

**PODCAST: A TECHNOLOGICAL TOOL FOR IMPROVING
LEARNING PERFORMANCE IN ALGEBRA
AMONG PRIMARY SCHOOL PUPILS IN OSUN STATE**

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Abstract: *This study examined podcast potency as a technological tool for improving students' learning performance in mathematics. The study employed a mixed-method approach for the data collection. The quantitative was a quasi-experimental design with pre-tests and post-tests while the qualitative research data were obtained through in-depth interviews. The population comprised all primary school pupils in Osun State in Nigeria. Participants were drawn from two schools, purposively selected within the Oriade Local Government Area. Two different instruments were developed by the researchers titled: Podcasts Achievement Test (PAT) and Podcasts Interview Guide: (PIG) were used to collect the quantitative and qualitative data with a reliability value of 0.86 for the achievement test. The data collected was analysed using ANCOVA with pretest scores as the covariate. The findings of the study revealed that students in the experimental group performed better with a mean score of ($M=18.2$), than the control group with a mean score of ($M=10.2$) due to the intervention given to them. Thus, the result shows that there is a significant difference in the performance of pupils taught algebra using the two methods- podcasting and conventional methods. One of the major contributions of this study is that teachers should be encouraged to use podcasting to*

teach mathematics at primary schools to improve learners' engagement and academic performance.

Keywords: Podcast; Technological tool; Algebra; pupils.

Introduction

Teachers' pedagogical strategies significantly influence the learners' capacity to remember and recollect the knowledge being taught to them. The procedure through which this information is conveyed determines how long the students can retain this knowledge in their long-term memory (Onowugbeda et al; 2024). Teaching strategies that are teachers-centered are passive and predominantly employ the lecture method which does not allow learners to actively participate in the class. This may result in challenges of students' poor knowledge retention (Bavishi et al., 2022). To provide students with relevant learning experiences, teachers must implement optimal information retention mechanisms using technology. In recent times, technology has become a teacher surrogate that has brought rapid innovations in the teaching and learning process by promoting learner engagement and knowledge retention.

The integration of technologies has brought modern devices into educational activities, allowing the education sector to operate more conveniently and easily even when knowledge is disseminated (Yugsan-Gomez et al, 2020 & Okoye et al, 2021). Technology places the learners at the centre of the learning process, emphasizing their active participation and engagement, departing from the traditional teacher-centred approach (Dayagbil et al. 2021). Technological knowledge and competencies have emerged as significant in improving the teaching-learning process (Odekeye et al., 2023). The pace of technological development influences innovation in education, as demonstrated by Olufunke (2019), who emphasises that Instructional materials are essential tools in learning every subject in the school curriculum. Adeyemi & Olatunde (2023) shows that instructional materials play a significant role in shaping students' academic success.

According to UNESCO (2020), using teaching materials such as electronic delivery devices like projectors, televisions, radios or computers and the internet promotes active students' participation and improves their understanding. One form of instructional tool that is beginning to appear in classroom settings is podcasts because learners are beginning to find it more useful in learning faster than using course notes (Copley, 2007). Podcast is an innovative and effective means of disseminating the required knowledge to the students (Chaves-Yuste & de la Peña 2023). Podcast is derived from two words "iPod" and "Broadcast" (International Podcast Day, 2017, & Indiana University

Knowledge Base, 2016). The acronym "POD" in Podcast stands for Portable on Demand, and "cast" originates from the word Broadcast (Business Dictionary, 2017). These broadcasts are published online through recordings and can be readily downloaded to desktop or laptop computers (Traxler & Kukulska-Hulme, 2019; Singh et al., 2022).

There are two types of podcasts, audio podcasts (simply referred to as podcasts) with solely audio content and video podcasts (also called vodcasts or video casts) which contain both audio and motion pictures as video clips. As Adegoke (2022) rightly proclaims, the step-by-step demonstrations provided by video podcasts serve as a valuable framework tool, enabling students to follow along and assimilate the problem-solving process. The utilisation of podcasts has grown in popularity over the years, especially in education. Podcasts are a form of technology that distributes sound or video to individuals (Robson, 2010), but they are typically similar to radio talk shows, in which the main form of media usage is sound distribution. Podcasts are distinguished from other forms of audio-video content, in that they are typically part of a series to which people can subscribe. Podcasts are easily available on mobile devices, increasing accessibility for the listener (Johnson, 2006; Khechine, 2013).

