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Awareness of the Instructional Usage of Virtual Reality among Students and Lecturers of Technical Education in Tertiary Institutions in Rivers State, Nigeria

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ABSTRACT

Exposure to practical activities with state of the act training facilities is key to effective students' preparation in technical and vocational teacher education. In the midst of scarce resources, adequate provision of training facilities to help this group of students engage in meaningful practical activities in schools is limited. Virtual reality could be an alternative complement in this regard. The study investigated the awareness of instructional usage of virtual reality among students and lecturers of technical education in tertiary institutions in Rivers state, Nigeria. The study employed a descriptive survey research design. The study participants for the study comprised a total of 48 persons. This consisted of all 36 students and 12 lecturers of technical education programme from two tertiary institutions in Rivers State. Data were collected using a validated questionnaire with internal consistency coefficient of 0.89. Data gathered were analysed with frequency counts, percentages and Mann-Whitney U test. The result generally showed that there was low level of awareness of: the concept of virtual reality, using virtual reality for instructional delivery, names of some virtual reality application for instruction, desktop virtual reality application, immersive virtual reality application, collaborative virtual reality application, augmented reality applications, potential benefits of virtual reality application, and how to use virtual reality for enhancing instructional delivery in technical education among students and lecturers. Although low level of awareness generally existed between students and lecturers, the students' level of awareness was slightly higher than that of lecturers. Furthermore, there was no significant difference in the level of awareness of the instructional usage of virtual reality among study participants from the two tertiary institutions investigated. Based on the results, it was recommended that organisation of seminars, workshops among others would enhance awareness of virtual reality among students and lecturers.

Keywords*:* Augmented reality, Instructional delivery, Technical and vocational education, Virtual reality

1. Introduction

An important aspect of any teaching and learning process is the utilisation of available instructional materials. Instructional materials help the teacher to present content of instruction to enhance clarity. They provide sensory experiences needed by learners for effective and meaningful behavioural change from learning for enhanced academic performance (Ajoke, 2017). There are different types of instructional materials. Capangpangan (2014) grouped them into four major types. They include: printed and duplicated materials, non-projected and displayed materials, still projected displayed materials and technological instructional media. The printed and duplicated materials include textbooks, laboratory manuals, training manuals and other printed documents used for instruction. The non-projected and displayed materials are objects such as laboratory reagents, apparatus, tools, instruments, machines, equipment and other real objects used for instructional purpose. Still projected materials are materials that serve as representation of actual objects. They include castings, globe, experimental models, charts, pictures, photographs, drawings, slides, filmstrips, motion pictures. Technological instructional media are instructional materials that utilize two or more media (text, audio, video, graphics and animations) for presenting content of a lesson with the aid of modern technologies such as computers, mobile phones, ipods among others.

Selecting instructional materials for instruction is based on some features. According to Capangpangan (2014) and Nwakaego (2024), instructional materials should give a true picture of the ideas they present; they should contribute meaningfully to the content of instruction; they should be appropriate for the learner's age, learning capability and experience and they should have a satisfactory physical condition. In technical education, teaching and learning is geared towards ensuring that students acquire skills needed for them to transit smoothly to the world of work in their chosen trade or vocation. Consequently, the content of learning is loaded with practical activities that require more of the use of hands for completing tasks. In this regard, instructional delivery in technical education require the use of instructional facilities that will help students learn the skills they require to function effectively in their different career options. These instructional facilities could include machines (e.g. lathe machines); equipment and tools (e.g. oscilloscope, signal generators, multimeters, hand held and powered drills). Some of these tools, equipment and machines are usually not available due to cost involved in acquiring them. Government, having so many responsibilities are not able to make them adequately available to schools. Furthermore, in some cases, using some of the equipment may not be very safe for students in schools to use. In the midst of scarce instructional facilities for teaching and learning of technical education occasioned by unavailability of the facilities and safety purpose, an option is to seek for alternative means of exposing students to practical activities. One of such means is the use of computer simulated applications which simulate real world objects for instructional delivery. A typical example of such simulated application is virtual reality.

Students in the subject area of technical and vocational education in tertiary institutions in Nigeria are usually trained to either work as teachers or instructors in schools or in an industrial sector related to their programme of study (Akaninwor, 2010). Consequently, they should be equipped with the practical skills they require to function effectively after graduation. In light of this, they

should be exposed to practical activities with state of the act facilities to help them transit smoothly from school to their various employment destinations. In the midst of scarce resources, adequate provision of training facilities to help students of technical and vocational teacher education engage in meaningful practical activities in schools is limited. Virtual reality could be an alternative complement in this regard. As a new and emerging technology gaining popularity in the educational sector, it would be necessary to investigate the awareness of the instructional usage of virtual reality among students and lecturers/instructors. This is because awareness of a technology could influence an individual's perception and knowledge of its usefulness, ease of use and eventual use of the technology. The result of this investigation will inform decision making toward enhancing awareness of the instructional usage of virtual reality in the field of technical and vocational teacher education.

2. Purpose and Research Questions

The main purpose of the study is to find out the level of awareness of the instructional usage of virtual reality among students and lecturers of technical teacher education in tertiary institutions in Rivers State, Nigeria. Two specific questions were used to guide investigation for the study.

i. What is the level of awareness of instructional usage of virtual reality among students and lecturers of technical teacher education in tertiary institutions in Rivers state, Nigeria?
ii. Is there a significant difference in the awareness level of the instructional usage of virtual reality among study participants from the tertiary institutions offering technical teacher education in Rivers state, Nigeria?

