An Investigation Into the Availability of Robotic Mediated Teaching Aids in Secondary Schools in Ika North-East of Delta State

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Abstract

Robotic mediated teaching aids are innovative teaching aids used in contemporary times to advance and enhance teaching and learning in schools be it lower basic (primary 1-3), middle basic (primary 4-6), upper basic (JSS 1-3), senior secondary schools and higher education institutions (HEIs) (university, college of education and polytechnic) in the context of Nigeria. It also has same resemblance with artificial intelligence (AI). The robotic mediated teaching aids can be explored and used in teaching various subjects in secondary schools including social studies, English language, mathematics, economics, integrated science, physical science, health science, biology, business education, technical drawing, civic education, music, and so on. This study therefore investigated the availability of robotic mediated teaching aids in secondary schools in Ika North-East local government area of Delta State. Three research questions were raised by the researcher to guide the study. The design of the study was descriptive survey research design. The population of the study was 6700 secondary school teachers in Ika North-East. The sample size of the study was 240 secondary school teachers which were selected using simple random sampling technique. The instruments used for data collection was a questionnaire tagged Students Robot Mediated Instruction Questionnaire (SRMIQ). The coefficient of the instrument is reliable having been used overtime by researchers. The instrument was validated by experts from faculty of Education, Delta State University, Abraka. Mean and standard deviation was employed in data analysis. The findings of the study were that teachers and students are not aware of robotic mediated teaching aids; there were no robots in secondary schools for teaching and learning in Ika North-East; most teachers including social studies teachers were not innovative enough in the use of information and communication technologies' (ICTs) tools in teaching and learning in secondary schools in Ika North-East and there were no funds for the purchase of robots and other ICT tools in secondary schools in Ika North-East. The implications of the finding are that: students may not be computer literate because of unavailability of ICT teaching aids in secondary schools. Second, students may find it difficult to pass JAMB because it is now a computer powered examination. Based on the findings and implications, the researcher recommended that teachers should be mobilized and sensitized on the importance of robotic mediated teaching aids in the 21st century; government should increase funding in secondary schools to enable authorities buy computer aids for teaching and learning; teachers should be encouraged to try out innovative teaching methods in the teaching and learning processes, and so on.

Keywords: availability, robot, teaching aids, computer, instructions, aids, internet and mediation.

1. Introduction

In contemporary times, everything about teaching and learning are gradually becoming automated, digital and computerized hence the growing emphasis on artificial intelligence (AI) and robotic mediated teaching aids. These are strategic approaches to easy teaching and learning at all levels of education including secondary education (upper basic and senior secondary). Teaching and learning in the 21st century are going through numerous challenges. The various challenges posed today in teaching and learning is such that innovations are daily needed to brighten the future of pupils/students who undergo these learning processes for career development, knowledge acquisition, life experiences or exposure. These innovations in education and for effective teaching and learning in good demand can be in the form of digital technologies widely in use in contemporary activities. Technology is so advanced that it has been employed in development of healthcare,

agriculture, mining as well as education. Education has become a sector that enjoys the trial of innovations in all aspects of life.

Robotic mediated teaching aid is often referred to as part and parcel of digital technology. It is relatively new especially in the Nigerian education system but is gradually becoming very popular. According to Cashman, Gunter and Gunter in Sanusi and Ezeodo (2020), digital technology can be taken to mean digital processing systems that encourages active learning, knowledge construction, inquiry, and exploration on the part of learners, and which allow for remote communication as well as data sharing to take place between teachers and/or learners in different physical classroom locations. Digital technology in this paper connotes teaching technologies such as computer, hardware, software, tools such as robotics and techniques that are used in or outside classrooms in facilitating, and improving the effectiveness and proficiency in teaching and learning of various subjects including social studies. Other tools included as aids in digital technology are computers, digital cameras, scanners, DVD players and digital pens. Others are PC video cameras, mobile phone and projectors that are being used by teachers' and students' to facilitate teaching effectiveness and competence. These are the various technological devices that promote and enhance teaching and learning. In the words of Salavati (2016), terms such as information technology (IT), information and communication technology (ICT) and educational technology are interchangeably employed to describe modern scientific breakthroughs. Robotic mediated teaching aid is an innovative teaching aid that is been explored in Nigerian schools. It is currently facing numerous challenges spanning from inability of teachers and students to operate robotic devices, inability of the schools to provide robotic devices for teaching and learning, lack of awareness on the parts of teachers and students on how robotic devices work in classroom teaching and learning and so on (Mezieobi, 2021). Robotic mediated teaching aid, which combines blended learning, online and face-to-face pedagogy, is a fast-growing mode of teaching and learning in schools. In contemporary times, schools strive for equitable and alternative pathways to course enrollment, retention, and educational attainment. But, the challenges to successfully implementing the use of robotic mediated teaching aids are that social presence, or students' ability to project their personal characteristics into the learning space, is reduced with potential negative effects on student engagement, persistence, and academic achievement (Gleason & Greenhow, 2017). Teachers in developed countries are experimenting with robot mediated teaching aids (RMTA) to address these challenges. In Nigeria, the presence and impact of robotic mediated teaching aids are not yet felt. According to Gleason and Greenhow (2017), results from a study of robotic mediated teaching aids at a large public school suggest that it offers advantages over traditionally used videoconferencing, including affordances for fostering students' embodiment in the classroom, their feelings of belonging and trust, and their ability to contribute ideas in authentic ways.

