NIGERIAN ONLINE JOURNAL OF
EDUCATIONAL SCIENCES AND TECHNOLOGY
nojest.unilag.edu.ng
nojest@unilag.edu.ng

Exploring the Effect of Tech- Intelligent Interactive Video- based Instructional Package (TVIP) on Mathematics Achievement among Primary School Pupils in Osun, Nigeria: An experimental approach

Tomi Ogundipe[1] Adetunmbi L. Akinyemi[2],
[1] *Department of Science and Technology Education, Faculty of Education, University of Ibadan, Nigeria; tommyjulia2003@gmail.com*

2 Department of Science and Technology Education, Faculty of Education, University of Ibadan, Nigeria; adetunmibia@yahoo.com

Corresponding author*: *tommyjulia2003@gmail.com*, *t.ogundipe@ui.edu.ng
+2348054278407, https://orcid.org/0009-0004-7294-4681

ABSTRACT

This study aimed to explore the Effect of the Tech-Intelligent Interactive Video-based Instructional Package (TVIP) on the achievement of primary school pupils in Mathematics in Osun State. The study adopted the pretest-posttest control group quasi-experimental research design. The data were collected using the Pupils' Achievement in Mathematics and Instructional Guide for the use of Tech intelligent interactive video Instructional Package IVIP). The participants were 145 (70 mal es and 75 females) among primary five pupils in Osun State. Two intact classes from two public schools in Osun senatorial Area of Osun Area participated in the study. 09; $p<0.05$, partial $\eta^2 = 0.1$ 7). Data were analyzed using Analysis of Covariance (ANCOVA). Results revealed that the group that used Tech-intelligent Video Instructional Package outperformed their counterpart in the conventional group. The findings highlight the significance of Tech-intelligent Video Instructional Package for instruction especially in Mathematics. It is recommended that mathematics teachers and educational stakeholders integrate tech-intelligent instructional package into the primary school curriculum to improve learning outcomes.

Keywords: Mathematics, Tech– Intelligent Interactive Instructional Package, Primary Education Pupils Achievement

Introduction

Mathematics provides pupils with essential basic skills, laying a solid foundation for numeracy, scientific thinking, and the manipulative abilities required to function effectively in society. As a vital tool in all spheres of human endeavor, including the social sciences, industry, and technology, Mathematics serves as the bedrock for understanding other subjects (Ogbe & Omenka, 2019). Beyond mastering computational skills, it enables learners to develop new ideas and establish connections between seemingly unrelated concepts. Consequently, it is recognised as a universal subject and the pillar of all scientific investigations and human development (Ali & Hassan, 2019). The role of Mathematics in society cannot be overemphasised, as it fosters the problem-solving, critical thinking, and analytical skills necessary for modern life (Okunuga, Awofala, & Osarenren, 2020).

Despite this significance, empirical evidence suggests that students' performance in the subject remains discouraging (Akhter & Usmani, 2018; Zezekwa, 2013). This persistent poor performance is often attributed to the perceived difficulty of the subject and the limitations of traditional teaching methods. Factors such as a rigid teaching environment, ineffective strategies, and a lack of learner interest further exacerbate the issue at various levels of education (Jacob et al., 2017; Tay & Wonkyi, 2018). Furthermore, many pupils experience "mathematics anxiety," which results in poor attitudes and low achievement (Sinclair & Bruce, 2015). Research identifies the continued use of conventional, teacher-dominated approaches—where learners rarely have the opportunity to explore or participate actively—as a primary barrier to success (Esan, 2015; Kurumeh et al., 2016).

To improve learning outcomes, Mathematics teachers must adopt methods that ensure pupils are actively engaged. In the current digital age, learners are "digital natives" who are naturally inclined toward digital technologies such as mobile phones and computers. Studies have revealed that the intellectual growth of students using digital technology in their learning is significantly higher than that of those taught via traditional methods (Oguntunde, 2014; Lawlor, Marshall, & Tangney, 2015). While various technological tools like simulations and gamification have been utilized at the secondary school level with positive results (Gambari et al., 2016), there is an urgent need to

integrate these technologies at the primary school level, which serves as the foundation for all future learning (Adekunle & Nelson, 2022).

