ANIMATION INTEGRATION IN TEACHING OF NEWTON'S LAWS OF MOTION AND ITS EFFECT ON ACHIEVEMENT AMONG SECONDARY SCHOOL PHYSICS LEARNERS' IN MAKUENI COUNTY, KENYA.

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DECLARATION

I declare that this thesis is my original work and has not been presented in any other university/institution for consideration of any certification.

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DEDICATION

This thesis is the result of many hard and rewarding experiences. I dedicate this work with joy and gratitude to those who have encouraged and motivated me along the way. Iam especially thankful to my family, my wife and children, who have supported me through the ups and downs of my career. I also appreciate my friends and classmates who have shared their insights and feedback with me. Above all, I praise God Almighty, who has blessed us abundantly in every aspect of our lives.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABL: Animation-Based Lectures

CG: Controlled Group

CSCL: Computer Support for Collaborative Learning

CTML: Cognitive Theory of Multimedia Learning

EG: Experimental Group

ICT: Information and Communication Technology

KCSE: Kenya Certificate of Secondary Education

KICD: Kenya Institute of Curriculum Development

LOS: Lesson Observation Schedule

MOE: Ministry of Education

PAT: Physics Achievement Test

PTI: Physics Teachers Test

PTQ: Physics Teacher Questionnaire

QASO: Quality Assurance Officer

SAT: Science Achievement Test

SCORM: Sharable Content Object Reference Model

SQ: Students Questions

ABSTRACT

This study investigated the effect of integrating animation in teaching on learners' achievement in Physics in Makueni County. The study applied a quasi-experimental research design, involving six secondary schools purposively sampled from thirty-eight public schools in Kathonzweni Sub-County, Makueni County. Data for the study was collected using: pre-test and post-test, learners' questionnaires, teachers' questionnaires, lesson observation, and interview schedules for Physics teachers. The Data for objectives (i) and (ii) were analyzed using a t-test to determine the significance of the difference in performance. For objective (iii), the data was analyzed using descriptive statistics. For objective (iv), the data was analyzed and coded along themes. The research study revealed that sub-county schools can perform equally well compared to county, extra-county and national schools when animation model are integrated in teaching. The results showed girls' performed better in county and sub-county schools when animation were used in teaching. There was a performance gap between girls and boys in county schools and also in sub-county schools. The study also found that learners had a positive attitude towards the integration of animation in all three experimental groups, and they found the learning process captivating. Furthermore, the study revealed that teachers demonstrated competence in selecting quality animated materials from a wide range of multimedia resources, and their psychomotor skills in handling animated hardware and software enhanced. The study recommends to the Ministry of Education (MOE) to designing and developing effective animations as supportive learning tools, and to assist in developing methodologies that can enhance dynamic delivery of learning support. The teachers Service Commission (TSC) should provide in-service training to teachers to sharpen their knowledge on animation. Additionally, the government should ensure the availability of electrical power and animation hardware and software. It is important to note that the findings of this study will be useful not only to the Ministry of Education, but also to school administrators and physics teachers in guiding the instructional integration of animations in teaching Physics, thus encouraging student interaction with both the concept and the content.

CHAPTER ONE

1.0 Introduction

This chapter establish a solid groundwork for the study, unveiling essential components pivoted to gaining a deep comprehension of the research. Through an in-depth exploration of the study's historical context, problem statement, objectives, research inquiries, and the study's importance. This comprehensive foundation also addressed the study's boundaries, assumptions, and conceptual frameworks, all aimed at intriguing and engaging the reader on a compelling intellectual journey.

1.1Background to the Study

Animated visuals are created by manipulating the appearance of static figures. They are computer-generated motion images that demonstrate the relationship between drawn figures (Mayer & Moreno, 2002). There are different types of animation, including stop motion, motion graphics, 2D animation, and traditional animation. These animated elements bring life to the screen through computer animation.

The use of animation has the potential to revitalize both teachers and students, creating a dynamic and engaging learning environment. However, not all animation have a positive impact on student performance. Therefore, the key to successful integration of animation in teaching and learning lies in its effective utilization.

Animation integration involve adopting, incorporating, and utilizing instructional resources, materials, and technology to facilitate student acquisition of both procedural and conceptual understanding. These two categories of knowledge equip students with the ability to tackle specific Physics challenges. In the field of education, an animation service is a tool that combines auditory and visual presentations for use in the teaching and learning process.

Incorporating animation into teaching and learning makes the material interactive, engaging and captivating for the students. For effective learning, animation elements must serve their intended function. The animation should be appropriately positioned so that students can easily see it without straining. Its quality should be of a standard that is suitable for the content being displayed. The components should be immersive and free from any harmful content for learners.

Physics, as the study of the relationship between matter and energy (Munish, 2016). In most situation, the principles, laws, theories, and fact of Physics may appear as abstract to learners. Therefore, the use of animation is necessary for teaching and learning, as it helps students concretely visualize these conceptual materials. Physics is taught as a part of science curriculum under the 8-4-4 system in Kenya Secondary Schools. It is an elective subject in the Kenya Certificate of Secondary Education (KCSE) examination, which is awarded after four years of Secondary School.

