African Multidisciplinary Journal of Development (AMJD)

Page: 254-260 https://amjd.kiu.ac.ug/

EFFECTIVENESS OF AN INTERACTIVE VIDEO-BASED PACKAGE ON THE MATHEMATICS ACHIEVEMENT OF HEARING-IMPAIRED STUDENTS IN ONDO STATE

Oyarinde Oluremi Noah
Department of Educational Technology, Adeyemi Federal University of Education, Ondo, Nigeria.
ORCID: https://orcid.org/0000-0002-5246-5286, Email: kikrem@yahoo.com, Telephone: (+234)7062254875

Abstract

Technology plays a crucial role in our society, especially in the field of education. Unfortunately, it is a reality that people continue to face many challenges in accessing education, especially those students with learning disabilities. There were continuous reports regarding the underachievement of students with hearing impairments in mathematics. This study explored the effects of an interactive video package on the mathematics achievement of hearing-impaired students in Ondo State, Nigeria. The study employed a quasi-experimental design with a control group that involved a pre-test and post-test. A total of 42 students with hearing impairments from the Ondo State School for the Deaf in Akure participated in the study. Data were collected using the Mathematics Achievement Test (r = 0.78) and analysed using a t-test at a 0.05 level of significance. The results show that the interactive video-based approach had a positive effect on the mathematics achievement of students with hearing impairments ($\bar{x}$ = 12.91, N= 21, SD= 0.45) and the control group ($\bar{x}$ = 10.94, N= 21, SD =0.552) and (T= 3.995, sig = .000 and $p < 0.05$). Also, the study observed that the interventions were of benefit to male and female students with hearing impairments, with male ($\bar{x}$ = 10.94, N= 24, SD= 2.437) and female ($\bar{x}$ = 10.13, N= 18, SD =1.962) students (T= 3.095, sig = .004 and $p < 0.05$). The study's findings suggested that mathematics teachers should implement an interactive video-based package as a student-centred teaching approach that can assist students with hearing difficulties.

Keywords: Hearing impairments, Interactive video-based package, Mathematics achievement, and Problem-solving skills

Introduction

Mathematics is often described as the language of the universe a timeless and borderless discipline that plays a vital role in shaping science, technology, and everyday life. Far beyond just numbers and equations, mathematics helps us make sense of the world by teaching us how to recognize patterns, form relationships, and communicate ideas through symbols (Iji & Abah, 2018). At its core, mathematics reflects the human drive to think critically, explore meaningfully, and seek intellectual and aesthetic clarity.

In primary education, learning the foundational operations addition, subtraction, multiplication, and division is more than just a classroom requirement. These skills are stepping stones to higher-level thinking and are essential for solving real-world problems. As Olasunkanmi and Oyarinde (2023) point out, math helps students build a mental toolkit that empowers them to interpret data, apply logic, and bring structure to the complexity of everyday situations.

However, not all students experience this learning journey in the same way. For students who are hard of hearing, learning mathematics can be uniquely challenging. Many of them struggle not because of a lack of ability but because traditional teaching methods often don't align with their communication needs. Research has consistently shown that students with hearing impairments face greater difficulties in

grasping mathematical concepts compared to their hearing peers (Adeniyi & Kuku, 2020; Ashmore, 2017; Sylvia, 2015). These challenges start early often in preschool and tend to persist, creating lasting barriers that impact academic success and confidence.

As mathematical content becomes more abstract and complex, the limitations of conventional teaching approaches become more apparent. When instruction relies heavily on verbal explanation and passive listening, it excludes students who depend on visual cues or alternative communication methods. This can leave students feeling left out, unmotivated, and even frustrated further widening the achievement gap (Ashmore, 2017). Regardless of whether students are in specialized schools or inclusive classrooms, the struggle remains largely the same (Adeniyi & Kuku, 2020; Shelton & Parlin, 2016; Tanridiler, Uzuner, & Girgin, 2015).

What's clear is that the root of the problem isn't just hearing loss or language development it's how we teach. The traditional, teacher-centered model tends to limit interaction, which is especially problematic for students who thrive through active participation and visual engagement (Shelton & Parlin, 2016). To truly support these learners, we need to rethink instruction in a way that invites them into the learning process. That's why more educators and researchers are turning to technology, and in particular, interactive video-based instruction, as a game-changer in inclusive education (Oyarinde & Komolafe, 2020; Olasunkanmi & Oyarinde, 2023).

Interactive video learning creates a dynamic environment where students can engage with content by clicking, swiping, or responding to prompts transforming passive watching into active learning (Schoeffmann, Hudelist, & Huber, 2015). It's not just about flashy visuals; it's about prompting deeper thought, encouraging prediction and reflection, and allowing learners to pause, replay, or re-explore ideas at their own pace (Papadopoulou & Palaigeorgiou, 2016; Chen, 2012; Delen, Liew, & Willson, 2014). This kind of learning fosters independence and supports self-regulation, which is particularly empowering for students with learning differences.

