International Journal of
Entrepreneurial Development, Education and Science Research
p-ISSN: 2360-901X | e-ISSN: 2360-9028

IJEDESR

July, 2023
Vol. 7, No. 1

Effect of Computer Drill and Practice Techniques on Senior Secondary School Student's Academic Achievement in Mathematics at Sokoto State in North Western Nigeria

[1]Aisha Dan Iya Sulaiman & [2]Mode Marafa

[1]School of General Education Department of Educational Foundations, Shehu Shagari College of Education Sokoto
[2]Department of Curriculum and Instructions, Shehu Shagari College of Education Sokoto

Article DOI:
10.48028/iiprds/ijedesr.v7.i1.08

Keywords:
Computer Drill, Practice Techniques, Secondary School Student, Academic Achievement, Mathematics

Corresponding Author:
Aisha Dan Iya Sulaiman

Abstract

This study investigated the effect of computer drills and practice techniques on senior secondary school students' academic achievement in mathematics at Sokoto State in North Western Nigeria. The study used a pre-test post-test control group quasi-experimental design on 200 senior secondary school students in the state. The population comprised all senior secondary school students offering mathematics as a compulsory subject in Sokoto State. Purposive sampling techniques and simple random sampling were used to select the sample. The instrument used for data collection in this study was Computer Based Instruction Mathematics Academic Achievement Test Scale (CBIMAATS). Data collected were analyzed using descriptive and paired sample t-tests. Findings from the study revealed that students' mean score in the post-test using computer drill and practice (M = 58.90, SD= 15.45) is greater than the mean score of pre-tests (M = 47.63, SD=10.45). The study concluded that the use of the computer and the teaching package with the materials such as videos, slides, CDs, sounds and animations in teaching mathematics makes it possible to have an interactive lesson. Based on the findings, it was recommended that more attention should be accorded to the use of the drill-and-practice instructional package in the Nigerian school system.

TETF/DR & D/CE/COE/SOKOTO/IBR/2022/VOL.1 BACH 8:5/NO.01 SPONSORED BY TETFUND

Background to the Study

The academic achievement of secondary school students in teaching and learning Mathematics as a subject affects almost every aspect of human life (Martins, 2013). The social, economic, political, geographical, scientific, and technological aspects of human beings seem to centre around numbers. Mathematics appears to be a subject that determines individuals' functionality in any given society. It is an essential requirement in every field of intellectual endeavour and human development to cope with the challenges of life. It can also be seen as a vital tool in the study of a school subject since it cuts across the school curriculum. Fajemidagba, Salman & Ayinla (2012) considered Mathematics as a central subject and tool for the development of all scientific disciplines such as technology, astronomy, graphics, industry, and analytical thinking in everyday life.

Mathematics is therefore not only foundational to science but also to technology, which is the bedrock of modern development. It can therefore be deduced that Nigeria as a nation needs a strong secondary school mathematics orientation and achievement for her scientific and technological aspirations to sail through (Harbor-Peters, 2001). Mathematics is the basic science necessary to understand most other areas of education. Setidisho. (1996), emphasized that it is surprising that no other branch of science forms such a powerful force. The Science Teachers Association of Nigeria (STAN, 1992) has identified mathematics as a central intellectual field of technological societies. Odusoro (2002), submitted in his contribution that the knowledge of sciences remains superficial without mathematics. Mathematics is important for Science and Science is important to technology, which is very important in the world, therefore, for any nation to be relevant, such nation must not overlook the importance of mathematics in her educational system. This underscores the premium placed on the study of Mathematics as one of the core and compulsory subjects in the Senior Secondary school curriculum for the advancement of scientific knowledge.

This implies that mathematics enjoys a prominent position in the Nigerian school curriculum (Federal Republic of Nigeria, 2014). This, in turn, is expected to translate to students' performance at its best in the subject, especially in the external examinations, but the reverse is the case. This is seen from the result analysis of the WASSCE in both private and public schools in Sokoto State in mathematics presented above.

However, Karigi and Tumuti (2015), Ihechukwu and Ugwuegbulam (2016), Laleye and Ogunboyede (2023) among others attributed various reasons to poor performance in Mathematics, which include lack of frequent practice, poor mathematical background, laziness, inadequacy of teachers and poor method of teaching (Fajemidagba, Salman & Ayinla, 2012), fear of the subject and strictness (Jameel and Ali, 2016), negative attitude (Karigi and Tumuti, 2015). Furthermore, mathematics phobia is an offspring of teachers' method of teaching, teacher-student relationships, and the use of abusive words on students (Ihechukwu and Ugwuegbulam, 2016).