Understanding Physics is crucial because it enhances quantitative and analytical skills required to analyze data and solve problems in various scientific fields and beyond. Physics enables us to comprehend organization of the cosmos and recognize the interconnectedness of seemingly unrelated phenomena.

Muhammad A.K. (2020) conducted a study emphasizing the significance of Physics. He highlighted that Physics represented intellectual journey that sparked the curiosity of young minds and pushed the boundaries of our understanding of the natural world. It served as the fundamental pillar of physical sciences, linking disciplines from chemistry and geology to biology and cosmology. Concepts forged in Physics laid the foundation for comprehending various scientific fields. Moreover, many essential tools driving scientific and technological progress originated directly from Physics. The concern and exploration of Physicists historically shaped the trajectory of future technologies.

Moreover, Physics serves as the foundation for most modern technologies and the instruments and tools used in science, engineering, medicine, economics, finance, law, and public policy. On the other side, students who develop a solid understanding of Physics can pursue careers as physicists and engage in research on national and international issues.

Furthermore, Physics knowledge opens the doors to numerous professional opportunities for learners, with grade c+ or above in Physics being either a requirement or added advantage. Uninformed Physicist can be hazardous, and the field of medicine would be severely impacted without Physics- based technology. Without qualified teachers, students would be unable to pursue various respected and lucrative jobs.

To summarize, Physics education plays a vital role in equipping students with quantitative skills, broadening their career prospects, and fostering a deeper understanding of the world. It is an essential subject for those interested in pursuing scientific and technological fields and provide a well-rounded education for all students.

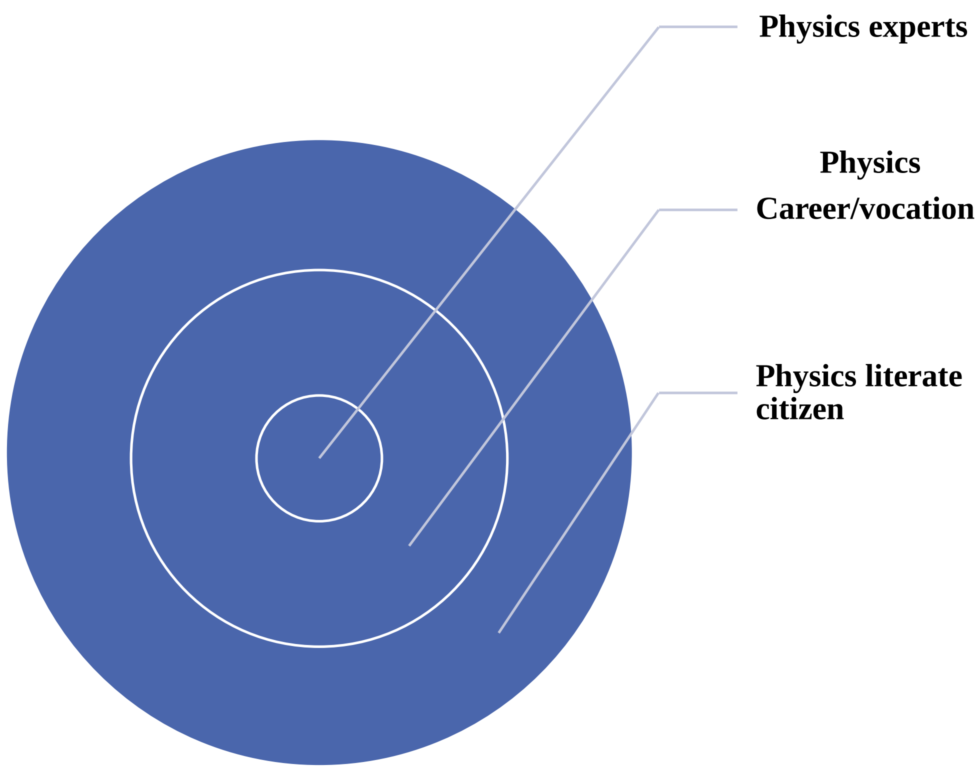

Figure 1.1 importance of Physics knowledge

A study done by Hakan et al (2022) in Turkey examined the impact of employing animation-based worked (AREWES) developed using augmented reality (AR) technology instead of traditional paper-based worked examples (TWES) on the academic performance, motivation, and attitudes of high school students during their programming education. The research utilized a quasi-experimental design and involved second-year students (N=94) enrolled in a basic programming course at a vocational technical Anatolian high school in Turkey. The findings of the study indicated a significant correlation between the final test scores and the students' attitudes towards AREWES. The study suggested that such technology could be beneficially applied to subjects requiring problem-solving skills, such as mathematics, Physics, and chemistry.

Unal Colak and Ozan (2012) conducted an assessment on the impact of employing animated instructional agents using modern technology and multimedia on student attitudes. They found that students frequently perceive these agents as engaging and enjoyable thereby enhancing learning comprehension, motivation, and attention effectively.

Additionally, this approach contributes to greater satisfaction and achievements in learning attitudes compared to conventional methods (Orie, 2022). According to Fernandez Rivas et al. (2020), education institutions worldwide are increasingly integrating such advanced technologies to enhance student's focus, understanding, and academic performance. This method of instruction provides students with a valuable tool to improve academic outcomes and reinforce knowledge retention.

