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Full Length Research

Influence of modern technology in learning Physics Education in the University of Cross River State, Nigeria

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ABSTRACT: The study is on the influence of using modern technology in learning physics education in Universities: A case study of the Department of Curriculum and Instructional Technology, University of Cross River State, Nigeria. Two research questions and two research hypotheses were formulated. A descriptive survey research design was adopted for the study. No sampling technique was used for the study. The entire population constituted the sample for the study, as the population is manageable. The study involved all 63 Physics Education students from 100 to 400 levels in the study area for the 2023/2024 academic session. A 20-item researcher-drawn instrument titled; Questionnaire for Influence of Modern Technology among Physics Education Students was used to elicit responses from the respondents. A four-point Likert scale was used for the response options. Pearson Product Moment Correlation was used to determine the reliability of the instrument after a test-retest of the instrument was done. A reliability coefficient index of 0.89 was obtained. Data collected was analyzed using mean, standard deviation and simple linear regression. The results obtained show that: computer usage significantly influences physics education students in their learning, and smartphone usage significantly influences physics education students in their learning outcome. It was recommended that: The University of Cross River State management should prioritise digital literacy among physics education students by promoting digital literacy education. Also, lecturers of the Department of Curriculum and Instructional Technology can be made to use education apps, and online platforms to enhance students' learning and promote individualisation of learning among physics education students.

Keywords: Modern technology, physics, physics education, computer, smartphone.

INTRODUCTION

Technological development has brought about great benefits to the life of man, especially in the teaching and learning area. The use of modern technology in the educational field has eased the workload of teaching and enhanced growth, progression and understanding in learning. Students can also learn on their own when these technologies are available to them, thereby increasing their capabilities. A smartphone is a cellular telephone with an integrated computer and other features not originally associated with telephones, such as Operating System (OS), web browsing and the ability to run software applications (TechTarget, 2024). The use of smartphones and computers in learning among Physics Education students has made learning more flexible, and easy and has reduced the inherent conventional learning method (Valk *et al.,* 2010). Students are able to access information faster from anywhere they are. The mobile technology has also helped to download information to the advantage of students and lecturers in school settings. With the growth of modern technologies, there is a significant change in how teaching and learning occur in schools. Abstract concepts are brought to life with more clarification since the internet-enabled devices incorporated into computer applications and software are among the eminent breakthroughs in this present dispensation (Foens and Nor, 2017).

Research from Advanced Placement Human Geography (2024) shows that modern technology refers to

the advanced tools, devices and systems that have been developed in recent years. It encompasses a wide range of technological innovations such as smartphones, social media platforms and Global Positioning System (GPS) navigation. The GPS navigation is a system that tells one the location of places. In Science Direct, modern technology refers to the convergence of computing and networking which empower users with decentralized control over advanced equipment and knowledge essential for its user. Modern technologies have a great impact on the teaching and learning process of physics education, they not only ease teaching but also enhance understanding and stimulate students' interest in learning, that is, if they are made available and put to use. Integrating them into the school curricula according to Sarker *et al.* (2019) improves students' learning outcomes across all educational levels and subject areas. Their use in schools helps students to be better prepared for learning and improved job prospects and a brighter future ahead.

Modern technology used in teaching involves smart-phones, computers and tablets. They are already present in the everyday life of a student and teachers alike. Their use helps to explore and create meaningful learning experiences for students (Drexel University School of Education). Utilizing different types of technology in the classroom, including a virtual classroom, creates learners who are actively engaged with learning objectives. For the purpose of this study, only the use of smartphones and computers is considered since they are the mostly and commonly used devices by both students and lecturers in schools.

Physics is a subject taught at high school and college level primarily by the lecture method together with laboratory exercises aimed at verifying concepts taught in the lecture. Physics as one of the arms of science is considered one of the fields of knowledge underlying the physical universe and applies continuously to people's ordinary lives. It tells more about everything in life (Samaila *et al*., 2021). Teaching physics according to Akimkhanova *et al*. (2020) is an interesting and complex field requiring constant research; such that the application of modern technology can increase interest in the study of the subject, and expand the possibilities of demonstrating experiments through virtual images. The researcher further contends that teachers have a unique opportunity to make a lesson more interesting, visual and dynamic by using information and communication technology (ICT) in the educational process. Physics education plays a vital role in shaping the future of Nigeria by equipping students with the necessary skills for scientific research and technological development. Physics education is aimed at developing pedagogical techniques and strategies that help students learn physics more effectively and help instructors implement these techniques.