3. Theoretical framework

The study is anchored on the theory of Technology Acceptance Model (TAM) by Fred Davis in 1989. The theory provides explanation for the use of technology. According to the theory, the actual use of a technology is a function of the behavioural intention to utilise the technology. Further, behavioural intention to use such technology is in turn influenced by perceived ease of use and perceived usefulness of the technology. In addition, the perceived usefulness of the technology is influenced by its ease of use (Ntshakala, 2016; Liao, Hong, Wen & Pan, 2018). Furthermore, Dinev and Hu (2007) proposed that an individual's beliefs and attitude towards a technology is influenced by the awareness of such technology possessed by the individual. It can be deduced that utilization of a technology is a function of an individual's awareness, perception of the usefulness and ease of use of the technology. It therefore implies that utilization of virtual reality for teaching and learning, being a new technology in the area of education, particularly in developing nations such Nigeria would depend on teachers' and students' level of awareness, perception of the usefulness and ease of use of this technology. The present study only focused on the aspect of awareness of the TAM model.

4. Virtual reality and its benefits in learning

Virtual reality is one of the new technological advancement employed in instructional delivery. Virtual reality (VR) is a visualization technique in which diagrams, images as well as animations are used for message communication (Bourguet, Wang, Ran, Zhou, Zhang, & Romero-Gonzalez,

2020). It is a simulated experience that represents the real world and used to immerse viewers in a completely virtual world where things invisible such as inner structure of materials could be made visible (Li, Nee & Ong, 2017). For example, virtual reality can be used to represent a lathe machine, an oscilloscope and signal generators. Similarly, virtual reality (VR) is a computer-simulated application that allows an individual to interact within an artificial three-dimensional environment (Mitchel, 2020). The simulated artificial environment provides the user opportunity to have a realistic-feeling experience. Virtual reality as a technology allows users to enter a virtual world and provides opportunity for interaction to enable a feel of reality (Wexelblat, 1993).

Virtual reality has a number of benefits in learning. For example, Putra and Pratiwi (2020) asserted that virtual reality makes learning easy for students; inspires motivation for learning among learners; makes learning to be fun and interesting and facilitate the delivery of lesson content. Virtual reality provides opportunity for impossible real life situations to be easily explored. Furthermore, Barrett (2012) and Chen et al. (2024) listed the benefits of using virtual reality in learning to include: offering the user opportunity to gain exposure scenarios that does not occur frequently or may be hazardous to replicate; offering an alternative low-cost way of creating full-scale real life training objects such as machines and objects; provision for reusability, updates, room for customisation and can potentially reduce training budget; provides opportunity for learners to engage in self-paced learning; creates room for safety in conducting exercise.

Similarly, the utilization of virtual reality technologies in education and training as well as engineering design has the advantages of safety for learners, cost saving, controllability and repeatability (Li as cited in Barrett, 2012). Furthermore, it offers the ability to attain proficiency and knowledge at a speedy rate, which is an important factor towards sustainability and profitability of companies, training organisations as well as governments.

Virtual reality applications are considered strong in visual as well as spatial representation of physical environments. As a result, areas of studies that require training in procedural skills and gaining of knowledge of practical activities could find virtual reality a viable instructional material (Perez, Marin & Perez, 2007). In a bid to determine the influence of virtual reality on learning outcome among students, Beijing iBokan Wisdom Mobile Internet Technology Training Institutions and Beijing Bluefocus E-Commerce Co. Ltd. conducted a study to compare the academic performance and knowledge retention of two groups of students. One group was exposed to instruction using virtual reality while the other group was exposed to instruction using the conventional teaching method. The study found that the group of students exposed to instruction using the virtual reality application outperformed the group exposed to traditional teaching method both in terms of knowledge gained and retention (Kamińska, Sapiński, Aitken, Rocca, Barańska & Wietsma, 2017).

In another similar study, Lee, Wong and Fung (2009) found a statistical significant variation in academic performance as well as perceived learning and satisfaction between students exposed to instruction using a desktop virtual reality application and those exposed to instruction using traditional method. Ogbuanya and Onele (2018) got similar result with Lee et al. Earlier studies by Fung-Chun, Angelier, Deffontaines, Jyr-Ching, Shih-Hao, Chin-Hui, Chia-Hui and Cheng-

Hung (2002); Song and Lee (2002) and Aoki, Oman, Buckland and Natapoff, (2008) also show positive learning outcome with usage of virtual reality for instructional delivery in subject areas such as geometry, geosciences and astronaut 3D navigation.

5. Virtual reality applications

A typical example of a virtual reality instructional material is virtual electrical service (VES) which is a computer application developed and used to visually demonstrate electrical installation in the building environment and simulation of the functionality of the installation (Barrett, 2012). Another example is AVATAR House which is also a computer application used for exploration of different parts of a house such as kitchen, bathroom, living room. It contains recognizable objects that produces sound when highlighted. Rooms in the house are designed to focus the user to certain objects and activities to practice for skills development and link to real-world activities (Youngblut, 1998). A typical virtual reality application is shown in Figure 1 below.

The virtual reality application shown in Figure 1 is a computer application that can be used for instructional delivery in Mechanical and Electrical Engineering Practical training. It comprises a simple user interface where learners can manipulate objects to gain knowledge and skills (Kamińska et al., 2017). Another example of a virtual reality application is V-Frog which is a dissection computer simulator that enable students to have hands-on learning experience in dissection. The application enables learners to repeatedly, cut, pull, probe, and examine a virtual specimen, as they would with a real frog (Lee et al., 2009). Considering the academic benefits associate with virtual reality particularly in practical-based academic programmes as technical and vocational education and training, there is possibility that if integrated in instructional processes, virtual reality could enhance learning.