Podcasts became popular in the early 2000s through the advancement of the internet and were historically referred to as audio graphs, webcasts, vodcasts, and the now more common mainstream term podcasts (Kay, 2012; Loomes, 2002). Presently, they are widely used to share information, stories, and knowledge on a tremendous variety of topics through audio or video files. These files are made available online so that students may download and listen to or watch them as instructional materials outside of class at a time and place convenient to them (Copley, 2007). Studies have shown that video and audio podcasts can assist students in learning mathematics (Kay et al., 2019; Sun & Cheng, 2020; Gómez-Ramrez et al. 2022).

Beyond the classroom, students expose themselves to millions of hours of content through various podcasts. This exposure to diverse perspectives fosters critical thinking skills (Brown, 2023; Lee, 2021). Additionally, podcasts contribute to the development of communication and collaboration skills among learners (Kim, 2022; Smith, 2019). Another attractive feature of podcasts is that they allow the listeners to take a break from excessive visual input from computer screens or textbooks, as well as potentially allow auditory input to occur while dual-tasking. This is especially convenient for individuals with busy schedules, as it allows knowledge and information to be accessible on the go to enhance understanding (Wang, 2020).

Recently, mathematics has been increasingly used in sciences, technologies, engineering, social science, humanities, education and

other related fields. The emphasis placed on the significance of mathematics in the school curriculum from primary to secondary levels reflects the subject's role in our society. According to the National Policy on Education (2014), the philosophy of mathematics education is to equip students for life and enable them to make logical decisions. According to Gbeleyi et al. (2023), the standing of mathematics in the manpower and technological development of any nation cannot be overemphasized therefore, mathematics is a discipline that plays a significant role in the sustainability, security, and technological development of any nation (Oloda & Fakinlade, 2017). Despite all the importance of mathematics education, Nigeria is still facing several challenges that hinder student achievement, critical thinking, and problem-solving skills. This could be a result of the traditional teaching methods, limited access to technology, inadequate teacher training, and lack of personalised attention to support, as students individualised help with challenging concepts in mathematics (Ajibola, 2019; Eze & Onwuegbu, 2020; Idowu & Aina, 2021; Okoro & Achor, 2022; Onoyala & Ajayi, 2023). Considering podcasting's potential as an instructional tool, this study proposes a solution to lower the negative impact of teacher-centred instruction on students' academic performance, specifically in the field of learning mathematics among primary school pupils in Nigeria.

Learning performance in the context means measurable outcomes that demonstrate how effectively students have met defined educational goals. These outcomes may include academic performance like test scores and grades, along with other factors such as motivation, engagement, and the acquisition of skills (York et al. 2019). Strong learning performance is shaped by multiple factors, including teaching methods, the learning environment, and individual student characteristics (Usman, & Madudili, 2019). Learners' performance in mathematics is influenced by the teaching and learning methods (Ayebale et al. 2020). This implies that the methods used in teaching are the keys to enabling the learners to understand the underlying key concept.

Rationale for Algebra

Algebra in mathematics at the primary level of education is a very vital topic that has great importance in helping children's growth and development psychologically. It has been identified as a mathematical gatekeeper that gives learners a passport to many educational opportunities (Ralston et al., 2018). Algebra often involves the manipulation of numbers and symbols to find unknown values, identifying and analyzing patterns, exploring relationships, making generalizations, and interpreting changes (National Council of Teachers

of Mathematics [NCTM], 2000; Stephens et al., 2015). A good understanding of algebra from primary school can help pupils learn to organise their thoughts, which makes it simpler for them to come up with rational replies when faced with challenging situations. It will enable students to comprehend symbols and manipulate and interpret the letters employed in various algebraic situations to provide solutions (Kieran, 2007; Sukirwan et al., 2018). Basic algebraic reasoning at the primary school level may include such problems as $3+2 = \underline{\quad}$, $3+y = 6$, what is the value of y ? $2g=10$, what is the value of g ?

Algebra questions will assist learners in thinking mathematically and expressing language with words, symbols, tables, and graphs (Stacey & MacGregor, 1999). Competence in algebra is essential for people across all types of education and professions where they use this language. However, it has been observed that despite the recognition of the importance of understanding algebra as a fundamental branch of mathematics, students are still facing significant difficulties when working on algebraic problem-solving and formal algebraic systems (Niringiyimana & Maniraho 2023). These difficulties are attributed to the poor teaching approach (Umar 2014. According to Muhammed et al., (2020), the teaching approaches adopted by teachers play significant roles in students' learning ability. The schools, therefore, are responsible for giving learners competence in algebra, and it is on this note that the study aimed at exploring the efficacy of podcasts in teaching mathematics among primary school pupils in Osun State.