Integration of technology in physics education is transforming teaching methods and learning experiences, offering a dynamic approach to understanding complex concepts that traditional methods struggle to convey effectively (Faresta *et al*., 2024). The researchers further explained that the introduction of technology into educational practices presents the opportunity to revolutionize physics teaching and learning and cater to different learning styles allowing for a more personalized educational experience. According to Jegede and Adedayo (2013), physics education is a major factor in enhancing technological development that provides basic literacy in Physics for functional living in society. Similarly, research by Naija scholar (2024) shows that physics education fosters critical thinking and problem-solving skills since advancement in physics leads to technological innovations and economic growth.

Ellermeijer and Tran (2019) contend that technology applied in physics education clearly demonstrated that it can help to make physics education more relevant, more linked to real life, and more authentic and can increase the opportunities for their own investigations by students. Modern technology has added value to teaching.

A computer as defined by TechTarget is a device that accepts information and manipulates it for some result based on a sequence of instructions on how data is to be processed. This includes the means of storing data for some necessary duration. The computer can be used for many functions, that is, as a calculator, browsing information on the net, sending and receiving messages, enabling communication through e-mail, video calls, taking pictures as well as connecting people globally. The computer and internet give endless possibilities and resources in improving the quality of work, the computer skills in education create great opportunities for teachers and inspire curiosity, imagination and interest of students (Murati and Ceka, 2017).

A study on the use of e-learning at higher educational institutions in Bangladesh on opportunities and challenges was carried out by Sarker *et al*. (2019). Their study critically examined the suitability of implementing effective e-learning through Learning Management System (LMS) at tertiary educational institution involving both students and teachers. Using a mixed method technique, data were collected from both students and their course teachers after administering questionnaire. The result shows that e-learning has been well accepted by most of the students as they are found routinely spending time on the LSM on regular basis for watching lecture video, viewing course information, reading posting of the fellow students in the forum. The constraints of the finding also indicate that learning materials poorly designed do not allow much interaction between students and lecturers. The study also indicates some problems such as poor internet connec-tivity which then restrict access to e-learning platforms. The researchers recommended that stakeholders and policy makers should request teachers and students to make proper use of e-learning.

A study by Ifeanyi and Chukwuere (2018) was carried out to investigate the impact of using smartphone on the

academic performance of undergraduate students at the North-West University, South Africa. The study employed a quantitative research approach. A random sampling technique was used to select respondents for the study. From a target population of 11,499 students, a sample size of 375 students was randomly selected. These students were given questionnaires which were all collected and analyzed. The research employed a quantitative research method. Results shows that; most undergraduate students are using their smartphones to engage with fellow students and lecturers, using smartphone distracts students from their studies in certain aspects. It was also found that, using smartphones shows academic capabilities and progression in students learning. The researchers are of the view that smartphone have been of great help to students' academic progression, while in some cases it has been a form of distraction to students' learning. From the study, it can be seen that though smartphones have their positive part by bringing about progression in learning, and its negative part by impairing learning when not properly used.

A study conducted by Oludare *et al*. (2021) on the impact of information and communication technology in teaching and learning of science subjects in Nigeria secondary schools aimed at ensuring that teaching and learning is reversed from highly teacher dominated to student instruction. The study sought to look into the impact of ICT in science subjects teaching and learning. Questionnaire was administered to teachers from 3 senatorial districts of Ondo State using a multistage sampling technique. Simple random and purposive sampling method were used to select sample for the study. Three research questions and three research hypotheses guided the study. The study employed a descriptive research design. The hypotheses were validated using PPMC statistics, at 0.05 significant level, the SSPS version 20 and frequency counts percentages were used to analyse data. The population comprises of all senior secondary school science teachers. A total of 15 schools were selected for the study 5 each from the 3 senatorial districts, and 10 teachers were selected from each school, giving a total of 150 teachers used for the study. Results obtained indicate that; using ICT for teaching and learning enables both teachers and students' performance efficiently. Though the study is on secondary, but the use of ICT cuts across all levels of education and as such the finding can be generalized to cover undergraduates as well.