Figure 1 (Source: Kamińska et al., 2017)

6. Empirical studies

Empirical evidence in the literature shows that studies conducted on virtual reality in relation to teaching and learning in Nigeria is scarce. During literature review for this study, studies on virtual reality related to teaching and learning covered the themes: challenges facing utilization of virtual reality for educational purpose which was conducted by Pfeil, Ang and Zaphiris (2009) in Europe;

attitude towards utilizing virtual reality for instruction conducted by Sirakaya and Kiliç Çakmak (2018) in Turkey; perceived usefulness of virtual reality in instruction which was conducted by Alqirnas (2020) in Saudi Arabia, Jensen (2017) in Scotland, Dobricki, Kim, Coppi, Dillenbourg and Cattaneo (2021) in Switzerland and Huang and Liaw (2018) in Taiwan. Other study theme related to virtual reality focused on the effect of virtual reality on motivation and academic performance among students which was conducted by Lund and Wang (2019) in USA and Lee et al. (2009) in Malaysia.

As shown from the previous paragraph, empirical studies related to virtual reality in the Nigerian context is limited in the literature. Three studies were found conducted in Nigeria in relation to virtual reality. One was by Soetan, Onojah, Aderogba, Obielodan, Ganiyu and Fakomogbon (2020) which focused on awareness of teachers towards the use of virtual reality for instructional purpose was carried out in Kwara State in northern part of Nigeria. A similar study which focused awareness of virtual reality among teachers was conducted by Taangahar, Fatoki and Ikondo (2022) in Benue state, Nigeria. The third was by Ogbuanya and Onele (2018) which focused on effect of desktop virtual reality application on instruction among students of electrical/electronics technology in four universities. Conducting the present study in Rivers Sate in Southern part of Nigeria would extent the knowledge of awareness of virtual reality and thereby adding to literature.

7. Research Methodology

The study employed a descriptive survey design. This is a research design where a survey questionnaire is administered to a sample or entire population with the aim of describing attitudes, opinions, behaviors, or characteristics of the population (Creswell, 2012). In this study, it was the intention of the authors to describe the awareness of the instructional usage of virtual reality among students and lecturers of technical education in tertiary institutions in Rivers State. Consequently, descriptive survey design was considered appropriate. The study was conducted in Rivers State, Nigeria which plays host to three tertiary institutions offering technical education as a course. They include: Rivers State University (RSU); Ignatius Ajuru University of Education (IAUOE) and Federal College of Education (Technical) Omoku (FCOE). The presence of technical education being offered in these institutions made the state an appropriate area for the study.

The study participants consisted of students and lecturers of technical education programme from two tertiary institutions randomly selected from the three tertiary institutions in the study area. The number consisted a total of 48 persons including 12 lecturers and 36 students of technical education programme from the two selected tertiary institutions. The lecturers comprised seven from FCOE and five from RSU. The comprised nine from FCOE and 27 from RSU.

Data were collected through a validated survey questionnaire used to ascertain the awareness of instructional usage of virtual reality among students and lecturers. The respondents were requested to rate their level of awareness of different aspect of instructional usage of virtual reality. Items on the questionnaire were rated on a four-point rating scale ranging from Very Low Level (VLL) to Very High Level (VHL). The internal consistency of the instrument was sought using Cronbach Alpha which yielded a coefficient of 0.89. A total 48 copies of the instrument were administered and all were retrieved and used for data analysis.

Frequency count and percentages were used for analyzing data collected. For research question one, results were presented using bar charts and interpreted with frequency counts and percentages. Mann-Whitney U test was used to analyse research question two which sought significant difference in the level of awareness of instructional usage of virtual reality between study participants from two different institutions. Mann-Whitney U test is used when the intention is to test for statistical significant difference between two independent groups having data measured on an ordinal scale which was the case in the present study (Laerd Statistics, 2013; Uzoagulu, 2011).

8. Result

The results for the study are presented in charts and table followed with interpretation.

Research Question 1: What is the level of awareness of instructional usage of virtual reality among students and lecturers of technical education in tertiary institutions in Rivers state?

Level of awareness was sought in terms of awareness of the concept of virtual reality; awareness of utilization of virtual reality for instructional delivery; awareness of different virtual reality applications for instructional delivery; awareness of the benefits of virtual reality applications for instructional delivery and knowledge of how to utilize virtual reality applications for instructional delivery in technical education. Data were based on participants' awareness of each area of instructional usage of virtual reality. There was a total of 12 lecturers and 36 students who responded to the survey questions. All responses of very high level and high level were collapsed together to be high level (HL). On the other hand, all responses of very low level and low level were collapsed together to be low level (LL). Results are presented bar chart.