In this 21st century, robotic mediated teaching aid has become very important for the internationalisation of the Nigerian education. The relevance of digital technology in teaching and learning process cannot be over-emphasized. Although at infancy, more pronounced in many industries today is the deployment of robots to serve in different capacities. Robots are classified into three categories. These include industrial robots, service robots and social robots. Social robots which are more deployed in educational circle was defined by Bartneck and Furtizzi (2014) as an autonomous or semi-autonomous robot that interacts with human beings by following the behavioural norms expected by the people with whom the robot is intended to interact. Social robots adapt to changing environment, make their own decisions, interact with human beings and socially fit into the human world. Educational robots are in the domain of social robots because of their interaction with human beings. Educational robotics function in the field of entertainment and motivation for research purposes (Davison, 2016). They can fit into curricular and extra-curricular activities. Educational robotics are mainly used for teaching and learning in schools especially in more digitally and technologically advanced countries of the world. The introduction of robotic mediated teaching aid has caused the evolution of learning opportunities like online learning, blended learning, distance learning and so on (Mezieobi & Chikwelu, 2019)

Educational robots can be used to perform various educational roles. They are deployed in two major domain namely passive roles and active roles (Iroju, Olakeke, Afolabi & Idowu, 2020). Three variables are involved in these defined roles. One is the content to be taught, the instructor, the type of student and the nature of the learning activity. Robots that play passive role are deployed in teaching or instructional aides. The advantage is that these robots can comfortably handle a large class and repeat instructions for the whole day without been tired.

Every teacher has ways of interacting using robots especially in teaching and learning. Social science teachers including social studies teachers in developed world have discovered the massive support received from service robots because they can be programmed to demonstrate basic concepts and steps in any pedagogy. A typical example of this type of robot is the LEGO Mindstorm designed to assemble kit that contain building block

pieces and a control unit manipulated by users to learn how to design, program and build another robot. Its main advantage is that it builds cognitive and psychomotor skills in students and projects their latent potentials towards career development. The specification of robotics in sciences may help students develop interest in Science, Technology, Engineering and Mathematics (STEM). According to Roubiainen (2019), mind storms is reusable and contains tutorials which help a learner learn basics of coding and concept development. Robotics as automated as they can be will also need human operation to work effectively and efficiently.

Also, educational robots are also deployed in language development. They are used as peers or companions and align with students irrespective of their educational level and area of specialisation especially for students in higher education institutions (HEIs). A typical example is the Nao robot that learns language such as English along with children. Nao robots are efficient in verbal interaction and communicating modern for speech synthesis. They also stimulate emotions such as: fear, anger, joy and sadness through their body language and facial expression. Therefore, through robotic technology, children can experience increased level of social interaction and educational experiences between robot and learners.

The use of educational robots is in fact advancing in developed nations and this has led to the increase in the demand for robots in children's education. One of the subjective purposes of introducing robots in homes, schools and other public domain is to facilitate instructional delivery through motivation, improving motor skills, facilitating and increasing pupil's interest as well as improving learning of skills. The three domain of learning therefore has effective representation in robot technology. The case of underdeveloped and developing countries of the world still leaves much to be desired.