Abdullahi & Sirajo (2020), in their study on the effect of resource factors and quality of instruction on performance in mathematics of Nigeria secondary school students revealed that there was a significant correlation between resource factors and academic performance of Nigeria secondary school students in mathematics. The researchers again found that there was a significant relationship between resource factors, quality of instruction, and Nigeria's secondary school students' academic performance in mathematics. Furthermore, class composition variable with respect to students' ability grouping also plays a crucial role in determining students' performance in mathematics. Students' ability grouping is the process of grouping all students in a classroom according to their academic achievement. The grouping is usually based on high, average and low average levels. According to Gamoran (1992), ability grouping is one of the most common responses to the problem of providing for student differences. He said that grouping has different effects in different circumstances. In selective high schools, Ireson et al. (1999) observed that students in upper groups received more attention and a resource, leading to higher levels of achievement, but this harms children in lower groups. In another development, Ireson et al. (1999) found that the performance of the best-performing students was unaffected by the change, while that of the lowest-performing students improved. He stressed that the ability range of the pupils in this study, however, it was restricted by the selective nature of the intake.

The global world has gone dynamic with the advancement in technology. There is application of technology in almost all human tasks and undertakings so much so that, as time goes by, the influence of technological development may render traditional skills inadequate and inefficient. Virtually, all aspects of human life such as communication, entertainment, fashion and even worship are complying with the trend in this era of technological advancement known as the computer age. Learning, as a process, is equally expected to move with the trend of technological development if the desired result must be achieved. Cepni*et al*. (2004) found that most students receive information from visual content sources, such as computers, which are very commonly used in their daily lives, making it more difficult to teach students in conventional ways. Where the principle of learning is taken into account; the richness of visual content makes education more sustainable and effective (Mudasiru and Adedeji, 2010).

Computer-assisted instruction utilizes computer and software applications to simplify concept teaching, learners' skills and improve instructions. It is an interactive strategy that presents instruction to encourage, motivate and transform abstract ideas into reality for learners' easy grasp of concepts. The strategy facilitates understanding and comprehension of subject matter and facts, addresses the needs of users and makes learners learn at their own pace (Ibrahim, 2012). The learning process is enriched with the use of graphics, texts, videos and sound. Topics are presented and the understanding of students is tested with computer-assisted programs that involve the use of drill practices, tutorials, problem-solving and instructional games and simulations. These instructional strategies can be used to tutor and facilitate students' skills and competence to perform better at a task. A tutorial is a computer program that engages and assists users in

learning. It is a strategy that provides information to students in the way and manner a human tutor does. Computer Tutorial can be learnt independent of time and place. Users are enabled to learn on demand and when motivated. Sessions could be skipped if learners are not beginners.

Data provided by the West African Examinations Council (WAEC) and verified and validated by the National Bureau of Statistics (NBS) for the year 2021 revealed that a total of 1.53 million candidates sat for the West African Senior School Certificate Examination in 2020, indicating a decline of 3.25% compared to 1.58 million in 2019. Of this, private and public schools recorded 707,478 and 830,756 candidates, lower compared to 710,552 and 879,431 respectively in 2019. By 2021, the total number of candidates who sat for the examination was 1.56 million; it shows an increase of 1.42% from 1.53 million in 2020. Out of this, 721,666 sat in private schools, indicating an increase of 2.01% compared to the preceding year, while 838,486 sat in public schools, showing an increase of 0.93%. This further shows a higher number of candidates in public schools than in private schools. Analysis by geo-political zone showed that the South-West recorded the highest number of candidates over the reporting period, followed by the South-South. Out of total number (male = 1,284, female = 1,090, total = 2,374), of secondary school students who sat for WASSCE in private schools in Sokoto state for the year 2021, (male = 1,259, female = 1,062, total = 2,321) students had 5 credits and above including Mathematics in private schools in Sokoto state. Out of the total number (male = 1,538, female = 618, total = 2,154) of secondary school students who sat for WASSCE in public schools in Sokoto state for the year 2021, (male = 1,087, female = 592, total = 1,679) students had 5 credits and above including Mathematics in private schools in Sokoto state (National Bureau of Statistics, 2022)

Mathematics as a subject requires great attention because success in it at the secondary level determines how far a student can go in further studies. This is because those students who fail to attain a credit pass might not gain admission into tertiary institutions. This poor performance is probably attributed to the lack of frequent practice on the part of students. Therefore, this study investigated the effect of computer Drills and Practice techniques on senior secondary school student's academic achievement in mathematics at Sokoto State in North-Western Nigeria.

