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EFFECTS OF E-LEARNING TOOLS ON STUDENTS' ACADEMIC PERFORMANCE IN DATA STRUCTURE

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Abstract

The study sought to determine the effect of e–learning tools on the students' academic performance in data structure. Descriptive research design of survey type was adopted for this study, a total of three hundred and thirty (330) students made up the sample of the study drawn from universities in south south Nigeria. The instrument for the study consisted of twenty (20) items questionnaire generated to answer the research questions. The data were presented and analyzed using descriptive statistics of frequency distribution analysis (FDA). The study found that E-learning tools is perceived to help in improving student's study skills; it provides students with some of the prerequisite skills for academic preparedness; ensure that students learn independently thereby improving students' confident and encourage students' class participation. Based on the findings of the study, it was concluded that students' use of e-learning tools has significant effect on their academic performance. Thus, it is affirmed that e-learning tools would significantly promote students' interest in the learning contents, make learning easy for students, allow students and motivate students towards better academic performance. The study recommends that the use of e-learning tools and technology in delivering lectures in the university should be encouraged so as to improve students' academic performance significantly.

Keywords: e-learning, academic performance, data structure

Introduction

The recent outbreak of Coronavirus Disease 2019 (COVID-19) reechoed the growing influence of technology on education. Many educational institutions across the world relied on the use of technologies to ensure continued education during the Coronavirus lockdown. Charles et al., (2020) reported that many institutions cancelled all their face-to-face classes, including labs and

migrated to e-learning. The effects of school closures due to COVID-19 were mitigated by educational institutions that had supportive e-learning facilities during the crisis. For instance, some University in Nigeria provided online education and trainings for her students and staff during the COVID-19 lockdown through the use of the institution's e-learning environment. The use of elearning platform provided opportunities for both students and staff to continue their normal teaching and learning activities during the COVID-19 lockdowns, thereby mitigating to large extent, the adverse effects of the lockdown on their staff and students. According to Onyema, et al., (2019), the integration of emerging technologies in teaching and learning process is no longer a choice but a need due to; the changing learning environment, demand for flexibility in methodology, and the need to enhance creativity and productivity in learning. Corinne (2018) opined that "emerging technologies have spawned the exponential development of software and AI-aided technology that aim to adapt learning methods and customize curricula to fit each student's ability to move forward at his or her own pace". For Onyema, Udeze, Chinecherem (2019), technology have modified teachers' method from traditional approach that often place them as dispensers of knowledge to a more flexible approach where they act more as facilitators, mentors and motivators to inspire students to participate and learn. The use of appropriate educational technologies increase the accessibility to learning resources and multiple learning approaches to meet the need of diverse learners (Onyema, et al., 2019). Educational technologies facilitate student-centred learning and problem-based education (Onyema et al, 2020). There are emerging trends in use of technology in learning. Nano-learning (n-learning) is the latest term in the natural progression: from distance learning (d-learning), flexible learning (f-learning), electronic learning (e-learning), blended learning (b-learning), and the recent addition, (mobile) m-learning (International Federation of Surveyors (FIG, 2010). There are also now

ubiquitous and Agile learning, all of which are tailored towards learner-centered education, problem-based learning, and productivity in learning. The current trends in education confirm that instructors are shifting away from authoritarian and non-interactive methods (Galy et al, 2011), to a more learner centered approach that includes the use of technology. The use of e-learning platforms is growing as the education industry move towards virtual or remote education. Education is a vital activity and quality education has traditionally been associated with strong teachers having high degree of personal contact with learners. The significance of education, particularly in a developing country like Nigeria has increased because of the need to catch up with the developed world in several areas, particularly in global competitiveness and best practices. As the world grows more towards being a global village, the need to innovate in teaching practices with particular reference to Information Communication Technology, ICT, becomes imperative if attempt is to be made to bridge the gap between the developing and developed world. E-learning according to Aboderin (2015), encompasses an ample array of systems, from the teacher using visual effects to students accessing academic materials online and teaching delivered entirely with the use of computer. E-learning is learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom (www.e-learning.gov, 2019). It (e-learning) involves the use of network technologies to create, foster, deliver and facilitate learning and it encompasses face-to-face, distance, mixed and blended delivery models that utilizes electronic means, a unifying term used to describe the fields of online learning, web-based training and technology delivered instructions. E-learning is a generic term for all kinds of teaching and learning conducted in an electronic or online media, often with the aid of internet and other technological platforms, tools or devices. E-learning is a learning process created by interaction with digitally delivered content, network-based services

