

**ARTIFICIAL INTELLIGENCE AND INSTRUCTIONAL
PURPOSES: ENHANCING SENIOR SCHOOL
STUDENTS' PRACTICAL PHYSICS LEARNING
OUTCOMES USING AI-DRIVEN MOTION GRAPHICS
TECHNIQUE IN ILORIN, NIGERIA**

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Abstract

The study determined the use of AI-driven motion graphics technique on students' performance on projectile motion in Ilorin, in the 2024/2025 academic session. Population of the study include all senior school students in Ilorin, Kwara State. The target population comprised only senior school II (SSII) students in public secondary schools in Ilorin South. A multistage sampling technique was adopted for the study. In the first stage, an intact class of 80 SSII students (36 males and 44 females) was randomly sampled from two different public single sex schools. The schools were then grouped into experimental and control groups based on gender, as male and female students respectively. The schools were

purposively selected based on gender. The experimental group received instruction with motion graphics aided with Knewton as AI for adaptive learning platform and Reelminda.ai for visuals. The control group received instructions using conventional method. Data were collected through pre-tests, post-tests, engagement questionnaires, and retention assessments guide. Data were analysed using descriptive statistics of mean and standard deviation. T-tests was used for hypotheses tested at the 0.05 level of significance. Findings from the study revealed significant improvement in students' academic performance, engagement, and retention when exposed to AI-driven motion graphics instructions. The study concluded that motion graphics effectively enhanced practical Physics learning when integrated with AI tools and recommends its integration into other Physics instructions at different levels for sustainable educational development.

Keywords: Motion graphics, Knewton, Reelminda.ai, Engagement, Retention and Gender.

Introduction

Physics education presents solutions to challenges due to its metaphorical nature to societal needs, making it important for teachers and learners to relate theoretical concepts to real-life applications (Mji & Makgato, 2022). In Nigeria, these challenges continue to persist and worsened as a result of the complex concepts in Physics themes and many extraneous factors that affects teaching and learning in secondary education, where students struggle with comprehension, engagement, retention, and knowledge applications (Anwo et al., 2025). To encourage the usage of learnt knowledge through Physics education in exploring unending problems in a society, digital technologies and multimedia learning tools presents unique opportunity to address these challenges (Hake, 2023). Specifically, on educational challenges, the advent of motion graphics integrate with animated visuals, text, and sound, offer a dynamic and engaging artificial intelligent

approach to teaching and learning of complex concepts.

AI tool have been put into usage to bridge knowledge gaps between theoretical concepts and practical understanding that provide learners with visual representations that simplify abstract ideas, enhance engagement, and improve knowledge retention (Kotsis, 2026). This study therefore specifically explored the potential of integrating AI tools with motion graphics instructions to improve learning of projectile motion in Physics on senior school students' performance.

This study was grounded in Mayer's Multimedia Learning Theory propounded in the year 1990 by Richard Mayer which was fully developed in the year 2001 and Paivio's Dual Coding Theory proposed in the year 1971 by Allan Paivio. Mayer's theory suggests that students learn more effectively when information is presented through both visual and auditory channels, facilitating better cognitive processing. On the other hand, Paivio's Dual Coding Theory supports this by emphasizing the place of information encoded through multiple sensory modalities which is more likely to be retained and recalled (Paivio, 1986). The combination of these theories underpins the hypothesis that AI-driven motion graphics could enhance learning outcomes by making abstract Physics concepts more meaningful.

The study also adopted the Constructivist Learning Theory also called Constructivism. Theory developed in the year 1969 by Jean Piaget (in the cognitive domain) and Lev Vygotsky in the year 1978 (in the social domain) further supports the use of AI-driven motion graphic instructions in the study. This theory encouraged interactive and student-centred. The present study adopted these theories as shown from figure 1. The figure outlined the typical Physics classroom used in the study, without access to full-scale laboratories. The conceptual diagrammed from figure 1

connected AI-driven motion graphics as the virtual experiments procedure, offering a safe and scalable learning.