Research Questions

1. Is there any significant difference in the performance of pupils taught algebra using podcasting instructional delivery and conventional methods
2. What are the perceptions of the pupils on the use of podcasts for instructional delivery

Hypothesis

1. There is no statistically significant difference in the learning outcome of students taught algebra using podcasting instructional delivery and traditional methods.

Method

This study employed a mixed-method approach for the data collection. The quantitative was a quasi-experimental design with pre-tests and post-tests for non-equivalent groups. This is due to the lack of random assignment to the experimental and control groups during data collection (Reichardt, 2009). The qualitative research data were obtained through in-depth interviews with the pupils. This study uses a pre-test measure

to evaluate the experimental and control groups after that only the experimental group receives the intervention. A post-test was conducted to assess both the experimental and control groups. The relative effectiveness of the intervention provided to each group was determined by comparing the performance of pupils in the experimental and comparison groups.

Population and Sampling

The study population is made up of all primary school pupils in Osun State. A sample of 54 primary school pupils participated in the study from two different private schools in Oriade Local Government Area of Osun State, Nigeria. The schools were selected for this study based on the researchers' convenience. Both groups were used based on the pre-existing intact classes of these schools. There are 28 pupils (16 males and 12 females) in the experimental group while the control group consists of 26 pupils (9 males and 17 females). The mean age of the pupils in this study was 10 years. Thus, the sample for the study was made up of students of mixed ages, abilities, and genders.

Instruments

Two different instruments were developed by the researchers titled: (i) Podcasts Achievement Test (PAT): This instrument was designed to evaluate the impact of podcasts on pupils' academic performance. (ii) Podcasts Interview Guide: (PIG): This instrument was used to get pupils' perceptions and obtain in-depth information about the intervention. These instruments were validated by five seasoned primary school mathematics teachers to ensure that the instruments measure what is expected. These experts were selected to ensure that the questions structured matched the context, correctness, behavioural objectives and logical presentation of the lesson plans. Test-retest was used to determine the reliability of the instruments and this achievement test was given to 15 pupils who were not among the participants in the study. After two weeks, the instrument was administered by the researchers to the same set of pupils. The results from the first and second administrations were exposed to stability testing. The data collected was analysed using IBM-SPSS version 23, and a reliability coefficient of $r = 0.86$ was obtained. This shows that the instrument was reliable because the acceptable level is $r \geq 0.7$.

Results

Table 1: Analysis showing the gender and the teaching approaches used for teaching algebra

Gender	Podcasting Group		Conventional Group		Total	
	N	(%)	N	(%)	N	(%)
Male	16	57.1	9	35	25	46.3
Female	12	42.9	17	65	29	53.7
Total	28	100.0	26	100	54	100.0

Table 1 shows the number of male and female pupils in the podcasting and conventional method groups. The table shows that for the experimental group, 57.1% of the participants were male and 42.9% were female. In the control group, 35% were male while 65% were female.

Table 2: Analysis Showing the Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Posttest Mean	Based on	1.53	1	52	.22
Median	Based on	.66	1	52	.4
Median	Based on and with adjusted df	.66	1	44.020	.420
trimmed	Based on Mean	1.38	1	52	.25
Pretest Mean	Based on	.020	1	32	.88
		.020	1	52	.89
Median	Based on	.020	1	51.2	.89
Median	Based on and with adjusted df	.018	1	52	.89
trimmed	Based on Mean				

Table 2 shows that the posttest achievement and pretest achievement scores measures were not statistically significant. This confirmed that the variance between the experimental and control groups was equal and

both the groups passed the test of homogeneity of variance.

Research Question 1: Is there any significant difference in the learning performance of pupils taught algebra using podcasting instructional delivery and conventional methods?