and tutoring support (Markus, 2018). Oye et al (2012) defined Elearning as the use of information and communication technology (ICT), including Web-based learning, computer-based learning, virtual classrooms and digital collaboration to enhance teaching and learning. According to European Commission (2001), e-Learning is the use of new multimedia technologies and the Internet to increase learning quality by easing access to facilities and services as well as distant exchanges and collaboration. The advent of e-learning is part of the collaborative learning paradigm that includes Web 2.0 technologies such as wikis, blogs, podcasts, social networks, and video-sharing sites, which are widely used by students (Galy et al, 2011). E-learning is bridging the gap between learning and work, workers can integrate learning into work more effectively by using the same tools and technology for learning as they use for work (Oye et al, 2012). E-learning does not necessarily replace the traditional teaching method, but it complements it.

E-learning has received much attention from various institutions and academic scholars in the past few years. E-learning is a computer based educational system that enables learner to learn anywhere and at any time. E-learning is mostly delivered through the internet, although in the past it was delivered using a blend of computerbased methods like CD-Rom (Epignosis, 2014). The use of e-learning tools in respect to learning process is critical for the successful implementation of various learning environments (Abdullah and Azzedine, 2011). Galy, Downey and Johnson (2011) noted that modern classroom, whether online or schools-based, use e-learning tools and learning management systems that capture student cognition and engages them in the learning process via technology, while increasing their need for self-directedness. Imperatively, the role that ICT play in the educational and learning environment cannot be over emphasized. The use of ICT in modern learning environment ranges from slide use of computers

in practical aspects to an online learning experience which enhances and improves students' intellectual and learning behavior (Smith, 2013). With the introduction of computers, the precursor of our modern-day ICT, and the promising potentials of computer-based instruction and learning, many researchers and institutions were motivated to invest viable resources so as to ensure the possibility of computers enhancing learning culture. Many authorities believe that computers should be brought into the education system because of the expectation that students would benefit quantitatively from computers by providing them with the software and hardware for an effective learning process (Wheeler, 2020). The digital age has transformed the way people communicate, network, seek help, access information and learn. We must recognize that young people, particularly students, are now an online population and internet access is through variety of means, such as computers, television and mobile phones (Al Ansari, 2016). Thus, as technology becomes more and more embedded in our culture, students must be provided with relevant and contemporary experiences that allow them to successfully engage with technology and even prepare them for life after school. The use of elearning tools, it is believed, would have a positive influence on both students' achievement, motivation and learning process in Data structure. Data structure is one of the required courses that students who study Computer Science at the tertiary institution level are often expected to take as part of their programme. It deals with how data is organized, stored or retrieved in the computer. A good data structure enhances the capability of the computer to access, store or fetch instructions, and efficiently implement algorithms. With the evolution of Bigdata, data structure would play a bigger role in data management, indexing and development of different modern applications, and augmentation of Big data technology.