Musasia, Abacha, and Biyoyo (2012) pointed out that students who perform well on national exams can enroll in higher education institutions. Learner's achievement levels gauge good schools and educational systems. (Swan, 2012). The implementation of the necessary curricular upgrade will depend on the usage of animation. The inclusion of animations in teaching and learning is made possible by the availability of multimedia resources in schools (Plomp, Anderson, law & Quale, 2009). Integrating animations into lessons is, therefore, the most efficient way to use them in teaching and learning.

The term "learner performance" refers to the academic success shown by competencies exhibited by certain abilities or information naturalization, either in an exam or when carrying out a relevant knowledge-related activity (Marzon, 2020).

Nurdyansyah et al. (2020) conducted a study in Indonesia focusing on the integration of moving images to innovate English language teaching. The research involved a sample of 39 first-grade students. Data collection encompassed three main phases: reduction activities, data presentation, and interpretation. The findings revealed a significant improvement in English learning achievement among primary school students through the use of animation. The study underscored the importance of teachers acquiring competencies to design engaging classroom activities utilizing animation.

According to Erdemir's (2009) research, Physics performance in Asia is poorer than in other scientific disciplines like chemistry and biology. The alarming trend has evolved into a grave peril for the nation's future and scientific progress. The lack of innovative teaching methods in modern classrooms, coupled with students' fixation on rote learning and struggles with grasping conceptual ideas in Physics, have contributed significantly to the worrying decline in academic performance. The country's survival and the potential benefits of scientific advancements are in the balance.

Revamping the teaching approaches, integrating cutting-edge techniques, and fostering a deeper understanding of conceptual aspects can ignite a new wave of enthusiasm for Physics among students. By addressing these challenges head-on, we can have the way for a brighter future, both for the students and the nation's scientific landscape.

However, it has been noted that the average Physics score on Kenyan national exams has declined over time. Additionally, students do poorly nationally, and more are abandoning Physics in their second year of secondary school studies (Muriithi, 2013). This resulted in a small number of students passing Physics-related courses at post-secondary institutions, contributing to the shortage of Physics-related workers in the labor market. Muindi (2015) noted that Makueni County similarly had poor student achievement. Since Form Three is an elective subject under Kenya's 8-4-4 system of education, enrollment is dismal.

The use of animation is one of the elements to improving the quality of learning. The most noticeable component of technology-based learning is now animation. Animations are among the most effective tools for cognitive processing because of their ability to bring reality into the learning environment. It is proven that a pupil who watches an engaging film will retain about 80% of it. However, when the same amount of time has passed, the identical student can only recall roughly 25% of the lecture material. It seems obvious that using cartoons to teach Physics will increase student retention of the material.

Ahmed et al. (2021) conducted a study in Indonesia exploring the challenges associated with learning electrochemistry, particularly due to its complex and abstract nature encompassing multiple levels of representation-macroscopic, microscopic, and symbolic. Their research aimed to investigate how students could enhance their comprehension through interactive computer animations and simulation models titled "interactive Electrolysis of Aqueous Solution" (IEAS). The study involved 62 male students aged 16 from two secondary schools. The findings indicated that IEAS positively impacted students' understanding and motivation to learn electrochemistry, suggesting its efficacy as a tool for educational enhancement in this field.

A Research conducted by Chan (2015) in the Hong Kong unveiled a remarkable discovery: a staggering 95% of educators expressed a profound grasp of assessment rubrics when exposed to animations, surpassing the comprehension achieved through mere text-based materials. These dynamic visual masterpieces centered on crucial aspects of university assessment policy, including rubrics and grade descriptors. The resounding affirmation from teachers regarding the integration of animations in their classrooms serves as a powerful testament to the unrevealing efficacy of these animated wonders in nurturing both the art of teaching and the pursuit of knowledge.

According to a study by Nursaila and Ibrahim (2016), students in Malaysia have some difficulty in understanding vocabulary and applying Newton's principles of motion. The study suggested combining educational software with multimedia to reduce the gap between procedural and conceptual understanding. The majority of pupils grasped the procedural element, which relied more on problem-solving techniques than conceptual understanding.

Safitri et al, (2021) conducted a study in Indonesia demonstrating that technology application could enhance alternative teaching methods, fostering greater interactivity to engage students more deeply in their learning. The technology facilitated visual concept transmission, enabling students to comprehend information actively rather than merely memorizing it. Through simple random sampling employing the solving formula sampling techniques, the research findings confirmed a positive correlation between the utilization of animated videos in educational settings and students' academic performance.

According to Tamara, Baita, Bolger, and Lone (2020), students reported favorable experiences when using laptops (89.19%, n=132) and cell phones (88.88%, n=136). Students were also comfortable looking for multimedia resources (76.31%, n=116).

According to Antwii, Addo-Wuver, and Hogan's (2018) report, students have given a pretest after reading Newton's Third Law of Motion. The pretest findings showed that they have difficulty in solving problems and frequently seem to forget that action and reaction are complementary opposites.