a. Awareness Level of the Concept of Virtual Reality

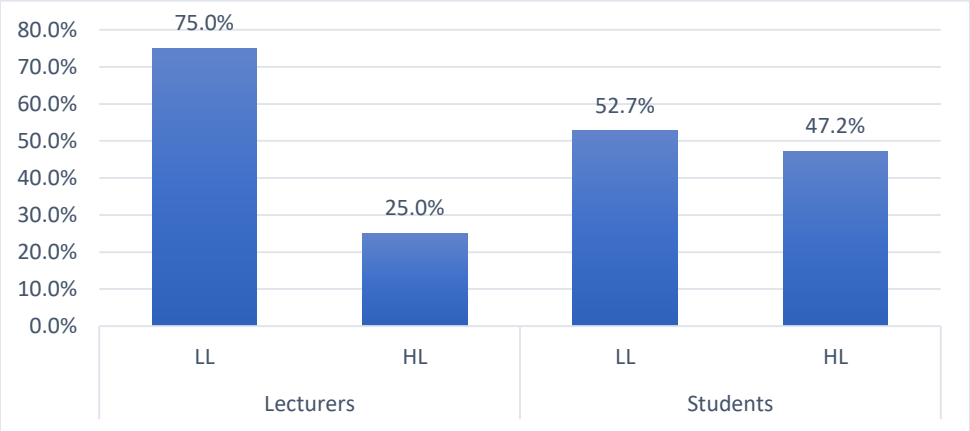

Figure 2: Awareness of Virtual Reality Concept

The result in Figure 2 shows that majority of the study participants had low awareness level of the concept of virtual reality. As shown, 75% (constituting 9 out of 12 lecturers) rated the awareness of the concept of virtual reality to be low. Furthermore, 52.7% (constituting 19 out of 36 students) rated their awareness of the concept of virtual reality to be low. It can be deduced from the result in Figure 2 that level of awareness of the concept of virtual reality was higher among students than lecturers. This is evident by 47.2% high level (HL) of awareness of the concept of virtual reality for students against 25.0% high level (HL) for lecturers.

b.Awareness Level on using Virtual Reality for Instructional Delivery

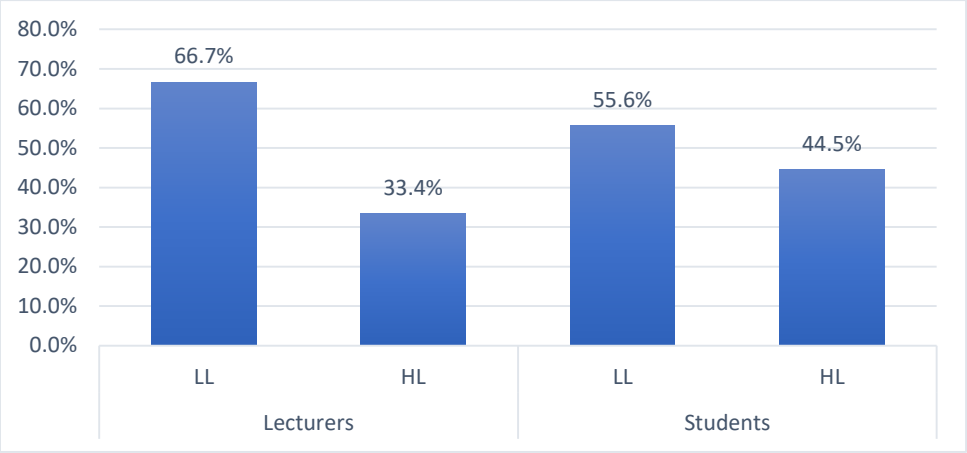

Figure 3: Awareness of using Virtual Reality for Instructional Delivery

The result in Figure 3 shows that majority of the study participants had low level of awareness of using virtual reality for instructional delivery. As shown, 66.7% (constituting 8 out of 12 lecturers) reported that they had low level of awareness of using virtual reality for instructional delivery. Furthermore, 55.6% (constituting 20 out of 36 students) reported that they had low level of awareness of using virtual reality for instructional delivery. The result in Figure 3 suggests that level of awareness of utilizing virtual reality was higher among students than lecturers. This is evident by 44.5% of the students reporting that they had high level of awareness of using virtual reality for instructional delivery against 33.4% of the lecturers reporting that they had high level awareness of using virtual reality for instructional delivery.

c. Level of Awareness of Names of Virtual Reality Applications used for Instructional Delivery

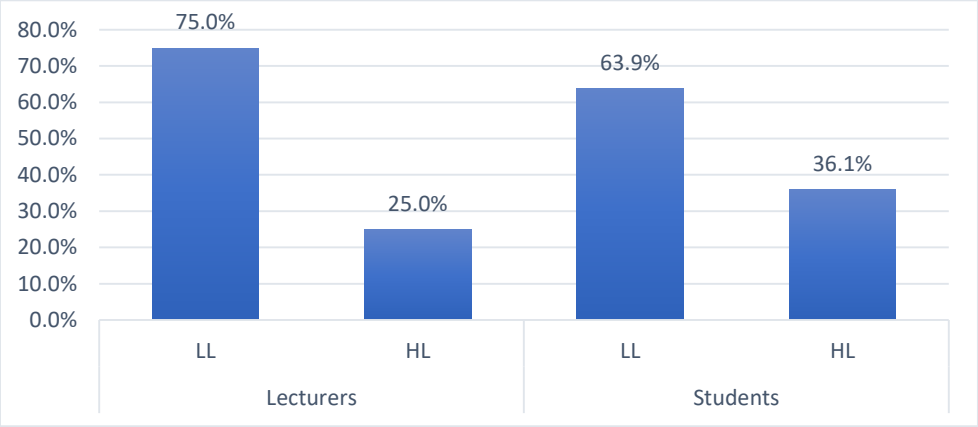

Figure 4: Awareness of Names of Virtual Reality Applications

The result in Figure 4 shows that majority of the participants rated their awareness of names of virtual reality applications used for instructional delivery to be low. This is evident by 75% (constituting 9 out of 12 lecturers) who reported that they had low level of awareness of names of virtual reality applications used for instructional delivery against 63.9% (constituting 23 out of 36 students) who reported that they had low level of awareness of names of virtual reality applications used for instructional delivery. The result in Figure 4 is indicative that level of awareness of names of virtual reality applications was higher among students than lecturers. This is evident by 36.1%

high level awareness of names of virtual reality applications used for instructional delivery among students against 25.0% high level awareness among lecturers.