While developed nations are advancing in every department of robot technology or robot mediated learning, African countries are mere observers. Many homes in advanced nations deploy robots to foster quality study habit in their children. Some robots are programmed to rehearse what was taught in school and teach ahead of the teacher. Some are deployed to specifically handle grey areas in children curriculum. Many are employed for revision during examination while others basically handle career development issues. Robots according to Miller, Nourbaklish and Siegwart (2013) are stimulating learning through entertainment; they have the ability to repeat concepts without getting tired unlike a human teacher. Hence, they increase the retention rate of students and also make learning simple by elucidating difficult abstract concepts. Robots are very good at repeating explanations as they have been programmed to do. They always need human directives in order to function effectively.

There are challenges in robot technology according to Mubin et al (2013) especially in training manpower who will deploy robots as teaching aids and high cost of buying them. However, its availability in secondary schools in South Southern states is the greatest challenge (Davison, 2016; Obioma & Mezieobi, 2023). The researcher therefore in this study is investigating the availability of robots in secondary schools in Delta state as teaching aids. No doubt the development in the use of digital technologies has influenced all sectors of life and education is no exception to this. The use of these technologies for enhancing the quality of education by making teaching and learning more relevant to life has been widely accepted by education stakeholders (teachers, parents, students, government, and so on) irrespective of their dual consequence. Using robots in the understanding of Haggins (2012) creates flexible learning environment that breeds innovation and a more collaborative learning environment that ultimately keeps students active. Bolstad (2017) in concert revealed that technologies in education open doors to countless resources, new experiences, new discoveries, and new ways of teaching and learning: the essence of which is to enhance education and make learning more fun and efficient.

Education is dynamic, changes and innovations are expected such as what is widely experienced today in robots. How compatible is our society with the changes, so far identified. The worry of the researcher is whether the technologies widely deployed in schools in advanced countries are available here in Nigerian schools. Where available, are teachers compatible with them? Sunusi and Ezeodo (2020) seem to disagree on the use of robotics in secondary schools in Kano State, when they further emphasized the need for strengthening the continual use of the traditional instructional strategies such as discussion, play-way, demonstration, field trip, and questioning that have their numerous limitations according to empirical evidence. It is only through empirical research that their availability may be ascertained. This study therefore seeks to investigate the availability of robot mediated teaching aids in secondary schools in Delta state of Nigeria which is a south-south state.

The main purpose of the study was to determine availability of robotic mediated teaching aids in secondary schools in Delta State of Nigeria. Specifically, the study sought to:

1. determine the availability of social robots in secondary schools;
2. ascertain the availability of electronic whiteboard; and

3.   find out the availability of personal computers for private studies.

Based on the specific purpose of this study, the following research questions were posed to guide the study.

1.   To what extent are social robots available in secondary schools in Delta state?

2.   To what extent are electronic whiteboards available in secondary schools in Delta state?

3.   What are the perceived challenges confronting the availability of digital electronic teaching aids in secondary schools in Delta state?

2. Method

The research design adopted by this study was a descriptive survey research design. Descriptive survey research designs are those designs in which information about opinions, attitude, preferences and perception are gathered from a group of respondents using either a questionnaire or an interview or observation or a combination of any two or all the instructions (Sunusi and Ezeodo, 2020). The area of the study was Ika North-East local government area of Delta state. The population of the study was 670 secondary school teachers (comprising 410 females and 260 males). The sample of the study was 240 secondary schoosls' teachers (comprising 160 females and 80 males). Convenience sampling technique was used to select the sample size. Convenience sampling is a non-probability sampling technique that involves the choosing of a variable or closest person as respondent in order to save time and energy (Sulaiman, 2012). The sample size is quite adequate for the study in accordance with the sampling procedure table given by Krejcie and Morgan as cited in (Sunusi and Ezeodo, 2020). A questionnaire designed by Sunusi & Ezeodo (2020) was adopted. The questionnaire was titled Secondary School Students Robot Mediated Teaching Aid Questionnaire (SSSRMTAQ). It is a ten item structured questionnaire responded on a 4-point likert scale of Very often (Vof); Often (Oft), Rarely (Rly), and Very rarely (VRly). To validate the instrument, the questionnaire, was presented to three specialists, two experts from the Department of Social Science Education, Delta State University, Abraka and one expert from the area of Measurement and Evaluation, also from Delta State University, Abraka. Observations and recommendations made were used in drafting the final copy of the instrument. A pilot study was carried out with 100 copies of the Secondary School Student Robot Mediated Teaching Aid Questionnaire (SSSRMTAQ) using secondary school teachers from Ika South local government area of Delta state. A visit was made to the selected schools twice and the data collected was analysed to obtain a reliability coefficient of 0.72 (See Appendix A for the Questionnaire). In Allison cited in Tulinayo, Ssentume and Najjuma (2018), it is opined that an instrument is regarded reliable if the Cronbach alpha coefficient is greater than 0.5. The data for the study were collected by the researcher and her well trained research assistants through personal interactions with respondents in selected schools. This provided a 95% rate of return. Data collected were analyzed, using the mean and standard deviation. Decision on the research questions was based on a criterion mean response of 2.5 and greater which was accepted while those that are less than 2.5 were rejected.