Table 3: Mean showing the performance of pupils taught with podcasting and conventional methods

Group		N	Mean	Std. Deviation
Posttest	Experimental	28	18.2	1.71
	Control	26	10.2	1.27
Pretest	Experimental	28	6.00	1.92
	Control	26	7.31	2.04

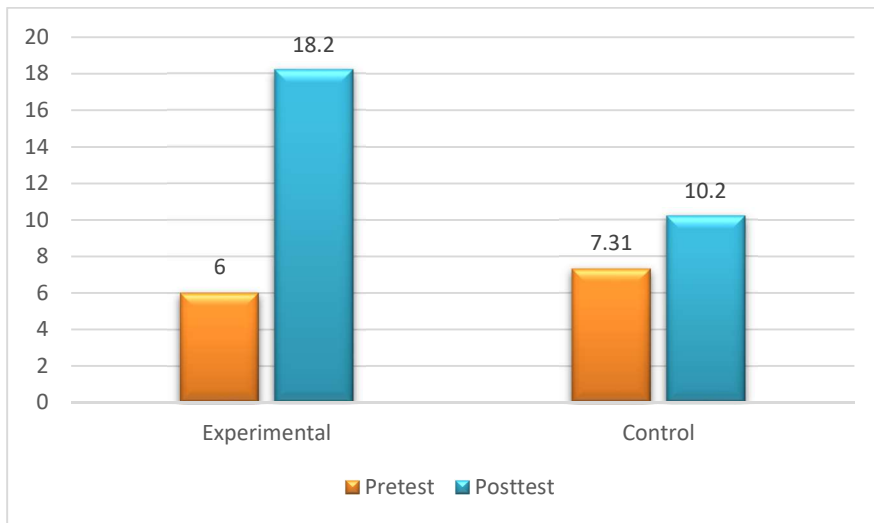


Figure 2: Showing the performance of pupils taught with podcasting and conventional methods

Table 3 shows the students' average achievement scores before the intervention, with the control group scoring higher ($M = 7.31$) than the experimental group ($M = 6.00$). However, following the intervention, the experimental group's mean score increased to ($M=18.2$), which became higher than that of the control group, which had a mean score of ($M=10.2$).

Research Question 2: What are the perceptions of the pupils on the use of podcasts for instructional delivery?
Based on the findings derived from students' interviews indicated that

podcasting as an instructional delivery had a positive impact on improving students’ academic performance.

Fiyin (Pseudo name, 10 years), the male said “I enjoyed podcast in class because I was able to understand algebra”

Sofiat (Pseudo name, 11 years), female said “I enjoyed the videos that you used to explain algebra and the examples used because I will always remember them. I wish my mathematics will continue to use it to explain other topics to us”.

Seun (Pseudo name, 10 years), male said “The classes were always fun and I learn faster because the teacher will pause, replay and allow us to ask questions before playing again and again.

Chiamka (Pseudo name, 10 years), male said “I love the way you teach us and I am always happy when you are coming to teach us”.

Deborah (Pseudo name. 11 years), female, said “The class is always interesting and I always understand your class. Thank you, sir.

Olajumoke (Pseudo name, 12 years), female “I enjoyed the class when compared with the way we used to learn from our class teacher and other teachers.

Based on this report, using podcasting as an instructional teaching tool increases students’ readiness, promotes engagement and improves students' academic performance during the teaching and learning of algebra.

Hypothesis 1: There is no statistically significant difference in the learning performance of students taught algebra using podcasting instructional delivery and traditional methods.

Table 4: ANCOVA table showing the Post-test Achievement with Pre-test Achievement as Covariate

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	862.62 ^a	2	431.31	189.68	.00
Intercept	756.96	1	756.96	332.89	.00
Pretest	3.31	1	3.36	1.48	.23
Group	804.67	1	804.67	353.87	.00
Error	115.97	51	2.27		
Total	12130.00	54			
Corrected Total	978.59	53			

a. R Squared = .881 (Adjusted R Squared = .877)

Table 4 shows the pre-test achievement with a P-value of 0.00, indicating that the podcasting class and conventional method groups had different initial entry levels, which aligns with the Pretest's goal. The ANCOVA adjusted all students to the same baseline. The analysis of covariance revealed no statistically significant difference in academic performance between pupils taught algebra using podcasting and those

taught through conventional methods ($F(1,51) = 353.87; P < 0.05$). Thus, the hypothesis is then REJECTED.

