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Science Teachers' Awareness of Availability and Use of Virtual Reality in Secondary Schools for Science Teaching in Covid-19 Era in Makurdi Metropolis

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Abstract

The study investigated the extent of science teachers' awareness of availability and use of virtual reality in secondary schools for science teaching in COVID-19 era in Makurdi Metropolis. Two research questions were answered and one hypothesis was tested in the study. The research design adopted was descriptive-survey design. A sample of 80 science teachers was arrived at using purposive sampling of 20 grant-aided schools with ICT laboratories. Data were collected using a validated, researcher-developed questionnaire which had a reliability coefficient of 0.64. Mean and standard deviation were used to analyze research questions and t-test was used to test the hypothesis at 0.05 level of significance. The findings showed that the extent of science teachers' awareness of availability of virtual reality in schools for science teaching in COVID-19 era had a low

mean of 1.87 below the upper boundary decision mean of 2.50. The extent of science teachers' awareness of use of virtual reality in schools for science teaching in COVID-19 era was high with a mean of 2.64 above the upper boundary decision mean of 2.50. The analysis also shows a calculated t-statistic of 5.16 greater than t-critical value of 1.68 at 79 degree of freedom at 0.05 level of significance. Therefore, the null hypothesis which states that there is a significant difference in science teachers' awareness of availability and use of virtual reality in schools for science teaching in a COVID-19 pandemic era was rejected. It was concluded that science teachers' awareness of virtual reality was to a high extent but the extent of its availability in schools was low. It was recommended that VR be made available in schools for teacher's use in the COVID-19 pandemic era by government and other stakeholders. Teachers are to enhance their awareness of the use of virtual reality for teaching of science in secondary schools.

Keywords: Science Education, Virtual Reality, Covid-19, Science Teachers, Technology Adoption

Introduction

The teaching of science in secondary schools seems to be greeted by many challenges in recent years and specifically, during the Corona Virus Disease (COVID-19) era. Even though schools may appear to have devised diverse instructional methods, the problem of the practical teaching of science in this era has continued unabated. The challenge, occasioned by the introduction of COVID-19 social distance protocol is believed to be against the students' interactive laboratory work in schools. Although the science curricula encourages the use of resources as students work together, the attainment of social distancing protocol among students appears to have made the protocol almost impossible. It is believed that human-computer virtual reality interface could provide the similitude of a laboratory as well as tackle the social distancing protocol. However teachers' awareness of availability and use of virtual reality in secondary schools cannot be assured. This is despite previous calls that usable facilities be made available in schools for teaching (Taangahar & Abya, 2018).

COVID-19 is a respiratory disease that has quite a number of fatalities and ranked as a pandemic across the globe, and has affected the normal operation of schools. The World Health Organizations' non-pharmaceutical intervention for tackling its transmission is; regular washing of hands, wearing of face mask, sanitizing the environment, checking of body temperature as well as avoiding large gatherings such as markets, stadia, churches and schools (Lagakos, 2020; Simon & Hans, 2020). In Nigeria the Federal Ministry of Health (FMH) mandated the National Centre for Disease Control (NCDC) to coordinate a national response to the disease. This was replicated in all States and sectors. In the education sector the scare from the early waves of COVID-19 led to the closure of schools with a considerate loss in the sector. However, the school closure was temporary and requires a rethink by educators, school owners and policy makers on how to constantly deliver education to students through radio, television and the internet. The efficacy of such delivery however leaves much to be desired as facilities required for such teaching appears not to be available and teachers' awareness of a facility that could resolve the challenge of teaching in the pandemic appear yet to be determined.

The fight against the virus through the maintenance of social distance of 1.5 or 2 meters was difficult to adhere to in schools, as classes cannot be easily expanded to accommodate the new dimensions. To this end NCDC, according to Amorighoye (2020), prescribed that schools with large population operate both morning and evening sessions and congested classes be split. However, an efficient split for a practical class may require splitting into several batches and the class spanning over a long period of time. This situation does not augur well for the students as they may not be able to remain attentive for long while waiting for their turn. It may also require more work-hands as teachers may not be able to teach all the batches using traditional methods. This necessitated the deployment of modern instructional technology such as Virtual Reality (VR) to augment existing teaching methodologies. Thus there is need in determining science teachers' awareness of availability and use of VR facility in secondary schools for science teaching in a COVID-19 era.