d. Level of Awareness of Desktop Virtual Reality Applications used for Instruction Delivery

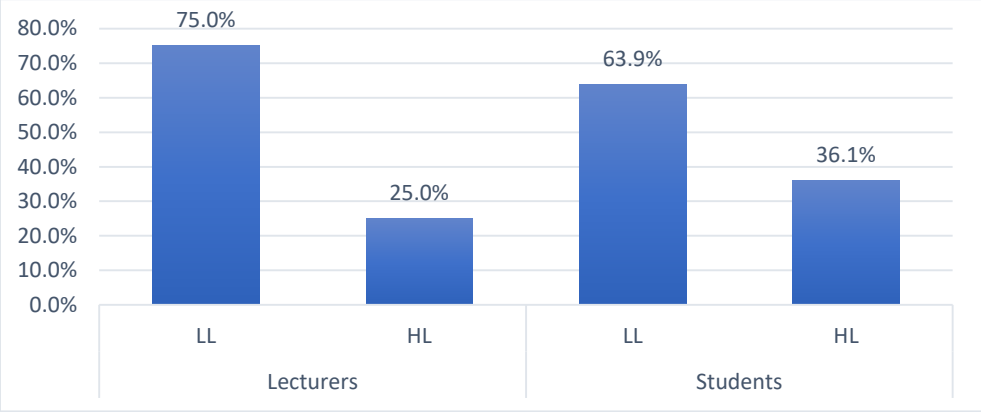

Figure 5: Awareness of Desktop Virtual Reality applications

The result in Figure 5 shows that majority of the study participants had low level of awareness of desktop virtual reality applications used for instructional delivery. This is evident by 75% (9 out of 12 lecturers) who reported that they had low level of awareness of desktop virtual reality applications used for instructional delivery against 63.9% (constituting 23 out of 36 students) who reported that they had low level of awareness of desktop virtual reality applications used for instructional delivery. The result in Figure 5 is indicative that level of awareness of desktop virtual reality applications used for instructional delivery was higher among students than lecturers. This is evident by 36.1% high level awareness of desktop virtual reality applications used for instructional delivery among students against 25.0% high level awareness among lecturers.

e. Level of Awareness of Immersive Virtual Reality Applications used for Instruction Delivery

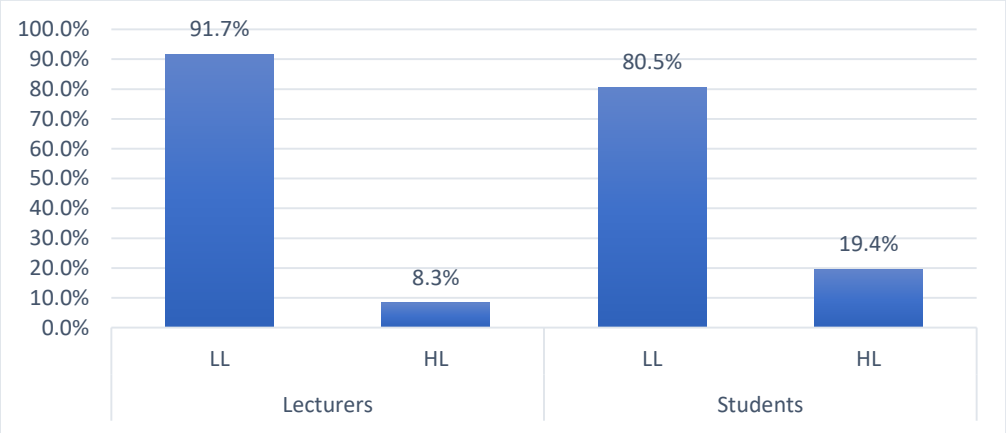

Figure 6: Awareness of Immersive Virtual Reality applications

The result in Figure 6 shows that majority of the study participants had low level of awareness of immersive virtual reality applications used for instructional delivery. This is evident by 91.7% (constituting 11 out of 12 lecturers) who reported that they had low level of awareness of immersive virtual reality applications used for instructional delivery against 80.5% (constituting 26 out of 36 students) who reported that they had low level of awareness of immersive virtual

reality applications used for instructional delivery. The result in Figure 6 is suggestive that level of awareness of immersive virtual reality applications used for instructional delivery was higher among students than lecturers. This is evident by 19.4% high level awareness of immersive virtual reality applications used for instructional delivery among students against 8.3% high level awareness among lecturers.

f. Level of Awareness of Collaborative Virtual Reality Applications used for Instruction Delivery