Understanding the influence of the use of modern technology in learning among Physics Education students in UNICROSS is therefore essential in improving their learning outcome. Modern technology can therefore be used to replace the gap in better understanding of concepts in learning of Physics Education in UNICROSS.

Purpose of the study

The purpose of this study is to find out the influence of modern technology in learning Physics Education in University of Cross River State. The study sought to:

1. Investigate the extent of the influence of using smartphone in learning Physics Education in University of Cross River State.
2. Determine the extent of the influence of using computers in learning Physics Education at the University of Cross River State.

The following research questions were asked to guide the study.

1. To what extent does the use of smartphones influence students' learning of Physics Education at the University of Cross River State?
2. To what extent does the use of computers influence students learning of Physics Education at the University of Cross River State?

The following null hypotheses were formulated to guide the study and were tested at a 0.05 level of significance:

H_{01}: The use of smartphone does not significantly influence students learning of Physics Education in the University of Cross River State.
H_{02}: The use of computers does not significantly influence students learning of Physics Education in University of Cross River State.

METHODOLOGY

Design of the study

This study adopted a descriptive survey research design. The design according to Nworgu (2015) is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. Nworgu noted that descriptive survey studies aim at collecting data on, and describing in a systematic manner the characteristics, features or facts about a given population. This design is considered appropriate because the researcher intends to collect and analyze data on the group of physics education students in UNICROSS to ascertain the extent to which modern technology influences students learning of Physics Education in UNICROSS.

Area of the study

The study was conducted at the University of Cross River State (UNICROSS). UNICROSS is chosen for this study because physics students at UNICROSS make use of modern technology (smart phones and computers) but the extent physics students use these smart phones and computers to learn Physics Education in UNICROSS is not yet known.

Population of the study

The population of the study consisted of all 63 students in the Physics Education unit of the Department of Curriculum and Instructional Technology, UNICROSS. It covers year 2 to year 4 students of the 2023/2024 academic session. Year 2 = 16 students, year 3 = 27 students, and year 4 = 20 students (Personnel Department of UNICROSS).

Sample and sampling technique

All the sixty-three (63) Physics Education students of the Department of Curriculum and Instructional Technology, UNICROSS constitute the sample. Therefore, no sampling process was carried out as the entire population constituted the sample for the study. This is because the population is manageable.

Instruments for data collection

The instrument that was used for data collection for this study is a questionnaire titled “Questionnaire for Influence of Modern Technology among Physics Education Students” (QIMTPES). The instrument is divided into two sections; section A and B. Section A contains demographic information of the respondents (Physics Education Students) such as gender. Section B is made up of two clusters C_1 and C_2. Clusters C_1 comprises of a 10-items instrument structured to illicit information on influence of smartphone usage among Physics Education students while, Cluster C_2 also comprises of a 10-items instrument structured information on influence of computers usage among Physics Education students. The responses were designed on a four-point Likert scale of very high extent (VHE), high extent (HE), low extent (LE) and very low extent (VLE) to determine the influence of using modern technology in learning among Physics Education students in UNICROSS. The instrument was validated and has a reliability coefficient of 0.89 through test retest method of determining the reliability. The statistical tool employed was Pearson Product Moment Correlation.

Data collection

The researcher administered the questionnaires to all the Physics Education students in UNICROSS. The responses collected from the respondents were subjected to further analysis.

Data analysis

The research questions were answered using mean and standard deviations. The mean value of 2.50 was used as a benchmark for the decision, while the null hypotheses were tested using simple linear regression analysis at a 0.05 level of significance

RESULTS

Research Question One: To what extent does the use of smartphones influence students' learning of Physics Education in UNICROSS?