Objectives of the Study

To explore how computer Drills and Practice techniques affect students' performance in mathematics in Secondary Schools.

Research Questions

How do Drills and practice techniques affect students' performance in mathematics in Secondary Schools?

Research Hypothesis

This study will seek to test the following research null hypothesis**:**

H_{01} Computer drill and practice had no statistically significant effect on students' academic performance in mathematics.

Literature Review

Computer tutorials are one of the approaches to computer-assisted programmes. It is the use of the computer for learning that allows the interaction of learners with the computer in a manner that ensures thorough learning and mastery of a specific concept compared to traditional teaching. Preferences for the computer tutorials are growing rapidly and providing teachers with a better option to collaborate with their students. There is growing interest and awareness among learners using online educational tutorials and software to study in different ways. Students structure and pace their patterns of learning and use skills and available resources to achieve learning objectives. Ampuch, Hiranrat, Pimbaotham and Singnam (2014), opine that the use of the computer helps to increase students' motivation as it plays significant roles in providing feedback such as 'correct', 'incorrect', 'ok', 'no', 'try again' to learners. The feedbacks enable students to correct faulty impressions of inappropriate knowledge already acquired. This tutorial strategy attempts to shift students from the traditional lecture form of instruction to a more innovative method of learning.

The most important value of computer tutorial is that it increases students' retention and comprehension of the courses. The computer tutorial is a self-paced, self-contained, and structured-content instructional unit that uses a hyperlink for videos and allows students to learn content without any teaching material except the computer (Udo and Etiubon, 2011; Shamsideen, 2015). The instructional program presents relevant information on concepts sequentially. It could be retrieved and studied for tests or examinations. This tutorial approach is used to teach concepts designed to allow learners to learn at their own pace and ability. Gambari and Yusuf (2015) posit that in computer tutorials, linear form or branching activities are used to present instructional tasks. In the linear form, students are provided activities with the same instructional sequence of information, an animation, a conclusion, review of the work; the computer asks questions and provides feedback. Since it is self-paced, it allows students to review materials if needed without slowing down the rest of the class. Learners engage the use of complex branching tutorials with alternatives depending on the mastery level of the learners (Swaminathan, 2012). More materials are covered with flexibility using the branching tutorial. Any branch can be selected and studied at any given time. The computer can review previously learned facts or select advanced work to engage with (Igweh, 2012).

Computer tutorials, an important strategy that can enhance students' achievement have simulation packages that provide animation tools for experiments that lessen production costs. Technologies teach more efficiently and faster in the form of lecture controlled system of what is presented to the learners. Students can better understand abstract concepts and become more active learners (Nadelson, Scagges, Sheffield and McDougal, 2015) when exposed to computer tutorial instruction. Udegbe (2010) observes that

students achieved significantly higher using computer instructional tutorial packages in probability than those taught using expository. Iyekekekpolor's (2013) study on computer tutorials and lecture strategies on students' achievement in science indicates that computer tutorials led to higher achievement among students than lecture strategies. Any science concept, therefore, may be taught with this approach to enhance learners' performance. Computer drills practice is another computer-assisted instruction used to facilitate learners' knowledge and understanding of science concepts.

Computer drill practice is a programmed instruction with a series of structured problems and exercises with the immediate provision of feedback to students' responses. It is a programmed instruction that presents practice items. This instructional package allows specific problem-solving by students and helps them obtain feedback on performance. The strategy involves the repetition of routine exercises, tasks and words to guarantee flawless performance. (Radhakrishnan, Raman and Haniffa 2018) note that drill practice is necessary to facilitate the learning of new content and assess previously learned content. Teachers and students are in touch with learning tasks, engage in creative information sharing, announce upcoming events, share contents of homework, note-taking, remind themselves of to-do-list, capture feedback, score and upload activities for further studies. Drill practice provides opportunities for the use of smart-friendly phones that enable teachers to access instructional activities anywhere they want. It saves teachers time in grading practice activities. Drill practice packages come in categories of activity-based flashcard websites like Quizlet or Study Blue that enable learners to create flashcards, practice their uses in sequence and also share with friends. Branching drills in the package allow students to engage in more challenging and advanced levels of questions after answering correctly a specified number. Distinctively high numbers of incorrect answers prompt the software to push students to lower stages of difficulty.