Discussion of findings

The first research question was to find out whether there is any significant difference in the performance of pupils taught algebra using podcasting and conventional methods. The finding shows that the academic performance of pupils taught algebra using podcasting as an instructional delivery was better when compared to those taught using conventional methods. This result is in line with the findings of Mason and Berson (2019) who observed a marked improvement in students' performance when exposed to podcasts as an instructional tool, revealing that podcast-based instruction led to higher retention rates and improved problem-solving skills in subjects requiring abstract reasoning, such as mathematics. Also, this result agrees with the findings of Harris and Walker (2020) that integrating podcasts into mathematics lessons increases engagement and comprehension among learners. Their study reported that students engaging with podcast-based lessons performed significantly better in tests and exercises than those in traditional classroom settings. However, the finding from this study did not support the result of Roberts and Gardner (2021), who reported no significant difference in academic performance between students taught using podcasts and those taught through traditional methods. The discrepancy between their findings and ours could be attributed to variations in the use of podcasting to impart knowledge, study duration, or the specific content covered or the subject.

The second research question was to find out the learners' Perceptions of using podcasts for instructional delivery. Based on the researchers' findings, the results show that the use of podcasting as an instructional delivery in teaching algebra among primary school pupils positively improved students' academic performance. The result aligned with the findings of Clarke et al. (2017), who investigated the impact of audio learning aids on student achievement in STEM subjects, they concluded that podcasting as an audio learning aid had significantly improved students' ability to grasp difficult concepts and boosted their confidence in tackling mathematical problems. Also, there is no discrepancy between the findings from research question two and the results of the findings of Evan (2008), who found that students who used podcasts as part of their learning routine showed better retention rates compared to those who relied solely on traditional textbooks. According to Fernandes et al. (2009), the ability to pause, rewind, and re-listen to specific parts of a podcast helps students process and understand complex information at their own pace. This aligned with one of the points made by the learners during the interview that says classes were always fun and they

learn faster because their teacher will play, pause and allow them to ask questions before playing again and again.

The only hypothesis in this study was to find out if there was no statistically significant difference in the performance of students taught algebra using podcasting instructional delivery and traditional methods. The result revealed no statistically significant difference in academic performance between pupils taught algebra using podcasting and those taught through conventional methods. This result supported the study of Light and Pierson (2014) who found that there was a significant increase in student engagement and understanding of mathematical concepts when taught with podcasts in Chilean classrooms. It also aligns with the findings of Saeedakhtar et al. (2021), who highlighted the significance of podcast-based resources meeting learners' preferences to boost engagement and motivation.

Conclusion

This study's findings indicate that podcasting is more effective for teaching algebra compared to conventional methods. A mixed-method approach was employed to test the two research questions (i.) Is there any significant difference in the performance of pupils taught algebra using podcasting instructional delivery and conventional methods (ii.) What are the perceptions of the pupils on the use of podcasts for instructional delivery and one hypothesis (i.) There is no statistically significant difference in the learning outcome of students taught algebra using podcasting instructional delivery and traditional methods in the study.

In this study, the experimental group's mean score was ($M=18.2$), which was higher than that of the control group, which had a mean score of ($M=10.2$). This means that pupils in the experimental group performed better than their counterparts in the control group. Also, the comparison of the performance between the experimental group taught algebra using podcasting and the control group taught using traditional methods using ANALYSIS OF COVARIANCE revealed a statistically significant difference in academic performance [$F(1,51) = 353.87$; $P < 0.05$]. This indicates that students in the experimental group performed significantly better than those in the control group. This implies that podcasting is an effective approach to enhance students' understanding of algebra, a subject often considered challenging.

Finally, the findings suggest that podcasting should be adopted as an instructional tool in teaching-learning of algebra to enhance students' understanding. Further research is recommended to assess its long-term effectiveness in various educational contexts.

Recommendations

Based on the findings of this study, the researchers' recommendations are as follows:

1. Curriculum planners at both state and national levels should actively provide the necessary facilities and resources to incorporate the use of podcasts as an instructional tool into the primary school curriculum.
2. Mathematics teachers should be encouraged and remunerated when they design or adopt the use of a podcast teaching approach to make the subject more engaging and accessible to pupils.
3. Training programs, workshops and retraining programs (such as conferences and seminars) that are related to mathematics should be organized to equip teachers with the skills needed to effectively create and use podcasts in their lessons
4. Schools should foster partnerships with technology providers and educational content creators to develop high-quality, curriculum-aligned podcast materials. Collaborations with experts can ensure that the podcasts used are pedagogically sound, relevant, and tailored to meet the specific needs of pupils.
5. Educational researchers should be commissioned to conduct further studies on the long-term impacts of podcast-based instruction across different subjects and educational contexts.

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