Olunde (2021) conducted a study in Nigeria that investigated the effects of interactive animation on teaching strategies and its impact on students' understanding of climate change. The research utilized a quasi-experimental design with two groups: an experimental group that received instruction through animation and a controlled group that was taught using traditional methods. Two schools in Benue and Niger states were selected through purposive sampling for the study. Both descriptive and inferential statistical methods were employed for analysis, with standard deviation addressing specific research questions. The findings revealed that animation-based teaching significantly improved secondary school students' comprehension of climate change.

Emi and Lisda (2017) conducted a three-tiered test and found that misconceptions about the relationship between an object's mass and the time it takes to fall freely were prevalent among students, while the connection between acceleration, mass , and force had fewer misconception. The use of animation in teaching Physics has been found to improve students' understanding.

Mogbo et al. (2021) explored how animation and concept map visual aids affected secondary school students' academic achievement, retention, and interest in Geography in Wesu, Abuja, Nigeria. They selected a sample of 120 students (53 males and 67 females) using a stratified random sampling approach. The study revealed that these visual aids greatly enhanced students' comprehension and academic performance regarding weather topics in Geography.

A study conducted by Kwako and Samuel (2017) in Nigeria revealed that computer animation helped students visualize abstract concepts in Chemistry.

An investigation conducted in Kenya by Nuni, Indushi, Rabari, and Kangali (2019) showed that animated electronic videos were an effective teaching tool for electronics, suggesting that Physics teachers in Kenya should be encouraged to use them. Teachers' candidates suggest that animation should be covered in teacher's courses to enhance their use of multimedia in teaching.

Munene (2021) found that animated movies can be a useful addition to text-based materials. Despite receiving ICT training, teachers may lack confidence in using multimedia effectively. The current Kenyan curriculum does not explicitly address the integration of multimedia and ICT leading to consequently. This suggests that animation should be based on teachers' preferences and the tools they find useful rather than on irrelevant standards of technological advancement.

For the integration of animation in teaching to be successful, schools must serve as the primary point of reference to establish an environment that helps and prepares educators to cope with the conditions required for the growth and innovation of the educational system.

In this instance, the researcher aimed to establish a correlation between the use of animation in teaching Newton's laws of motion and its impact on student accomplishment levels in national exams. Research and observation suggest that animation can be valuable tool in teaching various subjects, including Physics and chemistry. However, challenges exist in terms of teacher' proficiency, curriculum integration, and confidence in using multimedia effectively. Teacher preparation and support, along with a conducive school environment, are crucial for successful integration of animation and other multimedia in teaching.

Table 1.1 Examiners comments on candidate's performance on Newton's laws of motion

year	Questions	examiners comment on candidates Performance in Newton's laws of motion
2016	What is the takeoff speed of a football, Initially at rest with a mass of 0.6kg, which Is kicked by a footballer applying a force a 720N for a duration of 0.1s?	majority of the candidates failed to equate the impulse with change in momentum Ft=ΔMV
2017	Using the definition of impulse force, show That F=ma	Most of candidates they did know the the condition under which the law applies
2018	(a). State Newton's first law of motion (b). a wooden block initially at rest on a Horizontal surface is given an initial Velocity (u) so that it slides on the Surface for a distance (x) before coming To rest. Measurement of (x) are taken for Different values of (u) and a graph of u 2 against x is obtained. Answer the following Questions based on this experiment	Majority of candidates they did know the condition under which the law applies most of the candidates were unable to interpret the graph
2019	Two boxes, E and F are being pulled along a Frictionless surface with an identical force. Box E has a mass of 2.0 kg, while box F has A mass of 4kg. Using reasoning, state which Box will have a higher velocity	majority of the candidates were unable To identify the formula and apply it in a given problem
2020	a car of mass 100kg traveling at a constant Velocity of 40m/s collides with a stationary Metal block of mass 80kg. The impact takes 3 seconds before the two move together. Determine the impulsive force	Majority of the candidates were unable to differentiate which formula to use between elastic and inelastic collision

source *examiners KNEC report*

1.2 Statement of the Problem

In the pursuit of advancing education in Kathonzweni Sub-County, Makueni County, Kenya, during my masters' studies, I discovered a notable gap: there had been no prior research on the effect of animations on secondary school students' achievement in Newton's laws of motion. Concerns over poor science performance among students have resonated deeply with parents, educators, and policymakers. Factors such as negative attitudes towards learning, inadequate facilities, overcrowded classrooms, and a lack of suitable science equipment have been cited as contributing to this issue. Additionally, there's the persistent misconception that Physics is a daunting subject, further intensified by abstract teaching methods and poorly equipped laboratories.

Amidst these challenges, a glimmer of hope emerged with the potential of animation-based learning to address these educational deficits. However, conflicting views have surfaced regarding the effectiveness of multimedia tools like animations in teaching. Traditionalists argue that such methods may distract learners, contrasting with proponents who believe in their ability to enhance educational outcomes.

Moreover, practical obstacles such as irregular electricity supply and high maintenance costs of multimedia facilities have hindered their widespread adoption in schools. Even where available, these resources are often inaccessible to students, limiting their potential for self-directed learning and reinforcing dependence on traditional instructional methods.