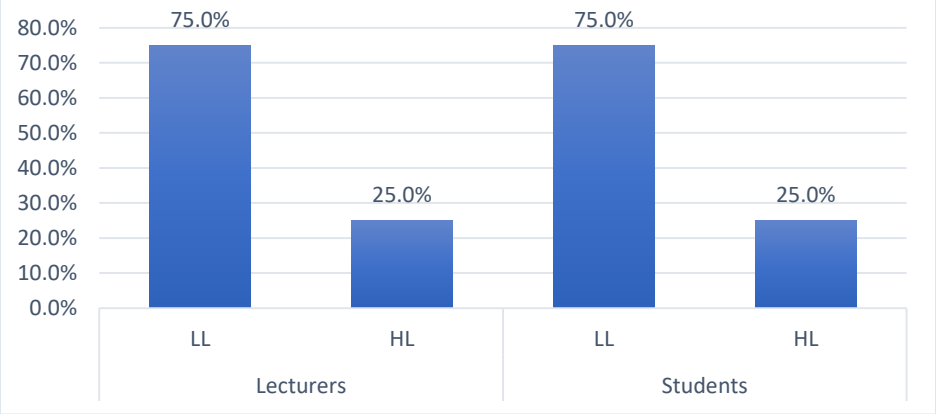

Figure 7: Awareness of Collaborative Virtual Reality applications

The result in Figure 7 shows that majority of the study participants had low level of awareness of collaborative virtual reality applications used for instructional delivery. This is evident by 75% (9 out of 12 lecturers) who reported that they had low level of awareness of collaborative virtual reality applications used for instructional delivery and also 75% (27 out of 36 students) who reported that they had low level of awareness of collaborative virtual reality applications used for instructional delivery. The result implies that both students and lecturers had similar level of awareness of collaborative virtual reality applications used for instructional delivery.

g. Level of Awareness of Augmented Reality Applications used for Instruction Delivery

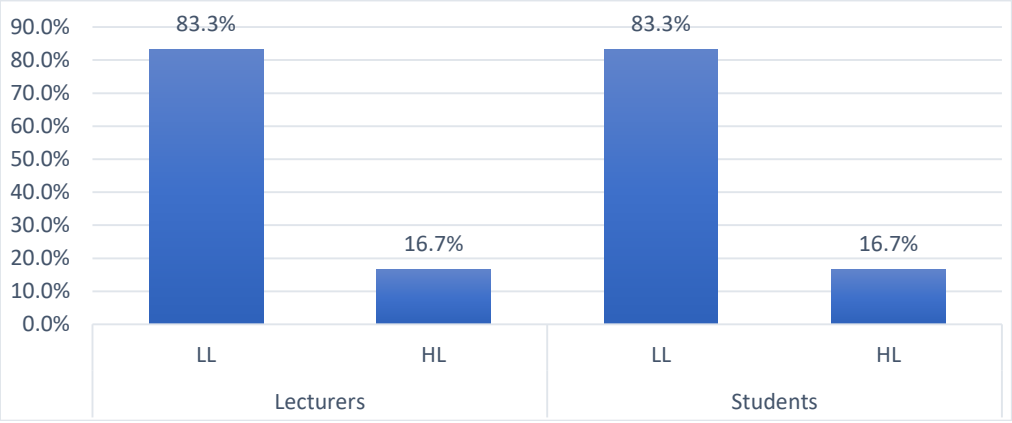

Figure 8: Awareness of augmented Virtual Reality applications

The result in Figure 8 shows that majority of the study participants had low level of awareness of augmented reality applications used for instructional delivery. This is evident by 83.3% (constituting 10 out of 12 lecturers) who reported that they had low level of awareness of augmented reality applications used for instructional delivery and also 83.3% (constituting 30 out

of 36 students) who reported that they had low level of awareness of augmented reality applications used for instructional delivery. The result in Figure 8 further reveals that both students and lecturers had similar level of awareness of augmented reality applications used for instructional delivery. This is evident by 16.7% high level awareness and 83.3% low level awareness of augmented reality applications used for instructional delivery among students and lecturers.

h.Level of awareness of potential benefits of virtual reality applications used for instruction delivery

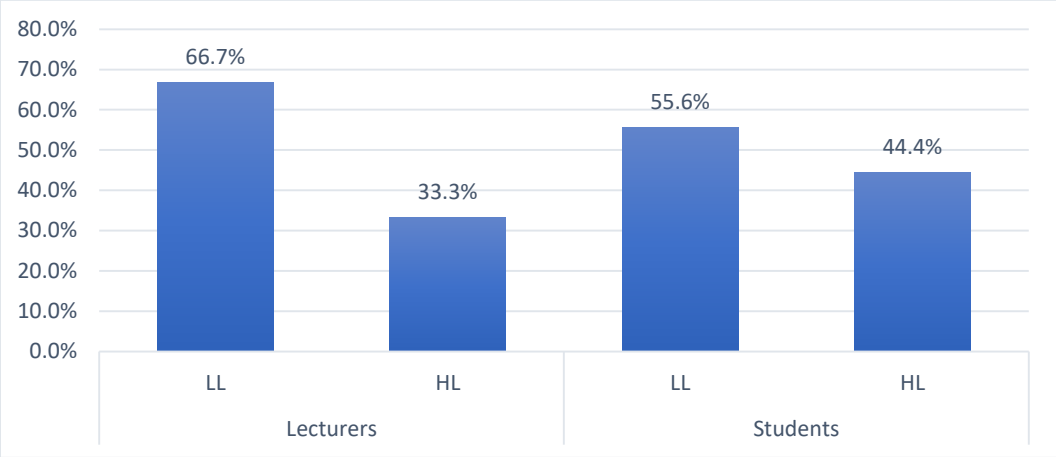

Figure 9: Awareness of Potential benefits of Virtual Reality applications

The result in Figure 9 shows that majority of the study participants had low awareness level on the potential benefits of using virtual reality applications for instructional delivery. This is evident by 66.7% (constituting 8 out of 12 lecturers) who rated themselves to low awareness of the potential benefits of using virtual reality applications for instructional delivery against 55.6% (constituting 20 out of 36 students) who reported that they had low level of awareness of the benefits of using virtual reality applications for instructional delivery. The result in Figure 9 reveals that level of awareness of potential benefits of virtual reality applications for instructional delivery was higher among students than lecturers. This is evident by 44.4% high level awareness of the potential benefits of using virtual reality applications for instructional delivery among students against 33.3% high level awareness among lecturers.