The use of Information Communication Technology, ICT in education lends itself to more student-oriented learning settings. With the world moving rapidly into digital media and information, the influence of ICT on both education and students' learning behavior is becoming more and more important and this importance will continue to grow in the 21st century. Web Based Training and its newer and more general synonymous term e-Learning are two of today's buzz-words in the academic world (Odhiambo, 2013). Decision-makers associate with its new ways of learning that are more cost efficient than traditional learning strategies and which allow students to better control the process of learning because they can decide when, where and how fast to learn. The emergence of e-leaning according to Ani and Ahiauzu, (2018), has tremendously transformed information-handling and management in academic environments. Although, classrooms are considered a face-to-face learning environment, yet the installation of ICT equipment such as web-based tools and other technologies would positively influence students' blended learning situation. This is because there appears to be some consensus that both teachers and students feel that ICT use in the class greatly contributes to students' motivation and engagement in learning. A very high percentage (86%) of teachers worldwide agree that students are more motivated and attentive when computers are in their study programmes so as to remain relevant in the rapidly changing condition for educational services (Salau, 2012). In this study, a research regarding the use of ICT and its influence on students' academic performance and learning outcome was provided. For many years, educational researchers have maintained an interest in the effective prediction of students' academic achievement at school. Societies all over the world strive to achieve quality education for her citizenry. In order to achieve this noble course, so many factors must be put into consideration. Among them is the introduction of ICT into education particularly at classroom level a result of

technological development. We are in the world of digital age where ICT needs to be introduced into classrooms to enhance learning and develop students' digital experience. Students' learning behavior and understanding have been the issue in many research studies as teachers have been observed complaining of the difficulties involved in classroom management practices due to lack of concentration by the students. This greatly affects the teaching-learning process. It is believed that proper use of ICT will foster learning and motivate students to come to class and engage in classroom activities. For instance, Youseff and Dahmani, 2018, is of the view that the use of ICT in education will allow for a shift from teacher-centered approach to student-centered approach thereby improving teaching and learning. Evidence exist to suggest that different teaching delivery styles can have different degrees of success as measured in terms of academic performance or achievement. In relation to online teaching, a growing number of studies have contended that e-learning improves students' performance in education. These studies claim that ICT have a potential to innovate, accelerate, enrich and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthen teaching and helping schools change (Alkhalaf, Drew and AlHussain, 2012). The potential of elearning to significantly affect education in a developing country like Nigeria is thus significant. For example, Osunade, Ojo and Ahisu, (2019), in their research work, reported that the use of e-learning has the following significant effect on the students: (i) has an edit effect in terms of quality of student work and practical examples through visualization; (ii) improves language skills through visualization; (iii) equalizes individual differences and particularly has dramatic effects for students with special needs; (iv) facilitates self-pacing with increased capacities to deal with individual learning styles, as students can work at their own pace and intensity suitable to their needs; (v) enables collaborative learning with

little indication of the isolated learner amongst other advantages. According to Barker and Wendel (2011) students in virtual schools showed greater improvement that their conventional school counterparts in critical thinking, researching, using computers, learning independently, problem-solving, creative thinking, decision-making, and time management. A study by Calderoni (2018) revealed that academic advantages over traditional classroom instruction were demonstrated by students in Mexico's Telesecundaria program, who were "substantially more likely than other groups to pass a final 9th grade examination" administered by the state; by students taking a chemistry by satellite course (Dees 2014); and by students learning reading and math via interactive radio instruction (Yasin and Luberisse 2018). Kearsley (2020) noted that given instruction of equal quality, groups of students learning online generally achieve at levels equal to their peers in classrooms. Equality between the delivery systems has been well documented over decades for adult learners. Evidence to date convincingly demonstrates that when used appropriately, electronically delivered education— 'e-learning'— can improve how students learn, and can deliver high-quality learning opportunities to all children" (National Association of State Boards of Education, 2011). On one hand, it is noted that e-learning is at least as effective as traditional instructional strategies (Rosenberg, Grad and Matear, 2013), and that there are no major differences in academic performance between the more traditional and more technology-oriented modes of instruction (Cavanaugh, 2011). Other studies however, find that greater online teaching has a negative impact on performance (Johnson, 2015). For instance, Adeyemi (2011) is of the view that despite the claims that e-learning can improve the quality of education, making materials available online results in improved learning results only for specific forms of collective assessment; resistance to change from traditional pedagogical methods to more innovative, technology-based teaching and learning methods by both students

and teachers; lack of qualified personnel; inadequate ICT infrastructure as a result of underfunding. Abulibdeh, and Hassan (2011), were also of the view that e-learning makes learners undergo contemplation, remoteness and lack of interaction or relation, making it require strong inspiration and skills to the management of time so as to reduce such effects. They also found that clarifications, offer of explanation and interpretation is less effective in e-learning; deteriorate institutions', teachers' role and several other identified challenges. Identifying the actual impact of e-learning on students, schools and the wider environment when put to use is actually difficult because of its newness and diversity of the programmes and the complexity of factors affecting outcome, measuring of its impact is an emerging issue and closely related on how the technology is used as an educational tool and other factors.