This situation underscores the urgent need to reassess teaching strategies, shifting away from conventional "talk and chalk" approach towards animation-supported education. Such a shift promises to not only improve academic performance in science but also to cultivate a positive attitude towards subjects like Physics among students.

Therefore, exploring the impact of computer-based animation learning on students' engagement and academic achievement in Physics has becomes imperative. This study aims to bridge exiting gaps in research and contribute valuable insights that could potentially transform science education in the region.

1.3 Purpose of the Study

The purpose of this study was to determine the effect of animation use on students' achievement in Newton's laws of motion.

1.4 Objectives of the Study

The following specific objectives of guide the study were:

1. To determine differential effectiveness of animation integration on achievement of learners in Newton's laws of motion based on school category.
2. To determine differential effectiveness of animation integration on achievement of learners in Physics based on gender.
3. To establish the learners' attitude toward integrating animation in teaching and learning of Physics.
4. To establish the experiences of teachers in integrating animation into the teaching of Physics

1.5 Hypothesis of the Study

Ho1: There is no significant difference in achievement for learners who use resources with animation and those who use resources without animation based on school category.

Ho2: There is no significant difference in achievement in achievement for learners who use resource with animation and those who use resources without animation based on gender.

1.6 Research Questions.

1. What was the learners' attitude toward integrating animation in teaching and learning Physics?
2. What was the experiences of teachers when integrating animation into the teaching of Physics?

1.7 Significance of the Study

The results of this research carried tremendous importance for educational service providers, policymakers, and administrators, presenting invaluable perspectives on optimizing animation as a potent pedagogical approach. The primary goal of this study was to tackle crucial concerns surrounding equitable subject selection, low enrollment rates, and subpar performance in the field of Physics. Consequently, the results could form a solid basis for the Ministry of Education's (MOE), Quality Assurance and Standard Officers to develop suitable measures aimed at enriching the academic achievement of high school students in Physics.

The incorporation of animation into Physics instruction and learning can be facilitated by the study's conclusions. By identifying the most effective techniques and strategies, this research can assist teachers and students in selecting the highest-quality digital content for education and learning. Such a selection will benefit both parties involved, as it can greatly enhance the teaching and learning experience.

Furthermore, colleges and universities stand to gain from this research as well. The findings can contribute to the development of relevant multimedia teaching tools, which can be utilized to support teacher candidates in their training. By equipping educators with effective resources, instructions can ensure that future teachers are well-prepared to employ animation as a valuable instructional tool.

Overall, the significance of this study lies in its potential to address pressing concerns within the educational field. By promoting equity, increasing enrollment, and improving underperformance in Physics, this research offers valuable guidance to stakeholders, enabling them to make informed decisions that will ultimately benefit the educational system as a whole.

1.8 Limitations of the Study

The study was undertaken solely within one sub-county of Makueni County, Kenya. This extension of this study to encompass various sub-county and schools necessitated the creation of multiple animations. The production of these animated materials, along with other necessary resources, constituted a technically intricate process demanding substantial time and resources during the preparatory phase.

Consequently, the study was confined to a single sub-county where schools were selected and utilized for research purposes within one sub-county of Makueni County, Kenya. The extension of this study to encompass various sub-county and schools necessitated the creation of multiple animations. The production of these animated materials, along with other necessary resources, constituted a technically complex process demanding substantial time and resources during the preparatory phase. Consequently, the study was confined to a single sub-county where six schools were selected and utilized for research purposes.

Data collection for the study might have taken a considerable amount of time due to the wide geographical area of Makueni County. During this period, some variables being studied could have changed, potentially influencing the study's results. The dynamic nature of certain variables makes it challenging to establish causality accurately.

Some parts of the study may require respondents to express their beliefs and opinions. However, relying on self-reported data through questionnaires or interviews introduces the possibility of response bias or inaccuracies. Respondents' opinion may not always reflect objective reality, and generalizing based on subjective responses can lead to flawed conclusion.

1.9 Delimitations of Study

The study is limited to Kathonzeni sub-county, which means that the findings may not be generalized to other counties or regions in Kenya or other countries. The specific characteristics and context of Makueni County may influence the results and limit their applicability to other settings. The study focuses only on public secondary schools in Makueni County. Private schools or other types of educational institutions are not included in the research, which may limit the generalizability of the findings to other school types.

The study primarily targets Form Three students and a small number of Physics teachers. By focusing on a specific grade level and a limited group of educators, the findings may not be representative of the entire population of secondary school students or Physics teachers in Makueni County.

The study concentrates solely on the effect of animation in the classroom on students' academic achievement in Physics. It does not explore other factors or teaching methods that may influence academic performance in the subject, potentially limiting the understanding of the broader context and variables that could affect the outcomes.

Only six secondary schools out of many in Makueni County were included in the study. The limited number of the schools may not adequately represent the diversity of schools in the county, potentially affecting the generalizability of the findings.

It is important to acknowledge these limitations to provide a clear understanding of the potential shortcomings in the study's methodology and data collection process. Researchers should take these limitations into account when interpreting the findings and avoid making overly broad generalizations based on the results.