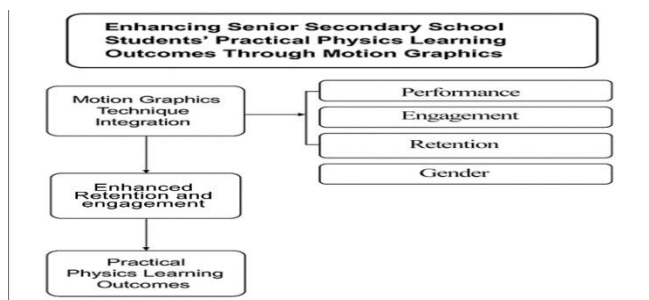


Figure 1: AI-driven Motion graphics to Enhance Senior School Students' Practical Learning Outcome

The conceptual diagrammed from figure 1 provided a viable solution by simulating content in bite-sized, engaged hands on activities, and allowing for repeated viewing at each learner's phase. This served as essential feature in differentiated instruction employed in the study.

Related literature reviewed established the importance of this tools to have promoted better performance in all levels of education. A notable example is the study conducted by Alhyari et al (2025) which examined the comparative impact of animated instruction against text-based instructional materials on student engagement in an Object-Oriented Programming (OOP) course at a Jordanian university. The study adopted quasi-experimental research that involved 60 undergraduate students, divided into two groups. The experimental group received animation-enhanced learning materials, while the control group worked with traditional text-based resources. The results revealed that students in the animation group displayed significantly higher levels of engagement, characterized by increased concentration,

enthusiasm, and willingness to participate in learning activities.

Furthermore, Sabitu and Khalid (2024) conducted a study that focused on the influence of a Computer Animation Instructional Package (CAIP) on the academic achievement and retention of senior secondary school students in geometry, in Oyo metropolis, Nigeria. The study assessed the effectiveness of the instructional approach, employed an achievement test and a retention test, both designed and validated to measure students' understanding of geometry concepts immediately after instruction and after a delayed period. The study revealed that students taught with the animation-based instruction not only outperformed their peers in achievement tests but also showed superior retention.

In another study conducted by Reed et al. (2022) which explored the comparative effectiveness of undergraduate-generated animations against traditional text-plus-illustration presentations in teaching complex neuroscience concepts at a U.S. university. The study assessed engagement levels among two groups of students, neuroscience majors and non-majors who were exposed to either animated instructional materials or conventional text-based content accompanied by static illustrations. The research utilized a student feedback questionnaire comprising 4 Likert-scale items and open-ended questions, designed to capture participants' engagement, interest, perceived understanding, and preferences regarding the instructional methods. The results revealed that students who were engaged with the animated materials displayed significantly higher levels of engagement, characterized by increased attention, curiosity, and willingness to interact with the learning content.

An empirical study carried out by Oyelekan and Olorundare (2019) provided substantial evidence supporting the efficacy

of motion graphics in enhancing chemistry students' academic retention. The study examined the effects of a computer animation instructional package on the achievement and retention of Nigerian senior secondary school students in chemistry. It utilized a quasi-experimental research design that involved participants from different secondary schools who were taught using either animated instructional materials or traditional lecture methods. The findings indicated that students exposed to the animation-enriched instruction performed significantly better in both immediate achievement tests and delayed retention tests.

The use of Knewton as AI for adaptive learning platform and Reelminda.ai for visuals in the present study was geared to improve students' understanding of projectile motion. The strategy was employed to address issue of abstraction in cognitive ability by providing concrete, visual representations of concepts in simultaneous vertical and horizontal motion that are otherwise hard to grasp. The Reedmee ai graphics have capacity to also develop retention capability among senior school students due to repeated exposure to the concept.

Statement of the Problem

Modern technology tools improved pedagogical practices utilized in classroom to improved students' performance. Studies from Oyelekan and Olorundare (2019), Reed et al. (2022), Sabitu and Khalid (2024) and Alhyari et al (2025) employed motion graphics and animated instructional strategies to improve learning outcome manually. The present study used automation AI tools to improve students' performance. Also, present study in its unique work considered variables of engagement and retention to determined performance specifically on the concept of projectile motion in physics with AI tools (Knewton as AI for adaptive learning platform and Reelminda.AI for visuals

observations) that automatically generated simulations of projectile motion. These AI tools addressed instead, personalized automated motion graphic instructions of real time animations to match students' learning pace and prior knowledge in practical concepts. While reviewed studies examined learning capacity, the present study significantly design an instructional tool with AI instructional capability that used a developed methodology geared towards effective use as teaching tool to improve performance, determine engagement and gauge retention simultaneously.