Table 1 shows respondents' mean and standard deviations on the extent the smartphone use influences students' learning of Physics Education in university. The results obtained show that items 1, 2, 4, 5, 7 and 8 had mean ratings of 2.65, 3.04, 2.78, 3.01, 3.01 and 3.00 with standard deviations of 0.86, 0.93, 1.27, 0.96, 0.90 and 0.65, respectively. These mean values are above the benchmark value of 2.50 which implies a high extent. This means smartphone use influences students learning Physics Education in UNICROSS to a high extent. These include: Smartphones enhance my understanding of complex Physics concepts through educational apps, I use my smartphone to access online Physics tutorials, which improves my learning, smartphones help me collaborate with classmates on Physics projects and assignments, My smartphone use for social media during study time reduces my focus on Physics assignments, smartphone-based educational games and simulations make learning Physics more engaging for me, and I rely on my smartphone for quick access to Physics formulas and references during study sessions. However, using a smartphone during Physics practicals does not enhance my understanding of experiments, the availability of Physics-related e-books on my smartphone does not support my learning, smartphones distract me during Physics lectures, affecting my learning negatively, and the use of smartphones in Physics Education does not help me in solving Physics problems more efficiently are in low extent, this is because their mean values are below the benchmark value of 2.50 which implies low extent. The cluster mean rating of 2.57 with a standard deviation of 0.86 showed that the use of smartphones influences students' learning of Physics Education at UNICROSS to a high extent.

Hypothesis One: The use of smartphones does not significantly influence students' learning of Physics Education at UNICROSS.

The result in Table 2 showed the simple linear regression analysis of the influence of the use of smartphones on students learning Physics Education in UNICROSS. The result showed that the regression coefficient for the use of smartphones was 0.716 and significant at $p<0.05$ level.

Table 1. Mean and standard deviation of respondents on the extent to which the use of smartphone influence students learning of Physics Education in UNICROSS (N = 63**)**.

S/N	Item Statement	Mean ($\bar{x}$)	SD	Dec.
1	Smartphones enhance my understanding of complex Physics concepts through educational apps.	2.65	0.86	HE
2	I use my smartphone to access online Physics tutorials, which improves my learning	3.04	0.93	HE
3	Using a smartphone during Physics practical does not enhances my understanding of experiments	2.14	0.88	LE
4	Smartphones help me collaborate with classmates on Physics projects and assignments	2.78	1.27	HE
5	My smartphone use for social media during study time reduces my focus on Physics assignments	3.01	0.96	HE
6	The availability of Physics-related e-books on my smartphone does not supports my learning	2.02	0.37	LE
7	Smartphone-based educational games and simulations make learning Physics more engaging for me	3.01	0.90	HE
8	I rely on my smartphone for quick access to Physics formulas and references during study sessions	3.00	0.65	HE
9	Smartphones distract me during Physics lectures, affecting my learning negatively	2.19	1.05	LE
10	The use of smartphones in Physics Education does not help me in solving Physics problems more efficiently	2.19	0.78	LE
	Cluster mean	**2.57**	**0.86**	**HE**

Table 2. Regression summary for the influence of use of smartphone on students learning of Physics Education in UNICROSS.

Model	Source	Df	Sum of Squares	Mean Square	F	Sig.
1	Regression	1	8.788	8.788	55.376	0.000[b]
	Residual	61	9.681	0.159		
	Total	62	18.469			

Parameter estimate

Variable	B	SE	r^2	r^2 (adjusted)
(Constant)	0.876	0.285	0.476	0.467
Use of smartphone	0.716	0.096		

The coefficient of determination r^2 was found to be 0.476 the value revealed that the use of smartphones accounted for 47.6% of students learning Physics Education in UNICROSS. Table 2 also reveals a β weight of 0.876. The regression equation therefore is Y= 0.716x + 0.876. Besides, Table 2 revealed that analysis of variance for the regression data produced an F-value of 55.376 and significant at $p<0.05$ levels. Therefore hypothesis 1 is not retained. ($p<0.05$), this means that the result is significant. Therefore, the null hypothesis which stated that the use of smartphones does not significantly influence students learning of Physics Education in UNICROSS is rejected. The inference drawn therefore is that the use of smartphones significantly influences students learning of Physics Education in UNICROSS.

Research Question Two: How does the use of computers influence students' learning of Physics Education at UNICROSS?

Table 3 shows the mean and standard deviations of respondents on the extent the use of computers influences students' learning of Physics Education in UNICROSS. The results obtained show that items 11, 14, 15,16, 18, 19 and 20 had mean ratings of 3.01, 2.84, 2.70, 2.52, 3.03, and 3.00 with standard deviations of 0.88,1.18, 1.11, 1.04, 0.98, 0.63 and 1.01 respectively. These mean values are above the benchmark value of 2.50 which implies a high extent. This means that the use of computers influences students learning of Physics Education at UNICROSS to a high extent. These include: using computers helps me

Table 3. Mean and standard deviation of respondents on the extent to which the use of computers influences students learning of Physics Education in UNICROSS (N = 63).