Several studies have reported the benefits of ICT-based activities (Dewiyanti*et al*., 2007 and Kilic-Cakmak, 2010). This includes improving communication and collaboration, the ability to provide more learning opportunities to geographically dispersed users, promoting active learning, and improving learner feedback processes. Particularly, one of the most important ICT-based learning activities is drill-and-practice which is the structured repetitive review of previously learned concepts to a predetermined level of mastery (Wiersma, 2000). Drills and practice software provide exercises in which students perform sample tasks, typically one at a time, and receive feedback on their correctness. Programs vary greatly in the type of feedback they provide in response to student input. Feedback can range from simple displays like “correct” or “incorrect,” “ok” or “no, try again,” to detailed animated displays or verbal explanations. Some programs simply present the next item if the student answers correctly.

Drill-and-practice is used as a means of teaching and perfecting skills or procedures. Mudasiru and Adedeji (2010), submitted that drill-and-practice, as an instructional package, entails the acquisition of knowledge or skill through systematic training

through multiple repetitions, rehearsing and practice that involves the repetition of specific skills. They posited that a typical drill and practice design involves four steps: a computer screen presents a student with questions to answer or problems to solve; the student responds; the student gets informed whether the answer is correct; if the response is correct, the student receives another problem to solve, but if otherwise, the computer displays the correction.

Several studies have been carried out in line with the study under review, either with the same or slightly different terminologies such as drill-and-practice, web-based practice, systematic practice and so on. These studies have pointed out that using the method has a positive effect on students' performance in comparison with traditional methods such as lecture method, monitor discussion and so on. Nguyen and Kulm (2005), used an innovative web-based practice instrument (WebMA) designed with randomized short-answer, matching, and multiple-choice items with automatically adapted feedback. Using middle school students in both fraction and decimal operations, they reported that the web-based group performed significantly better than the paper-and-pencil group. Gee, and Umar (2014) examined the impact of drill-and-practice courses on student performance and motivation in learning English. They opined that drill-and-practice activities as well as immediate feedback offered in the courseware helped the students to learn and understand better. Similarly, the study of Igweh (2012) revealed that students who were taught Basic Electronics with computer tutorials and drills performed better than those students taught with conventional teaching methods.

The class composition variable concerning students' ability grouping is envisaged to play a crucial role in determining students' performance, but studies have shown that class grouping plans have little or no effect. Rolstad *et al*. (2005) opined that higher-performing students have a higher affinity for study and therefore make greater progress in learning when separated from their peers. Grouping students according to ability level could make the slow learners develop a lackadaisical attitude towards their studies as a result of an inferiority complex which may set in, and may, in turn, hinder performance. In a study by Slavin (1990), using a method of best synthesis revealed that the effect of ability grouping on academic attainment was limited. The study compared ability-grouped classes with heterogeneous, mixed ability and grouping. He concluded that comprehensive grouping plans between classes had little or no effect and that the effect of grouping on achievement was essentially zero. Provided by studies using matched groups. Taken together, the median effect sizes for high-, average-, and low-performing students are +0.05, 0.10, and -0.06, respectively and are still very small. Isijola (2015) also found that comprehensive grouping schemes had little or no effect between classes, and ability grouping effects were essentially zero.

According to the National Policy on Education (NPE) of the Federal Republic of Nigeria (FRN, 2014), Secondary Education is the education which a child receives immediately after primary education to provide the students with diverse basic knowledge and skills for educational advancement. This suggests that for a student to experience any

educational advancement in mathematics as a subject, such a student must have been properly groomed at the elementary stage.

Roblyer and Doering (2013) suggested a four-step-by-step design to achieve a proficient result of drill practice including:

i. The computer screen presents questions and problems for students to attempt to answer.
ii. Students respond.
iii. Feedback is given by the computer to students on correct and incorrect answers.
iv. If the student is correct, the feedback will show, and the student will move to the next level of difficulty. If the student's response is wrong, the computer will show the student the accurate answer as feedback.

Azizi and Chu (2010), in the identification of drill and practice emphasize repeat activity of the facts or the efficiency gained. The need for drill practice enables students to attain a high level of skill mastery while ensuring their lasting value. Carrying out repeated exercises gives students added advantage to retaining the knowledge of what they have learnt. These guide and alert students for deep concentration as they carry out activities. Students use these ideas to help themselves make sense of science learning experiences. Computer drill practice offers closer, interactive and personal attention one may require for learning to take place. Engaging students with these devices encourage high-level participation and flexibility and help them become more creative at what they like doing for course selection and actualizing better performance. This gives promising input into science learning. A lecture strategy was also used in this study.