Objectives of the Study

The study determined senior secondary school students' performance using AI-driven motion graphics technique. Specifically, the study;

1. determined the effects of AI-driven motion graphics instructions on senior school students' academic performance on projectile motion against those taught using conventional teaching methods;
2. find the level of engagement of senior school students' when exposed to AI-driven motion graphics instruction on projectile motion with those who taught with conventional teaching methods;
3. examined senior school students' retention when exposed to AI-driven motion graphics instruction with those taught through conventional teaching methods on projectile motion; and,
4. explored if gender differences exist in the performance of senior school students when exposed to AI-driven motion graphics instruction with those taught through conventional teaching methods in projectile motion.

Research Questions

The following research questions were raised and answered in the study

1. What is the effects of AI-driven motion graphics

- instruction on senior school students' academic performance when taught projectile motions and those taught using conventional teaching method?
2. To what level of engagement does the use of AI-driven motion graphics instruction influence senior school students' performance when taught projectile motion and those taught using conventional teaching method?
 3. Does the use of AI-driven motion graphics instruction influence senior school students' retention when taught projectile motion and those taught using conventional teaching methods?
 4. Is there evidence of gender differences in the performance of senior school students when exposed to AI-driven motion graphics instruction compared to those taught using conventional teaching methods?

Methodology

The quasi-experimental research of pre-test and post-test control group design was adopted in the study that determined the impact of AI-driven motion graphics instructions on senior school students' performance on projectile motion. Population of the study included all senior school students in Ilorin, Kwara State. The target population consisted of senior school II (SSII) students in public secondary schools in Ilorin South. The multistage sampling technique was used in the study. Two different public single sex schools were purposively selected based on gender considerations. From each school, an intact class of students (36 males and 44 females) respectively was randomly sampled. The schools were then categorized as experimental and control groups according to gender, with male students assigned to experimental and female students to controls groups. A single class of SSII students were each chosen to participate in the study. This class was not divided or altered; it was kept intact and all students in that class were included.

Data collection involved administration of the three instruments. The instrument, “Motion Graphic AI-driven Performance Test” measured academic performance. The experimental group received lesson instruction using this instrument. It was designed and integrated with AI-powered adaptive learning platform, Knewton, used for tracking students’ performance and tailored towards instructional objective of the lesson to improve meaningful understanding of projectile motion, and Reelmind.ai, to generate dynamic projectile motion visuals, for feedback that provided a personalized, real-time insights to senior school students’ learning. The instrument “Engagement AI Questionnaire” was also administered to gauge student participation during lesson. The “Retention Assessments Guide Instrument” was conducted after two weeks as post instruction. The intervention lasted for three weeks. Data were analysed using descriptive statistics of the mean and standard deviation. Independent samples t-tests was used to determine significant differences. All ethical issues were strictly adhered to. In the study, collaboration with edtech developers was ensured to embed AI into motion graphics strictly on projectile motion, ensuring scalability and sustainability.

Results

Research Questions 1:

What is the effects of AI-driven motion graphics instruction on senior school students’ academic performance when taught projectile motions and those taught using conventional teaching method?

Table 1

Descriptive Statistics of Student’s Performance before and after AI-driven Motion Graphics Instructions

Measure	Mean	Mean Gain	t-value	p-value
Pre-test	42.75			

			26.15	14.67	<.001
Post-test	68.90	5.62			

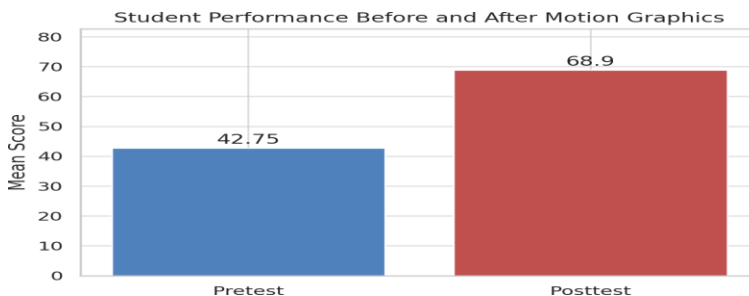


Figure 1: Students Performance before and after exposure to AI-driven Motion Graphics instructions

Table 1 shows a significant improvement in students' academic performance from the experimental group after the use of AI-driven motion graphics instructions. The average score in the group increased from 42.75 in the pre-test to 68.90 in the post-test, resulting in a mean gain of 26.15 points. This improvement is statistically significant, as indicated by a t -value of 14.67 and a p -value less than .001, suggesting that the observed gain is not due to chance. Post-test analysis further revealed a significant difference in performance in favour of the experimental group ($t_{(36)} = 5.62, p < 0.001$), demonstrating that students exposed to AI-driven motion graphics instructions performed better.