The flexibility and visual richness of video-based instruction also make it ideal for students who need structure, repetition, and a clear visual pathway to grasp complex concepts. But what about gender? Studies have shown mixed outcomes when it comes to gender and tech-based learning. Some research observed no significant difference in performance between male and female students with hearing impairments, while others noted a slight edge for male students (Kuku & Adeniyi, 2020; Parvez et al., 2019). These findings suggest that while gender dynamics may exist, the core focus should remain on making instruction inclusive and accessible to all learners.

With these insights in mind, this study set out to explore how an interactive video-based instructional package could support mathematics achievement among students with hearing impairments in Ondo State, Nigeria. It also examined whether gender plays any role in shaping learning outcomes within this tech-driven approach.

Statement of the problem

Mathematics holds a central place in both primary and secondary education not just as a standalone subject, but as a foundation for success in fields like physics, chemistry, and technology. These early school years are crucial for building that foundation. Yet, for many students with hearing impairments, learning mathematics feels like climbing an uphill battle. Traditional teaching methods mostly based on verbal instruction often fail to meet their learning needs. These methods lack the kind of interactivity, visual clarity, and technological integration that would help make abstract ideas more accessible and engaging (Adeniyi & Kuku, 2020; Ashmore, 2017).

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-13-2-23 African Multidisciplinary Journal of Development (AMJD)

Even though research has shown that visual and self-paced learning tools, like interactive video lessons, can be incredibly helpful for students who are deaf or hard of hearing, such tools are rarely used in classrooms (Papadopoulou & Palaigeorgiou, 2016; Delen, Liew, & Willson, 2014). These methods allow students to absorb information in ways that suit their pace and style rewatching when needed, interacting with content directly, and making sense of mathematical ideas in a way that's meaningful to them. Unfortunately, the general curriculum doesn't always reflect this need, especially for this underserved group of learners.

This context highlights a pressing need: we must adopt inclusive teaching strategies that tap into both the sensory and cognitive strengths of students with hearing impairments. One promising solution is the use of interactive video-based instruction an approach that invites students to participate more actively, grasp concepts more deeply, and ultimately improve their performance in mathematics. This study, therefore, aimed to explore the effectiveness of an interactive video-based instructional package in enhancing the mathematics achievement of students with hearing impairments in Ondo State, Nigeria.

Objectives of the Study

This study set out to explore how an interactive video-based instructional package influences the mathematics performance of students with hearing impairments. Specifically, it aimed to:

1) Determine whether there is a significant difference in the post-test mathematics achievement scores between students taught using the interactive video-based package and those taught using conventional teaching methods.
2) Examine whether there is a significant difference in the post-test mathematics achievement scores between male and female students exposed to the interactive video-based package.

Research Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

Ho_1: There is no significant difference in mathematics achievement between students taught using an interactive video-based package and those taught using the conventional method.

Ho_2: There is no significant difference in mathematics achievement between male and female students taught using the interactive video-based package.

Methodology

This study employed a quasi-experimental pretest-posttest control group design to determine the efficacy of an Interactive Video based Teaching Package on students with hearing impairment for learning mathematics at Ondo State School for the Deaf, Akure, Nigeria. The participants were 42 second-year students attending the Senior Secondary School of that school, who were randomly assigned to the experimental group (n = 21) and the control group (n = 21), where the former was taught with the aid of the new video-based package and the latter through the traditional method.

An undivided class is what got split to form 2 groups for the intervention. The study was quantitative and data were collected using a single research instrument, the Mathematics Achievement Test developed by the researcher. The reliability coefficient of MAT is strong (0.78); therefore it has high internal consistency. Teaching began by administering the MAT as a pretest to both groups to have a comparison baseline. Then MAT test was followed and mathematics instruction was given to the experimental group for five weeks, while simultaneously the control group was taught the same content using traditional instructional strategies. To ensure quality instruction and consistency, teaching was carried out by two trained research assistants who are certified special education teachers, proficient in sign language and mathematics.

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-13-2-23 African Multidisciplinary Journal of Development (AMJD)

MAT was re-administered to both groups as posttests. The scores of the pretest and posttest were collected, coded, and analyzed using independent sample t-tests to see whether there was any statistical significance in the difference in mathematics achievement between the two groups.

Results

Ho_1: There is no significant difference between the mathematics achievement of students taught with an interactive video-based package and their counterparts taught with the conventional method.

In order to investigate the effect of an interactive video-based package on hearing impaired students' achievement; the pre-test and post-tests were given, and their mean scores were computed to determine whether there was a statistically significant difference between them using a t-test. The findings of the analysis are shown in Table 1.

Table 1: Difference between experimental and control groups before the interactive video-based package.

Group	N	X	SD	T	Df	Sig. (2 tailed)
Experimental	21	11.81	0.55	3.886	31	.000
Control	21	11.92	0.51			

Significant at 0.05 alpha levels

Table 1 shows that there was no statistically significant difference between the pre-test scores of the experimental group ($\bar{x} = 11.81$, N= 21, SD= 0.55) and the control group ($\bar{x} = 11.92$, N= 21, SD=0.51) and (T= 3.986, sig. = .000 and p < 0.05) before they were exposed to the interactive video-based package. In other words, before the intervention, both groups of students exhibited the same levels of problem-solving skills.