The prediction and explanation of academic performance and the examination of the factors relating to the academic achievement are topics of greatest importance in different educational levels. Studies have shown that prior academic performance is an important predictor of performance at various levels of education. Students' performance remains one of the key determinants of the success of any technological innovation and initiative in any school and their academic performance and attitudes towards computers are suggested as having an influence on their use of e-learning tools. As ICT are being increasingly used in education, the need to monitor their impact on students' academic performance is ever more needed. This is because it is quite important to show the relationships between technology use and students' academic performance. There is also a need to show that education should be seen as using technology not only as an end in itself, but as a means to promote creativity, empowerment and equality and produce efficient learners and problem solvers. Many academic researchers have tried to answer this question at theoretical and empirical levels. But as ICT entails evolving technologies and

their effects are difficult to isolate from their environment, the relationship between the use of e-learning tools and student educational performance is unclear, and contradictory results are presented in the literature (Youssef and Dahmani, 2018) as explained earlier. The ability to effectively manage learning time is an important element in of electronic learner success (Kearsley, 2020). Palloff and Pratt (2019) hinted that interacting in a Web-based course can require two to three times the amount of time investment than in a face-to-face course. Roblyer (2019) pointed that students who have difficulty managing time are more likely to achieve less in a distance course or drop out altogether. Gibson (2018) equally mentioned that a key construct relating to distance learners' persistence is their self-efficacy for learning at a distance and that personal perceptions of competence (self-efficacy) are related to learners' perceptions of their ability to manage time effectively. Studies also suggest that student academic performance may be affected by both engagement effects and learning-style effects. Carini, Kuh, and Klein (2016), found that, although in general, the relationship between engagement and performance is complex; engagement is positively correlated with student performance. Their conclusion is supported by a number of empirical studies: Rodgers and Ghosh (2011) identified that 'effort' (or engagement) levels were highly significant in determining student examination performance though Davies and Graff (2015) study made in an e-learning context found that online engagement had no statistically-significant impact on examination performance. Other studies in this area have examined the issue of what determines the amount of time that a student spends on e-learning. Arbaugh (2020) is of the opinion that 'time' will depend on the student's attitude to the perceived usefulness, and also the ease of use, of this delivery medium. It is suggested that students who spend more time on internet-based courses tend to be the ones who take more ownership of the learning process, and as a consequence receive the greatest learning benefit

(good performance as measured by grades). From this, it can be inferred that we might expect to find a significant, and positive, relationship between the level of e-learning engagement and academic performance as students who use their time efficiently are more likely to learn and/or perform better than students who do not have good time management skills. Zimmerman and Risemberg (2017) opined that self-regulated learners know how to manage their time because they are aware of deadlines and how long it will take to complete each assignment. They prioritize learning tasks, evaluating more difficult from easier tasks in terms of the time required to complete them. They are aware of the need to evaluate how their study time is spent and to reprioritize as necessary.

Research Questions

The following research questions were raised to provide answers sought in this study:

1. What is the level of students' Utilization of E-Learning Tools for Learning data structure?
2. What are the effects of E-learning Tools and Students' Academic Performance in data structure?