3. Results

The results for this study were presented in line with the research questions as shown in Tables 1, 2 and 3.

Research Question 1: To what extent are social robots available in secondary schools in Ika North-East local government area of Delta state?

Table 1. Mean and Standard deviation analysis on the extent to which social robots are available in secondary schools in North-East local government area of Delta state

S/N	Social Robots	N	Vof	Often	Rarely	VRly	∑fx	$\overline{X}$	SD
1	Autism spectrum robot is for challenged studies are in use	240	0	0	-	240	240	0.00	0.00
2	Other therapeutic robots are available	240	0	0	0	240	240	0.00	0.00
3	Game robots are available for use in smart phones	240	50	90	100	20	710	2.98	0.17
4	Music robots are available for use in smart phones	240	30	90	100	20	710	2.98	0.12
5	Video robots are in use for literature in smart phones	240	40	100	80	20	640	2.67	0.94
6	Cognitive development robots other than games are in use	240	20	20	180	20	520	2.18	0.84
7	Entertainment robot called pepper is available and in use in school	240	20	10	190	20	510	2.16	0.74
8	Nao robots used to assess emotions are available and in use	240	20	10	190	20	510	2.16	0.74
9	Jijo 2 robots are available during field trips	240	10	10	200	20	490	2.07	0.93
10	Shakey robots are available in use	240	10	10	190	20	49	2.07	0.82
	Pooled Mean								

Table 1 revealed the available robots in individual teacher's smart phones. Items 3, 4 and 5 are robots that are available in teacher's smart phone not in the school. Other items such as, therapeutic robots used for vulnerable students, cognitive development robots, entertainment robots used for brain stimulation, pepper robots and those (robots) used to assess emotions are all not available for secondary schools' students to use.

Research Question 2: To what extent are electronic digital tools available in secondary schools in North-East local government area of Delta state?

Table 2. Mean and standard deviation analysis on the extent electronic and digital tools are available in secondary schools

S/N	Digital tools availability	N	Vof	Often	Rarely	VRly	∑fx	$\overline{X}$	SD
1	Digital cameras are available	240	30	10	180	20	530	2.21	0.73
2	Digital video cameras are available	240	10	10	200	20	490	2.04	0.64
3	Digital photo printers are available	240	10	10	200	20	490	2.04	0.64
4	Digital pens are available	240	10	10	200	20	490	2.04	0.64
5	Electronic white boards are available	240	5	15	200	20	485	2.02	0.71
6	Personal computers are available	240	15	5	180	40	475	1.98	0.93
7	Microphones for students are available	240	20	20	180	20	520	2.06	1.02
8	Ipods are available	240	5	10	200	25	475	1.98	0.93
9	CD/DVD drives are available	240	10	10	200	20	490	2.04	0.67
10	Projectors are available	240	10	10	200	20	490	2.04	0.4
	Pooled Mean							**2.05**	**0.76**

Table 2 revealed the unavailability of electronic digital tools in secondary schools in North-East local government area of Delta state. Digital cameras, digital video cameras, digital photo printers, digital pens, electronic white boards, microphone, Ipods, CD/DVD drives and projectors are not available in all the secondary schools selected for the study. A pooled mean of 2.05 was obtained.

Research Question 3: What are the perceived challenges confronting the availability of digital electronic teaching aids in secondary schools.