The lecture approach is a teacher-centred strategy that involves only the teacher doing most of the teaching activities while the students are either passive listeners that are minimally involved in the lesson. This approach uses talking and story-telling methods of teaching and the instructional strategy is chalk-talk and writes. This teaching strategy does not promote active and meaningful learning of science because it appeals to the senses of hearing only. Students' involvement in the teaching strategy is just to listen and sometimes take notes during the lecture, combine the information and organize it. The teacher does not recognize learners' differences to promote independent learning. A lecture strategy may result in covering a large number of topics in a single class period and make students develop listening skills. It is a straightforward process of imparting knowledge by the teacher to learners quickly. Teachers usually have greater control over what is being taught because they provide information on the topic only without involving the students (Kelly, 2015). It excludes the use of equipment and laboratory. A situation arises, where science teachers employ a lecture-chalk-talk instructional strategy in teaching cannot facilitate a robust learning outcome for the conceptualization of science knowledge and therefore, should be minimally used for instructions. Another aspect considered in the study is gender.

Gender is one of the factors that influence learners' achievement in sciences in senior secondary schools. Results have been inconsistent on gender in research over the years. Ugwuanyi and Nworgu (2014), report that male students tend to show more interest in numerically inclined subjects like the sciences than female students because they are intelligent, bold, tactful and aggressive and like problem-solving involving mathematics; while female students like reading and writing and do not get encouragement in science classes from the teachers but get negative comments about the kind of work/courses female learners should undertake. Mberekpe (2013) posit that gender imbalance exists in computer use, access, utilization, career and attitude. On the other hand, Gee and Umar (2014) show that female students are more significantly motivated than their male counterparts when learning using computer drills and practice software. Agboh (2015) observes that gender plays no significant effect when using computer-assisted instruction such as computer tutorials. Kang (2019), researched to understand the relationship between students' interest in science and perspectives for their future careers and found that under the same conditions, both genders perform equally well in science. John and Olatoye (2014) and Dama (2014) posit that the academic achievement of science students either male or female is not based on gender. If male and female students are exposed to the same quality material and resources for classroom instruction, and adequately engaged in a friendly-learning environment unbiased from stereotypes, they achieve equally.

Energy transformation in nature is a multidisciplinary concept that requires proper understanding by all students. It is the energy-changing process from one form to another. This process always happens within the individual and the environment around us. All energy is sourced from the sun. Radiant or solar energy from the sun is transformed into chemical energy by plants. This occurs during the process of photosynthesis. Photosynthesis purifies the environment by adding oxygen to it, otherwise, the atmosphere will be saturated with carbon dioxide released during respiration, decomposition and combustion (Herrman-Abell and Deboer, 2011). When food is consumed, chemical energy in food is utilized by the body and transformed into mechanical energy by doing work. It is involved in simple activities like; the conversion of gas and oxygen which is chemical energy to mechanical energy within the engine of a car to enable movement.

Methodology

The Quasi-experimental design of one group pre-test/post-test was used in the study to establish the effect of CBI on the student's academic achievement. A one-group pre-test post-test design is a quasi-experimental design where a group of respondents are tested before being exposed to an experiment, in this case, computer education and the scores of their performance before the experiment are compared with their scores after the experiment.

The study involves all senior secondary school students offering mathematics as a compulsory subject in Sokoto State. They were suitable for the study because they all offer

mathematics at O-level and computer studies. The total sample size of the study was 200 senior secondary school students. The study used a purposive sampling technique to select secondary school students who were offering mathematics as a compulsory subject. The study used a simple random sampling to select 200 participants from these students. The instrument used for data collection in this study was Computer Based Instruction Mathematics Academic Achievement Test Scale (CBIMAATS). The reliability and validity of the instrument were tested through content validity and face validity, the reliability of the instrument was calculated to be 0.85. The quantitative data were analyzed using descriptive and paired sample t-tests.

Results

The study tested the hypothesis based on the computer drill and practice (mathematics skills and competence). In testing the research hypothesis, a paired-sample t-test was conducted on the performance of the senior secondary school students, who were taught with the computer-based instruction methods. This was based on each element of the dependent variable (mathematics manipulative skills and competence). The test value was 50 marks indicating that the paired sample t-test was conducted against a hypothesized value of 50. Under this presentation, the respondents were requested to write the test in line with the major research hypothesis and the analysis focused on pairing the results of the pretest and post-test.

$H_{01:}$ **Research Hypothesis 1:** Computer Drill and Practice Has no Statistically Significant Effect on Student's Academic Achievement in Mathematics.

To test the first research hypothesis, data were collected and analyzed by using paired sample t-tests with average test scores for mathematics manipulative skills and competencies using computer drill and practice. The result of the analysis was presented in two tables, Table 1 and Table 2 paired sample statistics and paired sample test respectively.