i. Awareness Level on how to Use Virtual Reality for Enhancing Learning in Technical Education

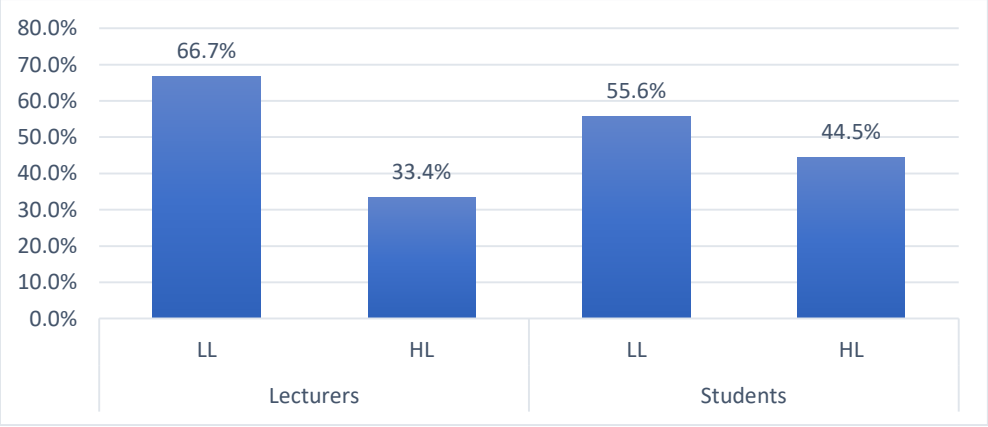

Figure 10: Awareness of how to use Virtual Reality for enhancing Instruction

The result in Figure 9 shows that majority of the study participants rated themselves to have low awareness of how to use virtual reality applications for enhancing instructional delivery in technical education. This is evident by 66.7% (constituting 8 out of 12 lecturers) who rated themselves to have low level of awareness of how virtual reality applications are used for enhancing instruction in technical education against 55.6% (constituting 20 out of 36 students) who rated themselves to have low level of awareness of how to use virtual reality applications for enhancing instruction in technical education. The result in Figure 10 shows that level of how to use virtual reality applications for enhancing instructional delivery in technical education was higher among students than lecturers. This was evident by 44.5% high level awareness of how virtual reality applications are used for enhancing instruction in technical education among students against 33.4% high level awareness among lecturers.

Research Question 2: Is there a significant difference in the awareness level of the instructional usage of virtual reality among study participants from the tertiary institutions offering technical teacher education in Rivers state?

Table 1: Mann-Whitney U Test on Level of Awareness of Virtual Reality between Rivers State University and Federal College of Education (Technical)

S/N	**Items of Awareness** Level of Awareness of	Mean Rank FCOE	Mean Rank RSU	Mann-Whitney *U*	p-value
1	Concept of virtual reality.	25.4	24.1	242	.74
2	Using Virtual Reality for Instructional Delivery.	24.0	24.8	248	.85
3	Names of virtual reality applications used for instructional delivery.	25.5	24.0	240	.71
4	Desktop virtual reality applications used for instruction delivery.	25.5	24.0	240	.71
5	Immersive virtual reality applications used for instruction delivery.	26.0	23.8	232	.55
6	Collaborative virtual reality applications used for instruction delivery.	23.4	25.1	238	.67
7	Augmented reality applications used for instruction delivery.	23.6	24.9	242	.73
8	Potential benefits of using virtual reality for instructional delivery.	23.5	25.0	240	.72
9	How to use virtual reality for enhancing learning in technical education.	23.4	25.1	238	.67

Field Data

The result in Table 1 shows the Mann-Whitney U Test for significant difference in the level of awareness of instructional usage of virtual reality between study participants from Federal College of Education (Technical) Omoku (FCOE) and Rivers State University (RSU). For item 1, study participants from FCOE had no statistical significant higher level of awareness of the concept of virtual reality than participants from RSU (*Mean Rank* = 25.4 for FCOE and 24.1 for RSU; *U* =