1.10 Assumptions of the Study

The study assumed that:

I. Physics teachers in secondary have certain skill levels in the use of technology. Also, learners have some prior experience which could help mastery of content in Physics.

ii. The sampled schools had adequate ICT infrastructure to enable animation integration into the teaching and learning of Physics. This adequacy was taken to be a ratio of students to computers of 1:1.

iii. The study assumed that respondents to study instruments were to respond to questionnaire guides honestly and accurately without bias.

iv. The study also assumed that students from the controlled group did not have or have access to animations in learning and that learners from the controlled group had not discussed details regarding the content of Physics with those learners in the experimental group. Lastly, the study assumes that the use of animation affects mastery of abstract content.

1.11 Theoretical Framework

The study was underpinned by Richard Mayer (2009) Multimodal Learning Theory, positing that auditory and visual modalities are pivotal in knowledge acquisition. It advocates for the integration of words, images, and audio in instructional materials, contending that such combination facilitates the formation of mental images, thereby enhancing learning efficacy. These mental constructs, akin to Piaget's schemas in cognitive learning theory, aid in the encoding and retrieval of information.

Notably, the theory underscores the significance of reducing abstractness in learning materials to foster easier comprehension and assimilation. Furthermore, the study elucidates that multimedia elements, particularly quality animation, play a crucial role in nurturing these mental images, thereby aiding learners in grasping abstract concepts and storing acquired knowledge in long-term memory (Hewson, 2002). Animation, in this regard, is portrayed as pivotal component in instructional design, offering a conducive learning environment for concept visualization.

However, effective utilization of animation hinges upon educators' adeptness in adhering to guiding principles, understanding learner characteristics, and aligning instructional objectives (Kwasu & EmaEma, 2015).

Moreover, the study highlights the significance of animation in contemporary educational discourse, emphasizing its pivotal role in instructional practices (Steward, 2002). Despite historical perception of animation as mere entertainment, its instrumental role in the educational arena has become increasingly evidenced (Okon, 2008). Thus, the study endeavors to explore the impact of animation when Physics interactive content developed and disseminated by KICD.

1.12 Conceptual Framework

The conceptual framework, as outlined by Driver et al. (1994), denotes the cognitive structure individuals utilize to organize sensory inputs, which then reflects in their responses to specific problems. This study's conceptual framework is rounded in its theoretical underpinnings, akin to how Physics encompasses abstract laws, concepts, theories, and principles, which can pose challenges for learners in visualizations.

To facilitate comprehension, animation resources were employed, aiding learners in forming mental images to grasp Newton's laws of motion without misconceptions. These imagen assist in both storing and retrieving knowledge and skills, aligning with Richard Mayer's Multimodal Learning Theory (MMT). The study focuses on animation and its role in fostering comprehension is depicted diagrammatically in figure below.

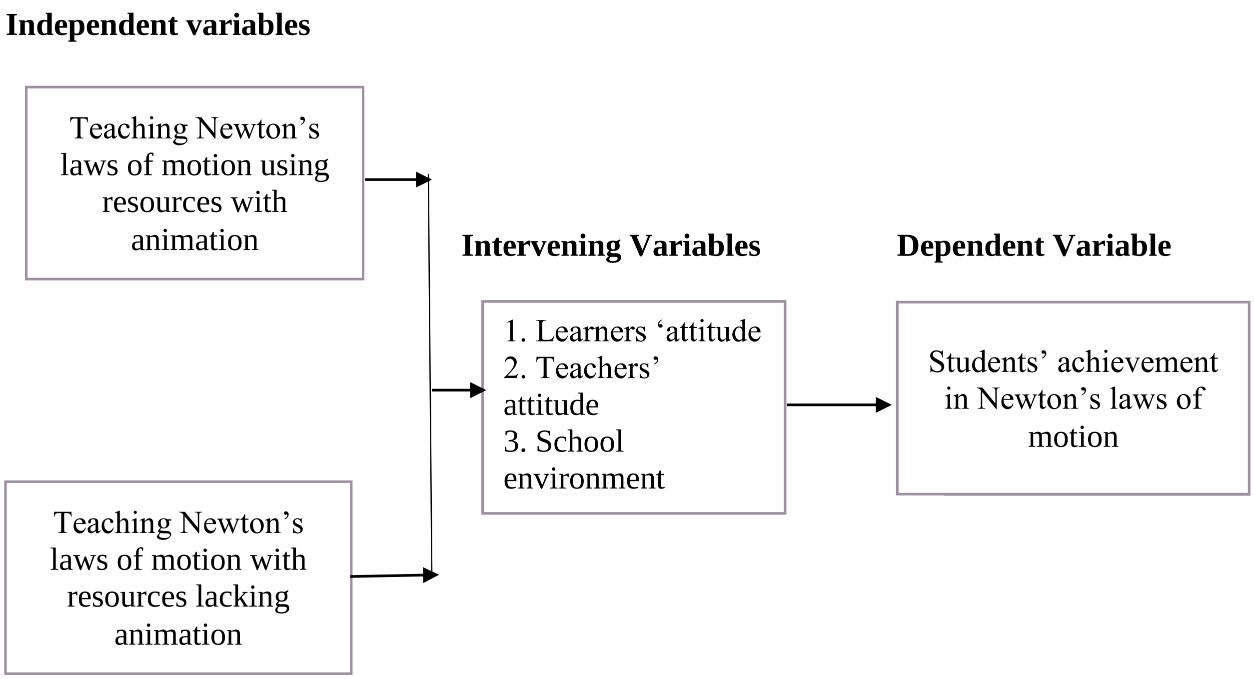

Figure 1. 2: Conceptual framework.