Table 1: Paired Sample Statistics the effect of computer drill and practice on mathematics manipulative skills and competence

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-test	47.63	200	10.45	1.653
	Post-test	58.90	200	15.45	2.443

Source: Field Data

The tables 1 above, a Paired Sample Statistics table, provided information about mathematics manipulative skills and competencies using computer drill and practice, having established that there is a significant difference. A sample size (n) =200, the mean and standard deviation scores on the pre-test were (M= 47.63, SD =10.45) and the mean and standard deviation scores on the post-test were (M =58.90, SD =15.45). This meant that mean scores for mathematic manipulative skills and competence of the students

(58.90±15.45) and (47.63±10.45) revealed that the majority of students had reached the required pass mark score (50) in mathematics manipulative skills and competencies in the post-test.

However, the researcher was interested in knowing whether the mean score of the mathematics manipulative skills and competences of the students in both pre-test and post-test had reached the average mean of the required pass mark score in mathematics (which has a mean of 50), by running paired sample t-test.

Table 2: Paired Samples Test the effect of computer drill and practice on mathematics manipulative skills and competence.

		Paired Differences					t	df	Sig.
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-test – Pre-test	11.28	12.73	2.01	7.21	15.35	5.603	198	.000

Source: Field Data

From Table 2 a paired sample t-test was conducted to evaluate the effect of computer drill and practice on mathematics manipulative skills and competence scores. Table 2 revealed that student's mean score in the post-test using computer drill and practice (M = 58.90, SD= 15.45) is greater than the mean score of pre-tests (M = 47.63, SD=10.45). There was a statistically significant increase in mathematics manipulative skills and competence scores from (M = 47.63, SD=10.45) to*[*(M = 58.90, SD = 15.45), *t (39) =5.603, p=<.05(two-tailed)]*. The mean increase in manipulative skills and competence scores was 11.28 with a 95% confidence interval ranging from 7.21 to 15.35. *The eta squared statistics (47%) indicated a large effect size.* Considering this, it was therefore concluded that computer drill and practice positively affect students' academic achievement on skills and competence. The study found that the mean score of post-tests had reached the average mean of the required pass mark score in mathematics (which has a mean of 50). The study found that the average scores of the students were slightly higher than the scale test score. The test reached the hypothesized score which determined the significant effect of computer drills and practice in developing mathematics skills and competence in the students.

This finding is in line with Laleye and Ogunboyede (2023), who examined the effects of drill-and-practice instructional package on performance in mathematics and found a significant difference between the posttest scores of students exposed to treatment and the control group at 0.05 level of significance. Specifically, the students exposed to treatment had higher academic achievement compared to students in the control group. The implication of this is that treatment has helped to raise the cognitive development of the students, and this in turn has enhanced their academic achievement. This is because the treatment (drill-and-practice instructional package) entails the active engagement of

students and their frequent interaction with computers. This finding is also in agreement with Nguyen and Kulm (2005), Gee and Umar (2014) and Isijola (2015) who variously reported that web-based practice and/or drill-and-practice instructional packages enhance students' academic achievement.

Conclusion

The fundamental aim of this study was to investigate the effect of computer drills and practice techniques on senior secondary school student's academic achievement in mathematics at Sokoto State in North-western Nigeria. The study concludes that the use of the computer and the teaching package with the materials such as videos, slides, CDs, sounds and animations in teaching mathematics makes it possible to have an interactive lesson. It can also be concluded that the use of CBI has positive effects on the learners' problem-solving skills. In addition, the presentations of topics using rich visual materials increase the achievements of the students. The results of the study indicated that the use of the interactive learning package assists the learners in increasing their achievements.

Recommendations

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

1. All concerned stakeholders should pay more attention to the use of the drill-and-practice instructional package in the Nigerian school system especially at the senior secondary level of education.
2. The teaching strategy (computer-assisted instruction) of drill and practice, tutorial, instructional games and simulations should be put to use. To make this possible, the stakeholders should mandate all classes in secondary schools to be taught mathematics by computer operation in their school curriculum.
3. The responsibility of a teacher in guiding and helping students is crucial. Teachers should always be present to guide their students when CBI is used in teaching. This helps them to use the time allocated for their lesson or revision more effectively and efficiently. In addition, classes should be equipped with necessary ICT facilities to leverage the potential of ICT in the school. This should be accompanied by the use of CBI packages that involve animation with narration (AN) and animation with text (AT) to serve as a way of boosting students' achievements in mathematics.
4. Teachers should be trained in Computer Based Instruction so that they can teach their students well for better performance, especially in mathematics.
5. Students should have the opportunity to use computer software to gain knowledge and skills in using them appropriately. They should also take time to be familiar with construction software. It can be suggested that the period of "the computer" lesson may be increased so that senior three students could be able to interact more with a computer.