S/N	Item Statement	Mean ($\bar{x}$)	SD	Dec.
11	Using computers helps me better understand complex Physics concepts through simulations and visualizations	3.01	0.88	HE
12	Using computers during Physics practical does not enhances my ability to analyze and interpret data	2.21	0.79	LE
13	Computers does not facilitate collaboration with classmates on Physics projects and assignments	2.36	0.62	LE
14	The availability of Physics software on my computer supports my understanding of experiments and theories	2.84	1.18	HE
15	Using a computer for non-academic activities during study time reduces my focus on Physics assignments	2.79	1.11	HE
16	Computer-based Physics simulations make learning more interactive and engaging for me	2.70	1.04	HE
17	I rely on computers for quick access to Physics-related research papers and study materials	2.52	0.98	HE
18	Computers distract me during Physics study sessions, negatively affecting my learning	2.44	0.88	LE
19	The use of computers in Physics Education improves my ability to solve Physics problems efficiently	3.03	0.63	HE
20	I use computers to access online Physics resources, which enhances my learning experience	3.00	1.01	HE
	Cluster mean	**2.69**	**0.91**	**HE**

Table 4. Regression summary for the influence of use of computers on students learning of Physics Education in UNICROSS.

Model	Source	Df	Sum of squares	Mean square	F	Sig.
1	Regression	1	12.946	12.946	142.987	0.000[b]
	Residual	61	5.523	0.091		
	Total	62	18.469			

Parameter estimate

Variable	B	SE	r^2	r^2 (adjusted)
(Constant)	0.422	0.216	0.501	0.596
Use of computers	0.861	0.072		

better understand complex Physics concepts through simulations and visualizations, the availability of Physics software on my computer supports my understanding of experiments and theories, using a computer for non-academic activities during study time reduces my focus on Physics assignments, computer-based Physics simulations make learning more interactive and engaging for me, I rely on computers for quick access to Physics-related research papers and study materials, the use of computers in Physics Education improves my ability to solve Physics problems efficiently, and I use computers to access online Physics resources, which enhances my learning experience. However, using computers during Physics practicals does not enhance my ability to analyze and interpret data, computers do not facilitate collaboration with classmates on Physics projects and assignments, and computers distract me during Physics study sessions, negatively affecting my learning are in a low extent, this is because their mean values are below the benchmark value of 2.50 which implies low extent. The cluster mean rating of 2.69 with a standard deviation of 0.91 showed that the use of computers influences students' learning of Physics Education in UNICROSS to a high extent

Hypothesis Two: The use of computers does not significantly influence students' learning of Physics Education in UNICROSS

The results in Table 4 showed the simple linear regression analysis of the influence of the use of computers on students learning Physics Education in UNICROSS. The

Table 4. Regression summary for the influence of use of computers on students learning of Physics Education in UNICROSS.

Model	Source	Df	Sum of squares	Mean square	F	Sig.
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	Total	62	18.469			

Parameter estimate

Variable	B	SE	r^2	r^2 (adjusted)
(Constant)	0.422	0.216	0.501	0.596
Use of computers	0.861	0.072		

result showed that the regression coefficient for the use of computers was 0.861 and significant at $p<0.05$ level. The coefficient of determination r^2 was found to be 0.501. The value revealed that the use of computers accounted for 50.1% of students learning Physics Education in UNICROSS. Table 4 also reveals a β weight of 0.422. The regression equation therefore is $Y= 0.861x + 0.422$. Besides, Table 4 revealed that analysis of variance for the regression data produced an F-value of 142.987 and significant at $p<0.05$ levels therefore hypothesis 1 was not retained. ($p<0.05$), this means that the result is significant. Therefore, the null hypothesis which stated that the use of computers does not significantly influence students learning of Physics Education at UNICROSS is rejected. The inference drawn therefore is that the use of computers significantly influences students learning of Physics Education in UNICROSS.

Summary of findings

From the data analysis and the interpretation of the results, the following findings emerged.