Awareness could be referred to as the ability to know or take cognizance of something. In teaching, teachers' awareness is described as a state where teachers are conscious of information or knowledge created through the interaction of an agent and its environment (Egomo, Enyi &Tah, 2012). Awareness conveys individuals' perception of information surrounding their environment. There are different categories of awareness: physical, social and workspace awareness (Ngwu, 2014). Workspace awareness is more related to this study because it mediates awareness of location, activity and changes within the workspace. Thus virtual reality environment is a workspace environment. It is also of interest to the study due to the desired transition of workspaces from physical to virtual environments especially as required in a COVID-19 environment of social distance.

It is essential for virtual environment to be made available in schools. Availability of this facility refers to its accessibility and readiness for use in schools. VR facilities available in secondary schools must be easy to get and not otherwise committed. Although it is expected that VR facility be at students' disposal, it appears the facility is not provided for in most schools, and even if it is, it may not be convenient for use by the students. Thus, availability of VR is believed to stretch from the mere presence of the facility in schools to its readiness for use by students. Mavellas, Wellington and Samuel (2016) decried that most schools do not operate under the recommended ICT learning environment. Habib, Jamal, Khalil & Khan (2021) also found out that even though a state-of-the-art automated infrastructure could be available in an institution, it may lack major e-learning features to support online classes and real time learning as required for use in a COVID-19 era.

Globally, there is the need for smart schools by various governments to overcome educational challenges of lesson delivery in a COVID-19 pandemic era. While it may be harmful to gather students in an actual laboratory and risking the violation of social distancing, students, in a VR class, can interact at safe distances, at different work stations and still work closely. This is because VR could be used to teach subjects for which conventional lessons might be harmful to the environment or costly to teach. A virtual screen user interface allows one to customize the home or class space to replace the traditional computer monitor with limited VR screen space. In a VR application a whole

wall or the entire hall could become a virtual screen. It is able to project an entire screen displaying 3D-elements of sight, hearing and sense of touch beyond computer interaction platforms of games, simulations and video conferencing. VR could be used as an efficient teaching tool because it supports direct experience of phenomena, offers multi-sensory communication and is physically immersive (Mukamal, 2017; Karp & McGowen, 2020). A VR laboratory can be introduced and the student finds himself inside. After the lesson the laboratory is virtually withdrawn and the student is in his normal class room again.

The organization of instructional content, materials, manner of presentation requires appropriate teaching methods. Some of these methods include: project, discovery, inquiry, demonstration and field trips (National Teachers Institute, 2012). VR, as resource, can be employed alongside many methods. When a teaching method is employed, VR can also provide the environment for the learner to perform an experiment. A VR class using demonstration method can provide a virtual real life laboratory and teacher to carry out real life-like demonstration. This is because in advanced VR, learners actively participate in the learning process. It is a method of learning where the virtual teacher appears to be present in the class to guide learners' manipulation of instructional materials. If guided discovery was used with VR, students would still be required to think independently and logically following directions as though they were in an actual discovery/inquiry class.

Despite the capabilities of VR, in guiding students in practical science classes in a COVID-19 era, the teachers' awareness of availability and the use of the facility appear to be in doubt. This study was therefore undertaken to determine the level of teachers' awareness of availability and use of virtual reality for the teaching of secondary school science in a COVID-19 era.

Research Questions

The following research questions guided the study:

i. To what extent are secondary schools science teachers aware of the availability of virtual reality in schools for science teaching in a COVID-19 era?
ii. To what extent are secondary school science teachers aware of the use of virtual reality in schools for science teaching in a COVID-19 era?

Hypothesis

The research hypothesis was tested at 0.05 level of significance.

i. There is no significant difference between science teachers' awareness of availability and their awareness of use of virtual reality in secondary schools for teaching in the COVID-19 era.

Methodology

Survey design was used for the study. The choice of this design was that questionnaire was used to collect data from respondents without treatment. The design was considered adequate since it looked into the status quo of teachers' awareness of availability and use of VR in schools for the teaching of science in a COVID-19 era. The study was carried out in Makurdi Metropolis, Benue State. The study population consists 20 grant-aided schools

with 80 science teachers. Purposive sampling was adopted so as to use only schools with ICT facility and all the 80 science teachers participated in the study.