References

Abdullahi, U. & Sirajo, M. (2020). Effect of resource factors and quality of instruction on performance in mathematics of Nigeria secondary school students, *Journal of Mathematics Education, 5*(1), 61-69. http://doi.org/10.31327/jme.v5i1.1200

Agboh, C. I. (2015). Effect of Computer-assisted instruction technique on students' achievement in sciences in colleges of education in South East Nigeria, *Research Journal of Education, 6*(20), 52-59.

Ampuch, A., Hiranrat, W., Pimbaotham, N. & Singnam, T. (2014). Developing a computer-assisted instruction with drill-practice for Grade 6 Students, *International Journal of the Computer, the Internet and Management, 2*(2), 47-53.

Azizi, Y. & Chu, S. P. (2010). *Teori-TeoriPembelajaran", Teori-TeoriPembelajaran, UniversitiTeknologi,* Malaysia, 2010.

Cepni, S., Ozsevgec, T., Sayilkan, F. & Emre, F. B. (2004). The comparison of achievement levels of science teaching program students at two Universities. 1st edition, V, *International Science and Mathematics Education Congress Report,* Ankara, 1241–1246.

Dama, P. O. (2014). Effects of gender on students' achievement in secondary school biology, *Journal of Education and Practice, 5* (22), 99- 102.

Dewiyanti, S., Brand-Gruwel, S., Jochems, W. &Broers, N. J. (2007). Students' experiences with collaborative learning in asynchronous computer-supported collaborative learning environments, *Computers in Human Behavior, 23*, 496–514.

Fajemidagba, M., Salman, M. & Ayinla, L. (2012). Effect of teachers' instructional strategy pattern on senior school students' performance in Mathematics word problem in Ondo, Nigeria, *Journal of Education and Practice, 3*(7), 159–168.

Federal Republic of Nigeria (2014). *National policy on education*, Federal Government Press, Lagos, Nigeria,.

Gamoran, A. (1992). Synthesis of research/is ability grouping equitable? *Educational Leadership, 50*(2), 11–17.

Gee, Y. T. & Umar, I. N. (2014). The effects of drill-and-practice courseware on students' achievement and motivation in earning English. World academy of science, engineering and technology, *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering. 8*(12), 3812–3817.

Harbor-Peters, V. F. A. (2001). *Unmasking some aversive aspects of school Mathematics and strategies for averting them*, Inaugural lecture, University of Nigeria, Nsukka. Enugu: Snaap Press Ltd.

Herrman-Abell, C., & Deboer, G. (2011). *Investigating students' understanding of energy transfer and conversion of energy using standard-based assessment items*, Paper Presented at National Association for Research in Science Teaching Annual Conference, Orlando, FL.

Ibrahim, A. (2012). Strategies for effective use of audio-visual aids for teaching in Nigeria secondary schools, *Minna Journal for Educational Studies, 5* (1), 99-110.

Igweh, A., (2012). *Combined effects of computer tutorial and drill on senior secondary school students' achievement, interest*, Retention in Basic Electronics in Lagos State. Unpublished Ph.D. Thesis, University of Nigeria, Nsukka.

Ihechukwu, N. B. & Ugwuegbulam, C. N. (2016). Causes and solutions of mathematics phobia among secondary school students, *Research on Humanities and Social Sciences, 6*(20), 105–109.

Ireson, J., Hallam, S., Mortimore, P., Hack, S., Clark, H. & Plewis, I. (1999). *Ability grouping in the secondary school: The effects on academic achievement and pupils' self-esteem*, Paper presented at the British Educational Research Association Annual Conference, University of Sussex at Brighton, September 2–5 1999. http://www.leeds.ac.uk/educoI/documents/00001359.htm.

Isijola, O. M. (2015). *Effects of computer-assisted instructional package (CAIP) on students' performance in basic science in Ondo West Local Government Area of Ondo State*, [An unpublished Master's dissertation, Adekunle Ajasin University], Akungba-Akoko.

Iyekekekpolor, S. (2013). Effects of tutorial computer-assisted instruction on senior secondary school students' achievement in geometry, *Journal of Educational and Information Technology, 8* (2), 130-132.

Jameel, H.T. & Ali, H. H. (2016). Causes of poor performances in mathematics from the perspective of students, teachers, and parents, *American Scientific Research Journal for Engineering, Technology, and Sciences 15*(1), 122-136.

John, O. & Olatoye, R. (2014). Comparison of male and female senior secondary students' Learning outcome in science. Katsina State, Nigeria, *Mediterranean Journal of Social Science, 19* (1), 71-78.