The diagram above illustrates the independent variable-such as animation content, teachers' ICT skills, and teaching methods- and their influence on learners' achievement in Newton's laws of motion, the dependent variable. Intervening variables, encompassing learners' and teachers' attitudes towards Physics, teachers' experience, and school environment, also play a crucial role. It was hypothesized that employing animation in teaching would enhance understanding among Form Three Physics learners, leading to improved achievement in Newton's laws of motion, while a lack thereof may result in lower attainment level.

1.13 Operational Definition of Terms

8.4.4 System – In Kenya, the education system is designed in a way that requires children to Complete eight years in primary schooling, followed by four years of Secondary schooling. If they have undergone two years of pre-school education (Typically between ages 3-6), they can proceed to four years of university Study.

Academic achievement –In this research, it refers to a learner's overall achievement as demonstrated by their abilities to actualize a particular skills or body of knowledge, whether in an exam or when carrying out a relevant task in knowledge application.

Digital content- refers to any information that has been made available or shared in a digital Format, such as text, data, sound, recording, images, videos or software that Can be downloaded or distributed electronically.

Performance differences- This can be either favorable or unfavorable depending on the Learner.

Form 3- The third year of secondary school, according to Kenya's 8-4-4 educational system. After completing form 4, the final and highest level of secondary education in Kenya, pupils move on to posts secondary institution.

ICT –is the umbrella term encompassing a range of technological instruments and methods used to transmit, disseminate, produce, manage, display, store, and retrieve information Electronically.

Animation integration- Using animation effectively in instruction and learning. Computerized multimedia is a synthesis of multiple communication Channels (Graphics, Sound, Video, Animation, Images and Text)

Physics- a scientific discipline taught in secondary schools that studies matter and its

Interactions with energy, including topics such as mechanics, electricity, Magnetism, thermodynamics, and quantum physics.

Teacher experience- This refers to the accumulation of knowledge, exposure, and training That a teacher has gained over time and which enables them to Integrates their knowledge into their teaching and learning.

CHAPTER TWO

REVIEW OF RELATED LITERATUR

2.0 Introduction

The literature review is divided into four themes, namely: (a) the differential effectiveness of learners' achievement by school category, (b) the differential effectiveness of learners' achievement based on gender in understanding Newton's laws of motion, (c) the attitude of the learners towards instructional integration of animation in learning, and (d) the experiences of teachers when integrating animation in teaching Newton's laws of motion.

2.1 Differential Effectiveness of Learners' Achievement Level by School Category

The achievement levels of students can be determined by the grades they receive on the assessment, which are derived from their examination scores. In Kenya, students sit for their national exams after four years of secondary education, marking the conclusion of secondary education. Students with these KCSE scores can pursue Physics-related courses at colleges, universities, or tertiary institutions. Numerous global research studies have investigated the influence of animation integration on students' achievement levels.

Animation has been proven to clarify complex subjects in educational contexts and foster a pleasurable learning experience while mitigating concerns about time constraints (Lin & Li, 2018).

A study published in 2013 by Owolobi and Oginni investigated the efficacy of combining multimedia integration and animation to improve science students' academic performance. The study employed quasi-experimental research design, selecting one hundred students using stratified random sampling. The Science Achievement Test (SAT) served as the instrument data collection. The research found that animated cartoons used to synchronize instructional presentations resulted in improved academic achievement. Similarly, a study by Egemen (2018) demonstrated that integrating technology into teaching and learning increases learner participation and interaction with the content.

Recent research into animation learning has demonstrated that alternative content types exert diverse impacts on the learning process. The learning experience underwent significant transformations in recent years, primarily attributable to the effective utilization of audio-visual resources. This evolution marked a shift from text-centric, non-interactive materials featuring static images to dynamic videos and animated content. These advancements not only enhance learner motivation but also facilitated improved learning outcomes. The integration of current technologies into distance learning activities further underscores these advancements (Azizah & Widiartin, 2019; Handayani et al., 2020).

Further, Muhammed and Tusin (2018) found that pupils struggled to integrate mathematical equations and grasp the concept of potential in a conservative force field. Bakla’s (2019) research in Turkey suggested that personalized animated cartoons can aid in the comprehension and awareness of punctuation among students.

Similarly, Hajara and Bukari (2017) explored the impact of integrating ICT into teaching and learning for students who struggle to learn at normal pace. They found that integrating technology allows students to interact the material and translate abstract notions into concrete ones.

The research by Moreno and Ortegano (2008) compared the use of films, animation, and narrative teaching techniques through controlled and experimental groups. In both tests, the video and animation groups demonstrated a more positive attitude toward learning and a higher level of application of the core knowledge compared to the control group. These findings support the use of animations and visual classroom examples to increase the application of knowledge. Another study by Adegbija and Falode (2014) found that instruction based on animation in CamStudio improves student performance in Physics and increases student motivation, resulting in a greater interest in learning. Animation-taught students outperformed their counterparts who relied on text-based materials and lectures.