1. the use of smartphones influences students' learning of Physics Education in UNICROSS to a high extent. And that the use of smartphones significantly influences students learning of Physics Education at UNICROSS.
2. That the use of computers influences students' learning of Physics Education in UNICROSS to a high extent. And that the use of computers significantly influences students learning Physics Education at UNICROSS.

DISCUSSION

Research question one looked into the extent to which smartphone use influences students' learning of Physics Education at UNICROSS. The results indicated that the use of smartphones influences students' learning of Physics Education at UNICROSS to a great extent. The result from the test of hypothesis one indicated that the use of smartphones significantly influences students' learning of Physics Education in UNICROSS. This is consistent with the findings of Wang *et al*. (2019), who found that the use of smartphones significantly enhances students' learning in Physics by providing access to educational resources, interactive simulations, and real-time problem-solving tools. The study concluded that smartphones are highly effective in supporting students' understanding of complex Physics concepts. Cheung and Hew (2009) explored the use of smartphones in higher education and found that they significantly enhance students' learning experiences, particularly in science disciplines like Physics. The study concluded that smartphones provide students with convenient access to educational resources, facilitating better understanding and engagement in their studies. Also, Gikas and Grant (2013) examined the impact of mobile devices, including smartphones, on student learning in higher education. Their findings revealed that smartphones significantly support learning by enabling students to access information, collaborate with peers, and engage in interactive learning activities, particularly in technical subjects like Physics.

Research question two sought the extent to which the use of computers influences students' learning of Physics Education in UNICROSS. The results indicated that the use of computers influences students' learning of Physics Education at UNICROSS to a great extent. The result from the test of hypothesis two indicated that the use of computers significantly influences students' learning of Physics Education in UNICROSS. These findings are in line with the findings of Adegoke and Chukwuneke (2017). They reported that the use of computers significantly influences students' academic performance in Physics. The study highlighted that computers provide students with access to advanced simulations, modelling software, and online tutorials, which greatly enhance their learning experience and academic outcomes in Physics Education. Osakwe (2012) studied the impact of computer-assisted learning on students' achievement in Physics and found that the use of computers significantly improves students' understanding and retention of Physics concepts. The study highlighted that computers provide interactive simulations and tutorials that greatly enhance the learning

process. Also, Akpan and Andre (2000) investigated the role of computer simulations in Physics education and found that students who used computers for learning Physics showed significantly higher achievement than those who did not. The study emphasized that computers facilitate a deeper understanding of complex Physics concepts through visual and interactive learning.

The finding of the first hypothesis, that is, the use of smartphones does not significantly influence the learning of Physics Education revealed that there was a significant influence of students learning of Physics Education in UNICROSS. The finding agrees with Ifeanyi and Chukwuere (2018) who found that the use of smartphones by students not only distracts them from their learning but also helps them in the progression of their learning process.

The finding of the second hypothesis, that is, the use of computers does not significantly influence learning of Physics Education revealed that there was a significant influence of students learning of Physics Education in UNICROSS. The finding is in agreement with that of Oludare *et al*. (2018) whose results show that; using ICT for teaching and learning enables both teachers and students to perform efficiently. Though the second review is on ICT, it should be noted that computer is also part of ICT.

Conclusion

From the findings of this study, smartphones are useful educational tools in the classroom, especially when studying difficult subjects like physics. Additionally, computers are crucial resources for improving physics learning outcomes because they give students engaging and interactive learning opportunities.

Computers and smartphones both have a significant impact on what UNICROSS students learn about Physics Education. Students' comprehension and recall of physics ideas seem to be much enhanced by the use of these technologies in the educational process. This emphasizes how crucial it is to use technology in teaching methods in order to facilitate and improve student learning.

The need for ongoing and increased technology integration into the educational curriculum is highlighted by the considerable impact that computers and smartphones have on students' learning outcomes. In order to fully reap the rewards of these resources, educational establishments must guarantee that students have the digital literacy skills they need, train teachers in the efficient use of digital technologies, and offer sufficient access to technology.

Recommendations

1. The University of Cross River State management should prioritise digital literacy among Physics Education students by promoting digital literacy
2. Lecturers of Curriculum and Instructional Technology can be made to use educational apps, and online platforms to enhance students' learning and promote individualisation of learning among Physics Education students.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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