Kang, J. (2019). Gender study on the relationships between science interest and future career perspectives, *International Journal of Science Education*, 41 (1), 80-101.

Karigi, M.W. & Tumuti, S. (2015). Students and teachers attitude factors contributing to poor performance in mathematics in K.C.S.E in selected public secondary schools in Kiambaa division of Central Province, Kenya, *The Strategic Journal of Business and Change Management, 2*(58), 316–332.

Kelly, M. (2015). *Lecture as a teaching method: Pros and Cons, 2015*, Retrieved on May 20, 2020 from http://www.macmillandictionary.com.dictionary/british/location

Kilic-Cakmak, E. (2010). Learning strategies and motivational factors predicting information literacy self-efficacy of e-learners, *Australasian Journal of Educational Technology, 26*(2), 192–208.

Laleye, A. M. & Ogunboyede, C. O. (2023). Effects of drill-and-practice instructional package on junior secondary school students' performance in mathematics in Ondo State, Nigeria. *European Journal of Education and Pedagogy* 4(1), 26-30.

Martins, D. B. (2013). Race, racial projects, and mathematics education, *Journal for Research in Mathematics Education, 44*(1), 316–333.

Mberekpe, M. (2013). *Towards gender equality in 21st century*, Enugu: Mek Publishers Limited, 95110.

Mudasiru, O. Y. & Adedeji, O. A. (2010). Effects of computer assisted instruction (CAI) on secondary school students' performance in Biology, *The Turkish online Journal of Educational Technology, 9*(1) 62–69.

Nadelson, L., Scagges, J., Sheffield, C. & McDougal, O. M. (2015). Integrating video-based demonstrations to prepare students for organic chemistry laboratory, *Journal of Science Education and Technology, 24(*1), 476-572.

National Bureau of Statistics (NBS) (2022). WAEC Results Statistics (2019 - 2021). *National bureau of statistics*, Reports (nigerianstat.gov.ng) available at: https://nigerianstat.gov.ng/elibrary/read/1241213?fbclid=IwAR3Wi9f-o20ZMM0v5hgIE5AmLQPV6dc25vCRE88UFmYlwVawveWfNO-c-lE#:~:text=By%202021%2C%20the%20total%20candidates,showing%20an%20increase%20of%200.93%25. Accessed on 23 June 2023.

Nguyen, D. M. & Kulm, G. (2005). Using web-based practice to enhance mathematics learning and achievement, *Journal of Interactive online Learning, 3*(3), 1–16.

Odusoro, U. I. (2002). *The relative effect of computer and text-assisted programmed instruction on students learning outcomes in Mathematics*, [Unpublished Ph.D. thesis], University of Ibadan.

Rathakrishnan, M., Raman, A. & Haniffa, M. A. (2018). The drill and practice application in teaching science for lower secondary students, *International Journal of Education, Psychology and Counselling, 3* (7), 100-108.

Roblyer, M. D. & Doering, A. H. (2013). Integrating educational technology into teaching, *Journal of Education, 6* (1), 81-102.

Rolstad, K., Mahoney, K. & Glass, G. V. (2005). The big picture: A metaanalysis of program effectiveness research on English language learners, *Educational Policy, 19*(4), 572–594.

Saminathan, B. (2012). Effects of computer-based instructional strategies in learning chemistry at higher secondary level, *International Conference on Software and Computer Applications (ICSCA),* IACSIT Press, Singapore, 165-169.

Setidisho, N.O.H. (1996). Aims of teaching mathematics, *West African Journal of Education, 4*(3), 251–260.

Shamsideen, S. A. (2015). Effects of computer-assisted learning methods on facilitating continuing education in Lagos, Nigeria, *African Educational Research Journal, 3* (4), 204-209.

Slavin, R. E. (1990). Achievement effects of ability grouping in secondary schools: A best evidence synthesis, *Review of Educational Research. 60*(3), 471–499.

Udegbe, I. (2010). Effects of tutorial package of computer-aided instruction on students' achievement in probability, *Journal of Education, 6*(2), 120-131.

Udo, M. & Etiubon, R. (2011). Computer-based science simulations, guided-discovery and Students' performance in chemistry, *Journal of Canadian Center of Science and Education, 5*(6), 2011, 211-217.

Ugwuanyi, C. & Nworgu, B. (2014). Assessment of senior secondary school physics students' conceptual understanding of force and motion, *Journal of Science Teachers Association of Nigeria, 49* (1), 171-183.

Wiersma, W. (2000*). Research method in education: An introduction*, USA: Pearson Education Co.