The questionnaire titled: Awareness of Availability and Use of Virtual Reality Questionnaire (AAUVRQ) was used. The questionnaire was divided into sections A, B, and C. Section A comprised of demographic data indicating whether a school has ICT or not. Section B was sub-titled: Awareness of Availability of Virtual Reality Questionnaire (AAVRQ) and Section C was sub-titled, Awareness of Use of Virtual Reality Questionnaire (AUVRQ). Respondents were provided the following options: Very High Extent (VHE) = 4, High Extent (HE) = 3, Low Extent (LE) = 2 and Very Low Extent (VLE) = 1. Both section B and C have 10 items each.

The instrument was validated by two experts both in Faculty of Education, Benue State University, Makurdi. The experts scrutinize whether or not the items conform to the subject matter, are clear and free from ambiguity, cover the variables of the study and are analyzable to provide answers to the research questions and test the hypotheses of the study. They accepted that the item is capable of measuring the objectives it is designed to measure. It was observed that the instrument should not determine teachers' awareness on types of VR but focus on awareness of availability and use of VR as observed in schools. The corrections were made by the researchers and the instrument was used for the study.

The reliability of the instrument was established by conducting a pilot study on science teachers who did not participate in the main study. Twenty copies of the instrument were administered to the respondents. Cronbach Alpha was used to ascertain the reliability with coefficients of 0.66 for science teachers' extent of awareness of availability of virtual reality facilities in schools for the teaching of science and 0.63 for the extent of awareness of use of virtual reality facilities in schools for the teaching of science. Since both coefficients were above 0.5, they were considered reliable to be used in the main study. This is because a reliability coefficient of 0.5 and above is considered reliable (Cronbach, 2005).

Permission was obtained from school principals for the administration of questionnaires in their schools. Deans of Science were briefed by principals to assist the researchers in administering the instrument. Data were collected by respondents ticking their level of awareness of availability and awareness of use of VR for teaching on a 4-point response option. Mean and standard deviation were used to answer research questions. A mean score from 1.00 to 2.49 indicated that more respondents scored the items on awareness of availability of VR in a COVID-19 era as low while a mean score from 2.50 to 4.00 indicated that more respondents scored the items as high. A t-test for dependent samples was used to test the hypothesis at 0.05 level of significance. A t-calculated value greater than the t-critical value indicate rejection of the null hypothesis as the difference was considered significant.

Results

Research Question One

To what extent are secondary schools science teachers aware of the availability of virtual reality in schools for science teaching in a COVID-19 era?

Table 1: Mean Rating of Extent to which Secondary School Science Teachers Aware of the Availability of Virtual Reality for Teaching in the COVID-19 Era

S/No	Items on Availability of Virtual Reality	X	δ	Remark
1	Virtual Reality can be seen in my school in the COVID-19 era for the teaching of science to a…	1.90	0.91	**LE**
2	The convenience for use of Virtual Reality for science teaching in the COVID-19 era in my school is to a…	1.65	0.87	**LE**
3	Accessibility of virtual reality in the COVID-19 era in my school for the teaching of science is to a …	1.86	1.07	**LE**
4	The ease to which Virtual reality obtainable in my school for science teaching during the COVID-19 era is to a …	1.81	1.02	**LE**
5	The presence of virtual reality for the teaching of science in the COVID-19 era in my school is to a …	2.04	1.10	**LE**
6	Virtual reality is properly maintained in my school for the teaching of science in the COVID-19 era to a	1.66	0.85	**LE**
7	The existence of virtual reality in my school for the teaching of science in the COVID-19 era is to a …	1.84	0.85	**LE**
8	Virtual reality is provided in my school for the teaching of science in the COVID-19 era to a	1.94	0.94	**LE**
9	Virtual reality is dedicated in my school for the teaching of science in the COVID-19 era to a …	2.06	0.94	**LE**
10	Virtual reality in my school is otherwise committed for the science teaching in the COVID-19 era to a …	1.98	1.11	**LE**
	Cluster Mean	**1.87**		**LE**

Note: LE = Low Extent

From Table 1, items 1 to 10 recorded mean score below 2.50 which is the upper boundary decision mean. Item 9 has the highest mean of 2.06 and item 2 has the lowest mean of 1.65. This indicated most respondents were of aware that virtual reality is available in schools to a low extent. The cluster mean of 1.87 is below the upper boundary decision rule of 2.50 implies that virtual reality is available to a low extent.