Methodology

The study adopts descriptive survey research method as the research design. A survey method for this study is quite appropriate in the measurement of respondent's opinion on the issue related to e-learning tools and students' academic performance. Likert-type items on a five-point scale for closed-ended questionnaires was employed to measure the respondents' perceptions on various issues relating to e-learning tools and students' academic performance in Data structure. The population for the study comprises of all the Computer Science students in south south Nigeria. To arrive at the appropriate sample size for the students to be selected as respondents,

Yamene's formula was applied. Thus, three hundred and thirty (330) students were selected as samples among six randomly selected universities. Data was collected with the use of questionnaire administration. The questionnaire was structured into two main parts. The first part focused on the demographic characteristics of the respondents. The second part focused on twenty-item questions related to issues of e-learning and students' academic performance. These were formulated as to provide answers to the research questions. Three hundred and thirty (330) copies of questionnaires were administered across universities in south south Nigeria. In measuring of the respondents' opinions as expressed in the questionnaires, Likert rating scale of five points was employed. Saunders, Lewis and Thornhill, (2000) assert that the Likert-style rating method of questionnaire design enables researcher to determine the views of the respondents on how they agree or disagree with a series of statements. It also has the advantage, in that, it enables numerical value to be assigned to cases for easy quantitative analysis (Zinberg, Revelle and McDonald, 2006). The researchers-designed questionnaire was validated by experts which involved two senior lecturers in the Faculty of Education and Department of Computer science in University of Uyo for vetting, correction and approval. The reliability of the instrument was measured by performing a reliability test using Cronbach alpha test to check the consistency and accuracy of the measurement scales. A reliability coefficient of 0.71 was obtained, indicating questions in each construct are measuring a similar concept. The questionnaire was administered with the help of research assistants to the respondents in the selected universities. The respondents were given a twenty four hours period to fill the questionnaire so as to allow for proper reflection on the options before being filled. All completed questionnaires were collected and collated for data analysis. The study used both qualitative and quantitative analysis of data in determining the relationship of variables involved

in the study. The data obtained from the field were presented using descriptive statistics (frequency distribution analysis, FDA i.e. Frequency Count). The responses to the questionnaire administered showed that a total of three hundred and thirty (330) copies of questionnaire were administered to the respondents. Two hundred and eighty-eight (288) copies of the questionnaire representing 87.3% were returned and considered fit for the study. This implies that majority of the respondents positively responded to the questionnaire, making it adequate the study.

Results

Research Question 1

What is the level of students' Utilization of E-Learning Tools for Learning data structure?

Table 1: percentage response of student utilization of e-learning tools for learning

S/N	Statements	SA (%)	A (%)	UD (%)	D (%)	SD (%)
1.	E-learning tools are readily available in computer science department for learning data structure	40 (13.9)	22(7.6)	14(4.9)	79(27.4)	133(46.2)
2.	I use educational blog for class interaction in data structure	61(21.2)	39(13.5)	21(7.3)	65(22.6)	102(35.4)
3.	Students read ebooks and ejournals to enhance academic performance in data structure.	12(4.2)	38(13.2)	14(4.9)	81(28.1)	143(49.7)
4.	Students process data structure assignments with the computer	23(8.0)	17(5.9)	11(3.8)	85(29.5)	152(52.8)
5.	Students use elearning tools for studying data structure	33(11.5)	22(32.2)	16(5.6)	93(7.6)	124(43.1)

Table 1 shows that 73.6% of the respondents affirmed (disagreed) that elearning tools are not available in computer science department for learning data structure; 58% disagreed, 7.3% of the respondents were undecided and 35.6% agreed that they do not use educational blogs for data structure class interaction and; 77.8% of the students agreed that they do not read e-books and ejournals to enhance academic performance in data structure. Also, 82.3% of the students do not

process data structure assignments with the computer. 3.8% of the respondents were undecided while 13.9% of the students claimed that they process assignments with the computer. The table further shows that 75.3% of the students do not use e-learning tools for studying data structure. 5.8% of the respondents were undecided while 19.1% say they use e-learning tools for studying data structure.

Research Question 2

What are the effects of E-learning Tools and Students' Academic Performance in data structure?