Table 2. Difference between experimental and control groups after the interactive video-based package.

Group	N	X	SD	T	Df	Sig. (2 tailed)
Experimental	21	12.91	0.45	3.995	31	.000
Control	21	10.94	0.552			

Significant at 0.05 alpha levels

The result from Table 2 indicated that there was a significant difference in the post-test mean scores of the experimental group after being exposed to the interactive video-based package ($\bar{x} = 12.91$, N= 21, SD= 0.45) and the control group ($\bar{x} = 10.94$, N= 21, SD =0.552) and (T= 3.995, sig. = .000 and p < 0.05). This indicates that the interactive video-based group outperformed its peers in the traditional group in terms of academic achievement.

Ho_2: There is no significant difference between the mathematics achievement of male and female students taught with an interactive video-based package.

In order to ascertain the effect of the interactive video-based approach on male and female students after being exposed to the interactive video-based package, data were obtained and evaluated using the t-test.

Table 3. T-test results of the achievement scores of males and female exposed to an interactive video-based package.

Group	N	X	SD	T	Df	Sig. (2 tailed)
Experimental	24	10.94	2.437	3.095	31	.004
Control	18	10.13	0.962			

Significant at 0.05 alpha levels

The result from table 3 showed that there was no significant difference in the achievement scores of males after being exposed to an interactive video-based package ($\bar{x} = 10.94$, N= 24, SD= 2.437) and females ($\bar{x} =$

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-13-2-23 African Multidisciplinary Journal of Development (AMJD)

10.13, N= 18, SD =1.962). This shows that the instructional package will be of immense benefit to all students, not minding gender disparity (T= 3.095, sig. = .004 and p < 0.05).

Discussion of Findings

Results from this study established a statistically significant difference in mathematics achievement between the group of students with hearing impairment who were exposed to the interactive video-based teaching package and their counterparts who were taught with the conventional method. This, therefore, reinforces the view that technology-enhanced learning could be used to bridge extant educational gaps among the students with special needs. Precisely, those students exposed to the experimental experience recorded better post-test scores, indicating that perhaps indeed the interactive approach could be more facilitative of understanding and performance in mathematics.

This is what Adeniyi and Kuku (2020) found about the influence of learning interventions on the achievement of mathematics students with hearing impairments in Lagos State. According to their study, learners who were exposed to targeted instructional interventions outperformed those who received the conventional type of instruction. A higher achievement for the treatment group over the control was reported in the evaluation of the Chinese sticks method of multiplication by Muhammad, Binji, and Abidah (2020) on their verbatim among the hearing-impaired students in Sokoto State.

Another study that proved the positive effect of technology-based learning is Parvez et al.'s research work, which discovered that the use of mobile applications containing Pakistan Sign Language substantially improved the understanding level on basic math concepts among the students. This, therefore, fine supports the idea that easy digital tools can help a lot in improving learning outcomes for students with hearing problems.

Both male and female students benefited equally from the interactive video-based package. In addition to the overall achievement, it is evident that the instructional tool is inclusive and works across gender lines. This is true because there is no significant difference in the reasoning abilities of male and female students with hearing impairments after receiving instructional interventions, as reported by Adeniyi and Kuku (2020). Prior research by Muhammad et al. (2020) also found that there was no gender-based disparity of significant levels in the achievement scores of the study participants.

This indicates that the interactive video-based package not only enhances academic achievement in mathematics but also the most important equitable learning experiences for male and female gender students with hearing impairments. Its effectiveness is in the ability to elicit engagement, which in turn accommodates diversity in learning styles while providing repeated access to instructional content an exclusive preserve for learners with special needs.

Conclusion

Results of the study show that the interactive video-based instructional package significantly brought up the academic achievement of students with hearing impairments. The intervention proved successful in making an environment for learning more accessible and attractive because it allowed students to learn at their own pace, revisit as necessary, and participate in the instruction actively. Also, the study found that there were no gender-related differences in achievement outcomes; that is, the interactive video-based approach is equally beneficial for both male and female students. These outputs indicate the potential of technology-driven instruction to enable inclusive and equitable learning experiences for students with hearing impairments.

ISSN: 2518-2951 https://doi.org/10.59568/AMJD-2025-13-2-23 African Multidisciplinary Journal of Development (AMJD)

Recommendations

Drawing from the results of this study, the following recommendations are proposed to enhance mathematics instruction for students with hearing impairments:

1) Adopt Interactive Video-Based Instruction: Schools should actively integrate interactive video-based packages into mathematics teaching, as they offer a more engaging and accessible learning experience for students with hearing impairments.
2) Capacity Building for Teachers: Regular training sessions and professional development workshops should be organized for mathematics teachers to build their competence in using interactive video tools effectively in inclusive classrooms.
3) Government Support and Funding: The government, through educational resource centres, should allocate dedicated funding to support the development and distribution of interactive video-based instructional materials. These resources would equip teachers with the tools needed to improve learning outcomes for students with hearing challenges.

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