Table 3. Mean and standard deviation analysis on the extent challenges confronting the availability of digital electronic teaching aids in secondary schools

S/N	Digital tools availability	N	Vof	Often	Rarely	VRly	∑fx	$\overline{X}$	SD
1	High cost of digital teaching aids	240	100	100	20	20	760	3.17	1.10
2	Lack of fund allocated to computer learning	240	150	50	20	20	810	3.38	1.42
3	Inadequate power supply	240	100	100	20	20	760	3.17	1.10
4	High poverty level of parents	240	100	100	20	20	760	3.17	1.10
5	Lack of trained teachers to use electronic teaching aids	240	100	50	20	20	690	2.88	1.02
6	Shortage of teachers in most rural secondary schools	240	150	50	20	20	810	3.38	1.42
7	Lack of fund for integration of digital technologies in schools	240	100	100	20	20	760	3.17	1.10
8	Poor budget allocation to schools in general by government	240	150	50	20	20	810	3.38	1.42
9	Poor integration literacy among education administrators	240	100	100	20	20	760	3.17	1.10
10	Poor information literacy among education administrators	240	100	100	20	20	760	3.17	1.10
	Pooled Mean							**3.20**	

Table 3 revealed the challenges hindering/confronting the availability of digital electronic teaching aids in secondary schools in North-East local government area of Delta state of Nigeria. The pooled mean was 3.20 showing that all the items from 1-10 are challenges to the availability of digital electronic teaching aids in secondary schools.

4. Discussion of Results

Result of the study was that robots were not available in all the schools selected for the study and that this is a reflection of what is obtainable in other public secondary schools in North-East local government area of Delta state of Nigeria. The meaning of this result was that secondary schools in North-East local government area of Delta state of Nigeria lacked the availability and services of robots used for various purposes in teaching and learning. The unavailability of a single robot for use other than in teacher's smart phones which students cannot access show that the use of digital technology in secondary schools in North-East local government area of Delta state is at abysmal level. The reason for this result is because of the absence of government commitment towards the growth of education while UNESCO advocated a budget of 6.8% for education in developing countries of the world. Nigeria is allocating less than 3% of their budget to education. Unavailability of adequate resource would have resulted in the neglect towards electronic digital teaching aids in secondary schools in North-East local government area of Delta state of Nigeria. The findings of this study was backed by the result of Sunusi and Ezeodo (2020) whose study observed that electronic digital tools/teaching aids were not available in secondary schools in Gwale Local Government of Kano State. A contradicting result was obtained by Odiniambo (2013) who found that computer was available and always used by teachers. Ajeigbe, Ogunsakin and

Shogbesam (2015) revealed a high level usage of ICT facilities in secondary schools among computer studies teachers.

Result of the study was that many factors resulted in challenges militating against availability of electronic teaching aids in secondary schools in North-East local government area of Delta state of Nigeria. The result means that electronic digital teaching aids were not available in secondary schools and that the enumerated factors from items 1 to 10 were the constraints behind their absence. The reason for the result was because of mostly government policy towards education in North-East local government area of Delta state of Nigeria. The funds allotted to education were not sufficient for such innovations in teaching pedagogy. The findings of the present study was in line with the result of Abass and Ayo (2013) that variables as, government poor funding of education, unavailability of electricity supply, lack of sufficient teachers in rural secondary schools and insufficient trained teachers in ICT contributed to unavailability of electronic digital teaching aids.

5. Conclusion and Recommendations

Based on the findings of this study, it was concluded that were numerous digital electronic teaching aids were not available in public secondary schools in Ika North-East local government area of Delta state of Nigeria and that robots such as Jijoz, Nao, Pepper were not available. Robotic mediated teaching aids were not seen in secondary schools in the study area irrespective of the fact that some areas in Ika North-East are perceived as urban areas while some areas are rural areas. Secondary schools in the urban areas of Ika North-East experienced the unavailability of robotic mediated teaching aids. The following recommendations were made:

1.   Based on the findings, the government should increase funding in secondary school to enable the purchase of ICT materials.

2.   Teachers should be adequately retrained and motivated to adjust to the use of computers in teaching in classes.

3.   Secondary schools' students should be exposed to the use of ICT and ICT accessories.

4.   Workshops and seminars on the use of electronic devices for teaching and learning should be organised by the schools' management for teachers and students.

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