The Tech-Intelligent Interactive Video-based Instructional Package (TVIP) addresses this need by combining video content with interactive elements such as quizzes, animations, and immediate feedback. Unlike passive video consumption, the TVIP captivates learners and stimulates their interest in Mathematics, driving them toward content mastery (Reiss et al., 2017). Previous research has established that interactive video-based instruction improves achievement in subjects like Geography and pre-service teacher training (Omonye, 2018; Oyarinde & Komolafe, 2019). However, the effectiveness of such technology may be moderated by factors such as gender. The influence of gender on academic achievement remains a subject of debate, with conflicting reports in existing literature (Abidoye & Oluwole, 2021). Therefore, this study explores whether the TVIP can enhance Mathematics achievement among primary school pupils in Osun State while accounting for the potential influence of gender.

Statement of the Problem

Mathematics is one of the crucial subjects that cuts across other subjects. It occupies a central position in the curriculum at all levels. Its centrality is essential to the study of other subjects. Despite the importance of mathematics, literature has established that mathematics, is one of most difficult and abstract subjects that pupils find difficult to understand. Furthermore, studies have shown that certain factors might be responsible for pupils' poor performance in mathematics. These factors include teaching methods, instructional strategies, and attitude of learners among others. Various strategies have been used to address this problem such as flipped learning, think-pair and share and gamification. Inspite the efficiency of these strategies, the problem of poor performance in mathematics has not been totally resolved. There is minimal information on the use of newer technologies in primary schools. Hence there is need to use appropriate technology in the classroom that adopt the use of newer technologies, since 21st century pupils are called digital natives that this, they love interacting with technology. Studies have shown that Tech-intelligent interactive video-based Instructional Package (IVIP) is very facilitative for students learning in different subjects such as Physics, biology but its effect on pupil achievement in Mathematics has not been given much attention especially among pupils in Osun State. The selected applications for this research is tech-intelligent interactive video-based instructional

package. It is purposively and packaged as learning strategy designed with the learner in mind and is characterized with; convenient navigation and language, simple operation, easy navigation that could enhance pupils' achievement in mathematics. This is why this study determined the effect of tech-Intelligent interactive video-based instructional package (IVIP) in mathematics achievement among Primary five pupils. The moderating effect of gender was also determined.

Objectives

The specific objectives are to determine:

1. the main effect of treatment (tech intelligent interactive video - based instructional package) on pupil achievement in mathematics.
2. the main effect of gender on pupils' achievement in mathematics.
3. the interaction effect of treatment and gender on pupils' achievement in mathematics

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant main effect of treatment (tech intelligent interactive video - based instructional package) on Pupils' achievement in mathematics.
2. There is no significant main effect of gender on Pupils' achievement in mathematics.
3. There is no significant interaction effect of treatment and gender on Pupils' achievement in mathematics.

Theoretical Framework

This study is anchored on the Constructionist theory of learning.

Constructionist theory of learning was propounded by Seymour Papert, this theory was established in order to challenge Piaget's constructivist theory by changing the perception that concrete thinking was a 'lesser' kind of cognitive process in relation to abstract thinking by pointing out that proper and rich exposure to the former was crucial in ever hoping to reach the latter (Chronis, 2015). He also argues that for children a key to learning is the process of engagement in activity, the ownership of ideas and style of learning and the exposure, that this expressing their ideas to others, for reasons of exploration and communication.

This theory is based on the premise that knowledge is actively constructed and that learning is enhanced when people are creating tangible objects in the world. A set of theories that defines the human beings as active constructors of their own learning and development The Constructionist Learning environment's emphasis on building, crafting, making and doing gave life to the theory

of constructionism. The relevance of this theory to this study is that, traditional teaching can be reconstructed by using technology to proffer solutions. Since we are in the era of digital world or digital society, learner can use technology like computer to solve problems.

Literature Review

Tech-intelligent interactive video-based instructional package is a video- based package that makes use of video in teaching and learning process. It can also be used for individualized learning. It is one of the powerful tools that present information in a motivating and precise way. It has been observed that it is one of the popular mode that majority utilizes in disseminating information to diverse kind of learners be it auditory learners, visual learners among others manner (Zhang, 2021). Interactive video-based instruction permits students or users to have independence over their learning as they are able to watch or review until the mastery of the content is achieved. Also, they can pause the video if they want to relax, this makes tech-intelligent interactive video- based learning an interesting one (Kuiper, Carver, Posner and Everson, 2015) confirm this approach to be effective because it can sensationally impact the pace of learning since it allows learners to proceed at their own rate. This strategy has huge implications for all level of students, who can view the video as many times as needed to ensure success (Plavnick, Sam, Hume, Odom, 2013).