Table 2: percentage response of the effects of E-learning Tools and Students' Academic Performance

S/N	Statements	SA (%)	A (%)	UD (%)	D (%)	SD (%)
1.	E-learning tools are essential for students' academic performance in data structure	110(38.2))	76(26.4)	34(11.8)	27(9.4)	41(14.2)
2.	E-learning tools provide learning opportunities that enhance academic performance in data structure	113(39.2)	95(33.0)	21(7.3)	27(9.4)	32(11.1)
3.	E-learning tools improve students' organizational skills in data structure	116(40.3)	107(37.2)	18(6.3)	19(6.6)	28(9.7)
4.	E-learning tools promote students' self confidence in data structure	122(42.4)	101(35.1)	25(8.7)	19(6.6)	21(6.8)
5.	E-learning tools help students' link data structure concepts to examination demands	141(49.0)	82(28.5)	23(8.0)	17(5.9)	25(8.7)

Table 2 shows that 75.4% agreed that e-learning tools is essential for students' academic performance in data structure while 23.6 disagreed; 72.2% also agreed that e-learning tools provide learning opportunities that enhance academic performance in data structure. 20.5% disagreed and 11.1% were undecided; 77.5% agreed that it improves students' organizational

skills in data structure, 16.3% disagreed and 6.7% were undecided; that e- learning tools promotes students' confidence in data structure (77.5%) while 13.4% disagreed and 8.7% were undecided and; it was also observed that 77.5% of the respondents supported that e-learning tools help students link data structure concepts to examination demands, 7.4% disagreed and only 1.1% were undecided, implying that e-learning tools improved students' academic performance in data structure.

Discussion

It was found that that there is a positive and high level of the utilization of elearning tools and students' academic performance in data structure. This agrees with the study of Odhiambo, 2013. They found that the higher the level of utilization of e-learning tools, the better the students; academic performance. Lack of availability of e-learning tools in schools affects the use of e-learning tools (Adeyemi, 2011). Also, that resistance to change from traditional pedagogical methods to more innovative, technology-based teaching and learning methods by both teachers and students makes utilization of e-learning tools low (Adeyemi, 2011).

The study also found that E-learning tools is perceived to help in improving student's study skills in data structure; it provides students with some of the prerequisite skills for academic preparedness; ensure that students learn independently thereby improving students' confident and encourage students' data structure class participation. The results from the study indicate that e-learning tools is essential for students' academic performance in data structure, provide learning opportunities that enhance academic performance and improves students' organizational skills as observed by Odhiambo, (2013); Baker and Wendel, (2001) in their studies.

Conclusion

This study examined the effect of e-learning tools on student's academic performance in data structure. The study shows that e-learning tools are essential for enhancing students' academic performance in data structure, because it encourages students' data structure class participation, ensure that students learn independently which boost students' confidence and provide learning opportunities that enhance academic performance in data structure. Therefore, the study conclude that students use of e-learning tools have significant effect on their academic performance in data structure. Thus, it is affirmed that e-learning tools would significantly promote students' interest in the learning content, make learning easy for students, allow students to apply skills and knowledge gained practically and motivate students towards better academic performance. Moreover, effective usage of e-learning tools would equally help in improving student's study skills, provide students with some of the prerequisite skills for academic preparedness, help students to link academic subjects to examination demands and improve students' organizational skills. eLearning is a new and innovative way of learning that is more cost efficient than some traditional learning strategies and allow students to better control the process of learning because they can decide when, where and how fast to learn.Its emergence (e-leaning) has significantly transformed information-handling and management in academic environments. its use in our secondary school system will go a long way in improving student-teacher, student-student interaction thereby promoting quality learning.

Recommendations

Integration, proper and effective utilization of e-learning tools in the teaching and learning process will bring about benefits in the academic and non-academic field to both the students and teachers. Therefore, in line with the findings of the study, the following recommendations are made:

1. The use of e-learning tools should be encouraged across all the universities so as to improve students' academic performance significantly.
2. The institution management and education development board in the state should as a matter of necessity put more e-learning facilities and equipment in place providing solutions to specific problems of curricula. The management of secondary schools and government agency(ies) in charge of secondary schools' development should recognize the impact and applicability of e-learning tools to enhance qualitative and quantitative decision-making in the successful academic output.
3. Lecturers should orientate and encourage the students towards the use of e-learning tools in the classroom and also encourage the use of social media website that focus on promoting teaching and learning.
4. Students should also help themselves by utilizing the mobile technologies majorly for academics.

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