Research Question Two

To what extent are secondary school science teachers aware of the use of virtual reality in schools for science for teaching in a COVID-19 era?

Table 2: Mean Rating and Standard Deviation of Extent of Science Teachers' Awareness of Use of Virtual Reality for Teaching in COVID-19

S/No.	Items on Teachers Awareness of Use of Virtual Reality for Teaching	x	δ	Remark
1	Science teachers' knowledge of use of virtual reality for teaching in COVID-19 is to a …	2.89	0.86	**HE**
2	The science teachers' understanding of use of virtual	2.70	0.88	**HE**

	reality for teaching in COVID-19 is to a …			
3	The realization of use of virtual reality for teaching by science teachers of in COVID-19 is to a …	2.66	1.07	**HE**
4	Science teachers' recognition of use of virtual reality for teaching in COVID-19 is to a …	2.62	1.24	**HE**
5	Science teachers' perception of use of virtual reality for teaching in COVID-19 is to a ….	2.62	0.88	**HE**
6	The preparedness for the use of virtual reality by science teachers for teaching in COVID-19 is to a ….	2.64	0.94	**HE**
7	Science teachers' responsiveness to the use of virtual reality in the COVID-19 era is to a …	2.54	1.20	**HE**
8	The consciousness of the use of virtual reality by science teachers in the COVID-19 era is to a …	2.54	1.17	**HE**
9	science teachers' familiarity with the use of virtual reality for teaching in COVID-19 is to a …	2.54	1.10	**HE**
10	Science teachers awareness of use of virtual reality in the COVID-19 era is to a …	2.69	0.90	**HE**
	Cluster Mean	**2.64**		**HE**

Note: HE= High Extent

From Table 2, item 1-10 recorded mean score above 2.50 which is the upper boundary decision mean. Item 1 has the highest mean of 2.89 while items 7, 8 and 9 have the lowest mean of 2.54 each. The cluster mean of 2.64 is above the upper boundary decision mean of 2.50 shows that science teachers are aware of the use of virtual reality for teaching of science to a high extent.

Hypothesis

i. There is no significant difference between science teachers' awareness of availability and their awareness of use of virtual reality in secondary schools for teaching in the COVID-19 era.

Table 3: t-Analysis on Teachers' Awareness of Availability and Use of Virtual Reality in Schools

Variable	**N**	**x**	**δ**	***t-cal.***	***t-crit.***	***d.f***
Teachers Awareness of Availability of VR	80	2.64	0.86			
				5.16	*1.68*	*79*
Teachers Awareness of Use of VR	80	1.87	1.11			

From Table 5, t-calculated value of 5.16 is greater than t-critical value of 1.68 at degree of freedom of 79, at 0.05 level of significance. Therefore, the null hypothesis is rejected. This implies that there is a significant difference in science teachers' awareness of availability and their awareness of use of virtual reality in schools for science teaching.

Discussion of Findings

The result obtained from the study revealed that the extent of science teachers' awareness of use of virtual reality for the teaching of science in secondary schools in Makurdi Local Government Area was high, even though their awareness on availability of virtual reality in schools was to a low extent. The study agrees with Apagu and Wakili (2015) who found out that VR facilities are not available to teachers and students for educational purposes. It also agrees with Soetan, Onojah, Aderogba, Obielodan, Ganiyu and Fakomogbon (2020) who stated that teachers are aware of virtual reality for the teaching of science, however the extent to which virtual reality was available in schools for the teaching of science was low. The reason for their awareness of the use could probably be through their personal use of the internet and not in the physical presence of the facility for use in their schools.

Conclusion

The study concluded that the extent of teachers' awareness of use of virtual reality for the teaching of science in secondary schools was high but their mean response on their awareness of availability of the facility in schools was low.

Recommendations

It is recommended that VR be made available in schools by government and other stakeholders for teacher's use in a COVID-19 pandemic era.

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