Tech-Intelligent Interactive video-based instructional package is a method through which knowledge is presented in electronic means using computer and other technological tools (Joshi, 2021). Interactive video-based supports this 21st century global way of learning because it contains some features such as audio, graphics, intonation, content and assessment that learners can interact which makes the lesson to be interactive. Interactive video has proven to be an operational technological tool for knowledge delivery (Ilesanmi, 2023). Interactive video-based instructional package contains more than narrative video; it encompasses instructional tool and interactive elements to encourage active engagement and participation. The elements contain assessment like short quiz, knowledge of result and other activities. Tech-Intelligent Interactive video-based instructional package contributed significantly to pupils' achievement.

Methodology

This study adopted the pretest-posttest control group quasi experimental research design. The population comprised Primary five pupils in Osun Senatorial district of Osun State. Two schools were selected in the study using the purposive sampling technique. This was done so that schools used for the experimental group must have computer gadgets for the implementation of the tech intelligent Interactive Video-based Instructional Package. The participants involved in the study were 145 Primary five pupils in two intact classes. The participants were assigned to treatment and control groups. The participants were one hundred and forty-five (145) in total, comprising of seventy (70) boys and seventy -five (75) girls. The instruments for data collection were Pupils' Achievement in Mathematics Questionnaire (with a reliability coefficient of 0.78) and instructional guides.

The study took one week for pretest administration, six weeks for treatment administration (three hours per week) during which the pupils in the experimental group were exposed to tech-Intelligent Interactive video-based instructional package while the control group was taught Mathematics using the conventional method. This was followed by one week of posttest administration. Data gathered in the study were analyzed using Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Results

H_o1: There is no significant main effect of treatment on pupils' achievement in Mathematics

Table 1: Analysis of Covariance (ANCOVA) of Post-Achievement by Treatment and Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1165.428a	4	291.357	9.503	.000	0.214
Intercept	5194.755	1	5194.755	169.442	.000	0.548
Preachievement	94.920	1	94.920	3.096	.081	0.022
Treatment	907.409	1	907.409	29.598	.000*	0.174

Gender	.061	1	.061	.002	.965	0.000
Treatment * Gender	1.763	1	1.763	.058	.811	0.000
Error	4292.130	140	30.658			
Total	36982.000	145				
Corrected Total	5457.559	144				

R Squared = .214 (Adjusted R Squared = .191) * denotes significant $p < 0.05$

Source: Researcher's Computation, 2025.

Analysis in Table 1 showed that there was significant main effect of treatment on pupils' achievement in Mathematics ($F_{(1,140)} = 29.60$; $p<0.05$, partial $\eta^2 = 0.17$). The model (tech-intelligent interactive video-based instructional package and the gender) explains 21.4% of the variance in the students final score in Mathematics. The treatment alone explained 17.0% of this variance. This implies that the (package) has a meaningful effect even after adjusting for the pretest. The effect size of 17.0 %. This indicates 17.0% of the total difference in students' achievement in mathematics is due to the significant main effect of treatment. Hence, hypothesis 1 was rejected.

Table 2: Estimated Marginal Means for Post-Achievement by Treatment and Control group

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Interactive video-based instructional package	17.67	0.70	16.28	19.06
Conventional method	12.39	0.66	11.08	13.70

H_O2: There is no significant main effect of gender on pupils' achievement in Mathematics

Table 1 revealed gender had no significant main effect on students' achievement in Mathematics ($F_{(1,140)} = 0.002$; $p>0.05$. Hence, hypothesis 2 was not rejected. This indicates that gender had no effect on pupils' achievement in mathematics.

HO3: There is no significant interaction effect of treatment and gender on pupils' achievement in Mathematics.

Table 1 also indicated no significant interaction effect of treatment and gender on pupils' achievement in Mathematics ($F_{(1,140)}=0.06$; $p>0.05$). Thus, hypothesis three was not rejected. This implies that treatment and gender had no effect on pupils' achievement in mathematics.