Research Question 2:

To what level of engagement does the use of AI-driven motion graphics instruction influence senior school students' performance when taught projectile motion and those taught using conventional teaching method?

Table 2:

Descriptive Statistics of Senior School Students' Engagement Score

Group	N	Mean	Mean Gain	t-value	SD	p-value
Exp	36	4.36	1.34	8.21	6.3	<.001
Control	44	3.02			7.2	

Figure 2: Senior School Students' Engagement Scores

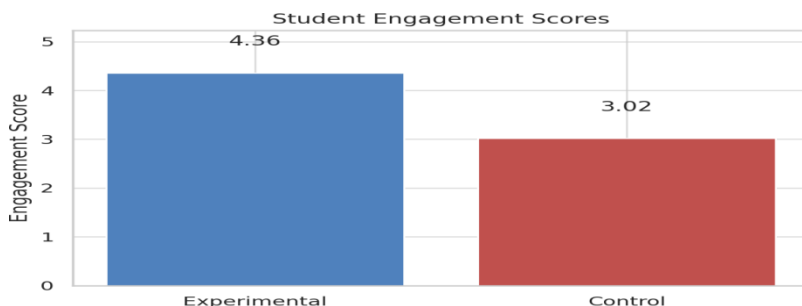


Table 2 revealed that students who were taught using AI-driven motion graphics instructions during had significantly higher engagement than those taught through conventional methods. The experimental group, which used AI-driven motion graphics instructions, achieved a mean engagement score of 4.36, while the control group scored only 3.02. This difference was statistically significant, as indicated by a t-value of 8.21 and a p-value less than .001. Furthermore, students in the experimental group reported higher engagement levels as measured by the Classroom Engagement Questionnaire (CEQ). The mean engagement score for the experimental group was 82.5 (SD = 6.3) compared to 68.4 (SD = 7.2) for the control group. A t-test confirmed the significance of this difference $t_{(36)} = 7.24, p < 0.001$

Research Question 3:

Does the use of AI-driven motion graphics instruction influence senior school students' retention when taught projectile motion and those taught using conventional teaching methods?

Table 3:

Descriptive Statistics of Students' Retention Scores

Group	N	Retention Score	Mean Gain	t-value	SD	p-value
Exp	36	66.45	4.75	9.11	5.4	<.001
Control	44	51.70			6.9	

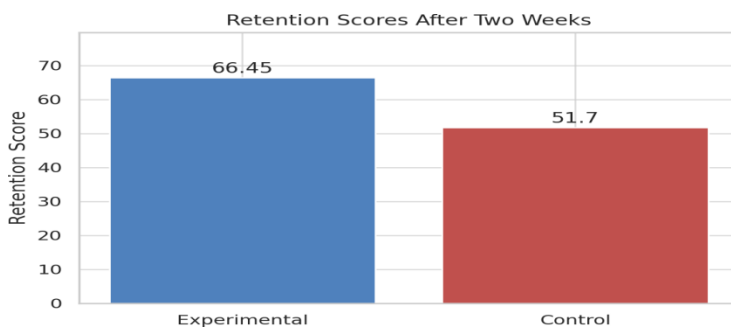


Figure 3: Experimental and Control Groups' Retention Scores

Table 3 shows the retention scores of the two groups. The experimental group, received instruction through the AI-driven motion graphic instructions, achieved a mean retention score of 66.45, while the control group, taught using traditional methods, scored significantly lower with a mean of 51.70. A t-test was conducted to compare the two groups, yielding a t-value of 9.11 with 78 degrees of freedom and a p-value less than .001. This indicates that the difference in retention scores between the two groups is statistically significant, with the experimental group retaining substantially more information after two weeks. Figure 4 represent retention scores after two weeks of post-instruction which showed the experimental group maintained significantly higher retention rates ($M = 78.6$, $SD = 5.4$) compared to the control group ($M = 65.7$, $SD = 6.9$), with the difference being statistically significant, ($t_{(36)} = 8.15$, $p < 0.001$).

