactively implement a comprehensive policy mandating lecturers to adopt and utilize fourth industrial revolution (4R) technologies in teaching students.

2. The department should laisse with the university management to establish a functional ICT laboratory in library school, which should be equipped with state-of-the-art technologies, most especially internet access and connectivity as well as electric power supply.

3. Lecturers in library schools should cultivate positive attitude towards adopting and utilizing emerging technologies for pedagogy.

4. The library school management should laisse with the university management to train lecturers on advance skills required for adopting and utilizing fourth industrial revolution (4R) technologies for effective pedagogy.

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