Discussion of Findings

a) Tech-Intelligent Interactive Video-based Instructional Package and Pupils' Achievement in Mathematics

The result from the report of the study showed a significant main effect of treatment on Mathematics achievement. It has a significant effect on pupils' achievement in Mathematics. In other words, pupils who were exposed to tech-intelligent interactive video-based instructional package (IVIP) achieved better in mathematics than pupils in the control group. The positive effect of the tech-intelligent instructional package on achievement may be due to the fact that the packages contain direct instruction and are easy to use which make it easier for users to learn through exploration. The effectiveness of tech-intelligent interactive video-based instructional package (IVIP might be due to the fact that, the learners are actively involved in the teaching and learning process and constructing their idea or knowledge themselves The effectiveness of this instructional package in this study is in tandem with the observation of Joel, Ashipala and Kamenye (2021) that implementation of interactive video- based instructional package improv es mastery learning and intellectual ability.

b) Gender and Achievement in Mathematics

The result also showed there was no significant main effect of gender on achievement in mathematics, suggesting that both female and male pupils are more likely to use tech-intelligent interactive video-based instructional package Though the male pupils obtained slightly higher than mean achievement score than female but the difference was not significant. This finding is in tandem with findings of Dossi, Figlio, Giuliano and Sapienza (2021) who also reported no significant difference between male and female.

c) Interaction Effects of treatment and Gender on Achievement in mathematics

Result of finding showed that the two-way interaction effect of treatment and gender had no significant effect on pupils' achievement in mathematics. This implies that male and female responded the same way to the treatment in terms of their academic achievement in mathematics.

In other words, the treatment used in the study imparted equally on both male and female based on their academic achievement in mathematics. This implies that the effect of treatment recorded on pupils' gender was not based on pupils' achievement. This result is affirmed by the finding of Tella and Sulaimon (2022) who reported that there was no significant interaction effect of treatment (inquiry-based instruction enriched with origami activities) and gender on pupils' achievement in fraction.

Conclusion and Recommendation

Based on the findings, it could be concluded that the reports of this research have established that tech-Intelligent Interactive Video-based Instructional Package (IVIP) is potent in increasing pupils' achievements in Mathematics as against conventional strategy. Also, it has significantly improved pupils' achievement in mathematics because it provides enjoyable learning environment to study various concepts and ease of use which could lead to improved academic achievement.

Based on the findings of the study, it is recommended that:

1. Teachers in Primary Schools should incorporate the Interactive Video-based Instructional Package (IVIP) intomathematics classroom as it is an effective and practicable alternative to the traditional approach to teaching and learning.
2. Mathematics Teachers and Educators should be sensitized through Workshops, Seminars, and Conferences on Interactive Video-based Instructional Package (IVIP and its integration in Mathematics education.

REFERENCES

Abidoye, F.O., and Oluwole, O. S. (2021) influence of Biology teachers on senior secondary student performance in South-West Nigeria. *Science Journal of Education*. 9.2:40-44.

Adekunle, P.G and Nelson, A.I. 2022. Use of ICT Tools and Academic Engagement of Students in South-West Nigeria Universities. *International Journal of Library and Information Technology 2.1:204-233*

Akhter, N. and Usmani, A. 2018. Analysis of Secondary School Students' Achievements in Geometrical Part of Mathematics. *Journal of Educational Research.* 21 .2: 46-59

Ali, N.A. M and Hassan, N. C. 2019. Mathematics anxiety and mathematics motivation among students in the faculty of science of a public university in Malysia. *International Journal of Academic Research in Progressive Education and Development* 8.4: 952-961

Barman, M., and Jena, A. K. 2023. Effects of Interactive video-based instruction on learning performance in relation to social skills of children with intellectual disability. *International Journal of Developmental Disabilities*. 69.5: 683-685.

Dossi, G., Figlio, D., Giuliano, P. and Sapienza, P. 2021. Born in the family: Preferences for boys and the gender gap in math. Journal of Economic Behaviour and Organization, 183:177- 181.

Esan, F. 2015.Cooperative problem - solving strategy and students' learning outcome in algebrai c word problems: A Nigerian case, *International Journal for Infonomics (IJI),* 8.1: 986-988.