Research Question 4:

Is there evidence of gender differences in the performance of senior school students when exposed to AI-driven motion graphics instruction compared to those taught using conventional teaching methods?

Table 4:

t-test Analysis of Students' Performance by Gender

Gender	N	Mean Score	Mean Gain	t-value	p-value
Male	36	69.40	1.00	0.48	0.63
Female	44	68.40			

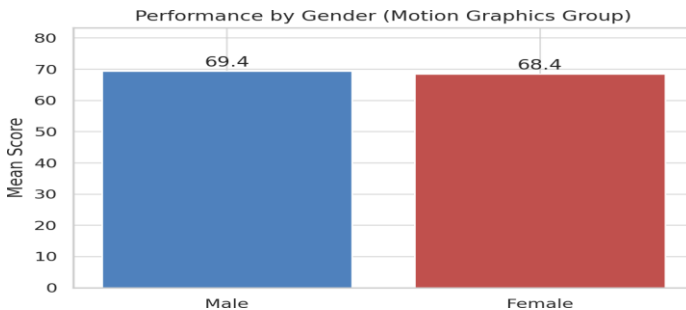


Figure 4: Male and Female Performance Scores

Table 4 shows the comparison of mean scores between male and female students who were taught projectile motion using motion graphics. The mean score of male students was 69.40, while female students had a slightly lower mean score of 68.40. However, the statistical analysis using an independent samples t-test revealed that the difference in scores was not statistically significant, $t_{(36)} = 0.48$, $p = 0.634$. Since the p-value is greater than the commonly used significance level of 0.05, we conclude that there is no significant difference in the performance of male and female students.

Discussion of Findings

The significant increase in scores from pretest to posttest shows that AI-driven motion graphic instructions have a strong positive effect on students' academic performance. Students exposed to AI-driven motion graphics showed significantly higher engagement levels, suggesting that this method is more interactive and appealing for performance. The results of the study indicated that AI-driven motion graphics is a very successful teaching approach that simultaneously increases retention, engagement, and achievement among senior school students.

Firstly, as observed by Emrah (2025), AI-driven motion graphic instruction improved academic performance more than traditional methods. Secondly, as corroborated in the study of Li (2026), the intervention make lessons more interactive and attention grabbing, which makes engagement supports deeper learning and participation. Thirdly, learners remember content beyond the immediate test. The fourth finding implies that the intervention is effective across genders; considered equitable rather than tailored to or biased toward one group.

The results from the study revealed a substantial difference in academic performance and engagement, with the AI-driven motion graphics group achieving a higher mean score compared to the control group. This implies that the difference was not only statistically significant but also practically significant, as indicated by a large effect. The result align with findings of Sebitu and Khalid (2024) which emphasized that multimedia-based instruction improved students' comprehension and application in Physics through visualization and engagement. Furthermore, the study is in line with the findings of Emrah (2026) that found that the retention is high significantly when groups are compared through intervention. This implies that students taught using

AI-driven motion graphics retained more knowledge over time. This is also in consistent with study conducted by Reed et al. (2022) that established animated and interactive visuals improve long term memory by reducing cognitive load and chunking information into manageable parts.

One of the unique strengths of the study was its exploration of gender-related effects in students' performance. The results indicated no statistically significant difference between male and female students in the experimental and control groups. This suggested that motion graphics benefited both gender. The male and female students' scored mean score is high. This implies that marginal difference does not show biasness of gender difference. This outcome counters previous assumptions that technological interventions favour one gender over another such as in the findings of Oyelekan and Olorundare (2019), which concluded that motion graphics not only simplify instruction but also enhanced students' emotional connection to the subject matter of both male and female students.

Conclusion

The study concluded that AI-driven motion graphics represent a valuable instructional tool for enhancing the teaching and learning of Physics concepts. The tool simplifies complex concepts in projectile motion and improved students' performance, engagement and retention. In other words, AI-driven motion graphics improved academic performance, engagement and retention in senior secondary school Physics education with no gender preference.

Recommendation

The study recommended the integration of additional AI platform into other themes in Physics classroom activities and encourages further research on AI-driven motion graphics instruction application across different subject's areas.

Primary schools and higher education institutions where population could be manage, controlled and communication gargets are assured could also use the AI tools to improve learning outcomes.

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