24, $p = .74$). For item 2, study participants from RSU had no statistical significant higher level of awareness of using virtual reality for instructional delivery than participants from FCOE (*Mean Rank* = 24.0 for FCOE and 24.8 for RSU; $U = 25$, $p = .85$). For item 3, study participants from FCOE had no statistical significant higher level of awareness of names of virtual reality applications used for instructional delivery than participants from RSU (*Mean Rank* = 25.5 for FCOE and 24.0 for RSU; $U = 24$, $p = .71$). For item 4, study participants from FCOE had no statistical significant higher level of awareness of desktop virtual reality applications used for instructional delivery than participants from RSU (*Mean Rank* = 25.5 for FCOE and 24.0 for RSU; $U = 24$, $p = .71$). For item 5, study participants from FCOE had no statistical significant higher level of awareness of immersive virtual reality applications used for instructional delivery than participants from RSU (*Mean Rank* = 26.0 for FCOE and 23.8 for RSU; $U = 23$, $p = .55$). For item 6, study participants from RSU had no statistical significant higher level of awareness of collaborative virtual reality applications used for instructional delivery than participants from FCOE (*Mean Rank* = 23.4 for FCOE and 25.1 for RSU; $U = 24$, $p = .67$). For item 7, study participants from RSU had no statistical significant higher level of awareness of augmented reality applications used for instructional delivery than participants from FCOE (*Mean Rank* = 23.6 for FCOE and 24.9 for RSU; $U = 24$, $p = .73$). For item 8, study participants from RSU had no statistical significant higher level of awareness of the potential benefits of using virtual reality for instructional delivery than participants from FCOE (*Mean Rank* = 23.5 for FCOE and 25.0 for RSU; $U = 24$, $p = .72$). For item 9, study participants from RSU had no statistical significant higher level of awareness of how to use virtual reality for enhancing instructional delivery in technical education than participants from FCOE (*Mean Rank* = 23.4 for FCOE and 25.1 for RSU; $U = 24$, $p = .67$).

9. Discussion of Findings

The result generally shows that there existed low level of awareness of instructional usage of virtual reality among students and lecturers in the study area. Percentage awareness was low among students and lecturers regarding concept of virtual reality, using virtual reality for instructional delivery, names of some virtual reality application for instruction, desktop virtual reality application, immersive virtual reality application, collaborative virtual reality application, augmented reality applications, potential benefits of virtual reality application, and how to use virtual reality for enhancing instructional delivery in technical education. There was no significant difference in the level of awareness of instructional usage of virtual reality in these dimensions between student participants from Federal College of Education (Technical) Omoku and Rivers State University, Port Harcourt, Nigeria. Although low level of awareness generally existed between students and lecturers, the students' level of awareness was slightly higher than that of lecturers.

This result has similarity and difference with the result obtained by Soetan et al. (2020) who conducted a study to ascertain the level awareness of computer teachers towards the use of virtual reality for instructional purpose in secondary schools across Kwara State, Nigeria. Soetan et al. found high level of awareness among the teachers on one particular virtual reality application (virtual bicycle) and average level of awareness on another particular virtual reality application

(3D Map World). Furthermore, the teachers had low level of awareness on other listed applications such as virtual biplane, vitcher (I and II) and conceptual design space (CDS). However, the present study was not focused on any listed or particular virtual reality application like in the study of Soetan et al. The low level of awareness of the instructional usage of virtual reality among teachers is at variance with the result by Taangahar et al. (2022) that teachers had a high level of awareness of the use of virtual reality for instructional purpose during COVID-19 period in Benue state, Nigeria. A possible explanation for the variance in the result could be attributed to the fact that in the study by Taangahar et al. secondary schools equipped with information and communication technology facilities were used. And more so, during COVID-19 era, secondary schools in Nigeria were tasked with responsibility to engage students in online learning (Soladoye, 2020). Consequently, teachers within ICT facility equipped schools might have explored various resources (including virtual realities) for engaging students in science teaching.

The result that level of awareness of virtual reality was higher among students than lecturers corroborates that of Tripathy and Panda (2021) who found that pre-service teachers (students) had a higher level of awareness of augmented reality than teacher educators (lecturers) in Odisha, India. This result is surprising and was not expected. It was expected that lecturers always sought for instructional resources to aid their instructional delivery. Consequently, they should have engaged in some form of internet search to gather information about the potential usefulness of virtual reality for instructional delivery. The fact that students nowadays, grow up with digital technologies and as such may be conversant with current technologies may be a possible explanation for the higher level of awareness among students than teachers in the present study. This aligns with the result by Sheriff (2012) where both students and teachers had some level of agreement that students have higher comprehension of technology than lecturers.

Conclusion

The result of the study has shown low awareness of the instructional usage of virtual reality applications among lecturers and students of technical education within the studied institutions. This is an indication that virtual reality applications may not be available or provided for instructional usage in the tertiary institutions under study at the time of the study. It can also be deduced that full knowledge of the educational benefits of virtual reality may be limited among students and lecturers. Consequently, acceptance of virtual reality as useful resource for complementing and enhancing teaching and learning in technical education may require more effort.

Recommendations

Based on the findings of the study, the following recommendations were made:

i. Awareness programmes, such as seminars and workshops, should be organized at the departmental level for lecturers and instructors of technical education in the tertiary institutions under study to create awareness of virtual reality applications. Such seminars and workshops should cover identification of various virtual reality applications, and how they could be utilized for instructional delivery in technical education programme (particularly the delivery of practical content).

ii. Awareness programmes in form of conferences and symposium on digital tools for enhancing teaching and learning in technical education should be organised for lecturers of technical teacher education. Virtual reality and other digital tools capable of aiding practical content delivery could form sub-themes in such programmes.

iii. Lecturers and instructors who have awareness and knowledge of virtual reality applications, useful for instructional delivery in technical education, should be encouraged to expose their students to learning with such applications. This could be achieved by giving students assignment or directing them on where and how to access such tools.

iv. Students' knowledge and awareness of digital technologies such as virtual reality should be harnessed in the process of instructional delivery in technical education through appropriate teaching methods, such collaborative learning.

v. A database of virtual and augmented reality applications suitable for instructional delivery in technical education courses should be developed and made available to students' access.

vi. A synergy should be created between instructional designers in the field of technical and vocational education and training (TVET) and application developers in the field of education to develop virtual and augmented reality applications suitable for specific course content to aid effective instructional delivery in the field.

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