Ilesanmi, A. 2023. Teaching and Learning with Instructional Videos Issues and Concerns for Educational Practice. *International Journal of Instructional Technology and Educational Studies*

Jacob, T.A., Decl, C., B, Kajuru, Y. K. Musa, M and Bala, K. 2017. Effect of concrete manipulative approach on attitude, retention and performance in geometry among junior secondary school students in Benue State, Nigeria, 7.6: 80-85

Joel, M. H., Ashipala, D. O and Kamenye, E. 2021. Interactive Video Technology as A Mode of Teaching: A Qualitative Analysis of Nursing Students' Experiences at A Higher Education Institution in Nambia. *International Journal of Higher Education (IJHE).* 10.2

Joshi, N. 2021. Video-Based Learning: Definition, Emerging Trends, and Usage. Retrieved from https://evelynlearning .com/video-based-learning

Karakarcayildiz, R.U and Yenilmez, K. 2020. Investigation of geometrical thinking levels and polygons classification skills of 7th grade students. *Osmangazi Journal of Educational Research* 7.2:39-43

Kurumeh M. S., Obarakpo J. S., Odoh C. O. and Ikyereve, R. O 2016. Enhancing senior secondary school students' achievement in geometry through the utilization of Rusbult Problem Solving Model in Keffi Metropolis, Nasarawa State, Nigeria. *Merit Research Journal of Education and Review,* 4.6:65-70.

Lawlor, J., Marshall, K. and Tangney, B. 2015. Bridge21–Exploring the potential to foster intrinsic student motivation through a team-based, technology mediated learning mode. Technology, Pedagagy and Education, in press.

Ogbe. A.O. and Omeka, J.E.2019. Science and Mathematics Education as Tools for developing Enterpreneurship Skills among Secondary School Students in Cross River State, Nigeria. *Global Journal of Educational Research* 18:35-45

Oguntunde, S.A. 2014. Development of computer-based multimedia instructional technology in college of education distance learning programme in Ibadan. PhD Thesis.Dept. of Teacher Education. University of Ibadan

Okunuga, R.O., Awofola,A.O.A and Osarenren, U., 2020.Critical thinking acquisition of senior secondary school science students in Lagos state, Nigeria:A predictor of academic achievement . *Journal of Curriculum and Instruction 13.1.44-51.*

Omonye, R. J. 2018. Interactive video package as determination of secondary school students 'interpretative skills and attitude towards map reading in Benin Metropolis. Unpublished M.Ed Thesis, University of Ibadan.

Oyarinde O. N. and Komolafe, O. G. 2019. Pre-service mathematics teachers' attitude and computer skill toward the use of video-based instruction as a delivery method in algebra. Journal of studies in education, 19 .1:25-40.

Reiss, N., Diestmann, G., Inkermann, D., Albers, A. and Vietor, T. 2017. Understanding Design Methods Using Explanatory Videos for Knowledge Transfer inEngineering Disci plines, 60: 518–523.

Sharon, V. 2017. Creating digital awareness with interactive video. PWC, Digital Learning.

Sinclair, N.,Bruce, C.D.2015. New opportunities in geometry education at the primary school. ZDM Mathematics Education.47.3:319-321.

Sriyanto, W. and Kaniadewi, N. 2019. Using Technology in the era of IR 4.0 (Factor analysis from students' perception). *International Journal for Educational and Vocational Studies,* 1.5:450-456.

Sunzuma, G., Masocha M. and Zezekwa N. 2013. Secondary School Students' Attitudes towards their Learning of Geometry: A Survey of Bindura Urban Secondary Schools, 3.8: 402-406.

Tay, M. K. and Wonkyi, T.M., 2018. Effect of using Geogebra on senior high school students' performance in ccircle theorems. African Journal of Educational Studies in Mathematics and Sciences, 14: 1-9.

Tella, A. and Sulaimon, F. A.2022. Improving Pupils' Achievement in Fraction using Inquiry-Based Instructional Strategy Enriched with Origami Activities. *Indonesian Journal of science and Mathematics Education, 5.3:285-290.*

Zhang, P. 2021. Learning Strategies, Motivation and learners' Perspectives on Online Multimodal Chinese Learning, Chinese Language Teaching Methodology and Technology. 4.1:5-8