Qaddum et al. (2021) suggested that the presentation of materials in a visually distinctive manner was believed to enhance student motivation, particularly in relation to their engagement with advanced technologies. The researchers posited that such visual distinctiveness could effectively stimulate students' interest and enthusiasm, potentially leading to increased engagement with the subject matter. This approach not only acknowledges the importance of technological advancements in educational settings but also underscores the role of visual appeal in facilitating enhanced learning experiences.

Similarly, Singh et al. (2009) conducted a study evaluating the effectiveness of animation-based lectures (ABL) in physiology instruction. They found that students had a favorable opinion of ABL, considering it more beneficial than static learning tools such as PowerPoint or transparencies, which were considered dull and ineffective. The study recommends using ABL to balance traditional teaching with modern animations that may encourage students to learn.

In the study conducted by Balley et al. (2021), it was found that active participation in animations correlated positively with increased levels of motivation and enhanced learning outcomes. The research underscores the significant impact of animation engagement on both motivational factors and academic performance.

2.2 Effect of Animation on Achievement of Learners Based on Gender

Technology-integrated instructional methods not only improved the caliber of teaching (Akram et al; 2021) but also facilitated students in skill development, heightened their motivation, and efficiently augmented their knowledge and information (Chen et al; 2018).

In Bistrovic's (2017) study, a framework was devised for incorporating cognitive and effective components into teaching methods during the initial phase of lessons. Various sets of activities were to inspire student engagement, utilizing strategies such as stimulating curiosity, encouraging exploration, or fostering healthy competition. The multimedia elements encompassed audio, textual content, and visuals, with presentations featuring animations, video, and interactive components. These tools were integrated to enhance both learning motivation and the overall educational experience, addressing key aspects that facilitate effective teaching and learning.

Wong, Castro-Alonso, Ayres, and Paas (2018) conducted a study to examine the efficacy of a constructive learning task under different situations and evaluate the direct association between teaching demonstrations, gender, and local ability. They found a significant interaction between sexual ability and performance, indicating that men performed better than women. These findings suggest that gender and the learning environment should be taken into account when measuring teaching effectiveness.

Sanchez and Wiley (2010) investigated the performance of men and women while reading a scientific paper about plate tectonics with animated versions of images or no visuals. They found that including animations in this scientific object completely eliminated functional inequalities between genders. This suggests that gender disparities in learning outcomes can be eliminated by enhancing the understanding of scientific events.

Heo and Toomey (2020) found that while gender differences did not significantly influence students' learning performance and views, males and females exhibited distinct learning behaviors. These findings could assist designers in creating an animated platform that can accommodate the demands and preferences of both genders.

Mhamed et al (2021) conducted a study on teaching Physics using computer simulation and found no difference between the results of boys and girls in the experimental. Both genders performed equally well.

Yezierski and Birk (2006) demonstrate that women report higher participation and support for decision-making. They also discovered that increased multimedia degrees have a conflicting effect, and animation decreases engagement and decision support. Linek, Gerjets, and Scheiter's (2006) found that viewing molecular-level animation improves students' comprehension, particularly for female students, narrowing the gender gap in understanding before the intervention. The study highlights the significance of using molecular-level animation to improve students' comprehension, especially for female students.

Coward, Crooks, Flores, and Dao (2012) conducted a study indicating a key sexual interaction mechanism in the cognitive test. They found that women are superior at learning to draw, whereas males are superior at reading pictures. These results emphasize the importance of considering individual differences, such as gender, when designing multimedia learning materials. According to Coward et al. (2012), gender collection influences students' attitudes more than their performance. This data proves that only feminist and gender groups can be advocated as beneficial group interventions in the CSCL. In contrast, fewer male groups should be avoided since they result in poor group performance and negative individual attitudes.

In a study, Boucheix and Schneider (2009), the operation of a three-pulley system was presented to two groups of students on a computer screen. The results showed that animation and sequential static frames enhanced understanding. However, in the second trial, controlled energy had no notable effect on comprehension, especially for learners with insufficient spatial and mechanical reasoning skills.

Despite efforts to promote gender equality in science education, gender disparities in mathematics and science continue to be a significant concern. Ellison and Swanson (2010) found that the gender difference in mathematics among high-achieving students in the United States and Denmark is overstated. While Joensen and Nielsen (2013) revealed that gender disparities in mathematics persist across all educational levels.

Aina (2013) found that male students fared better in Physics college education, suggesting that lecturers should pay extra attention to female students. Wudu and Getahum (2009) mentioned that low academic performance among female students might be due to sexual harassment by male peers and sometimes professors.

2.3. Establish Attitude of the Learners towards Instructional Integration of Animation

Learners' attitude is the disposition to respond in a particular manner to learning. Learners' responses can range from positive to negative or good to awful. Much research have been done to explore how students' attitude are affected by many factors. Researchers have explored students' attitudes when animation and ICT are included in the instruction.

Language attitudes have been shown to impact the way language is employed, both in everyday interactions and within educational settings. According to Dewantara et al. (2019) and Kasmawati & Saputri (2021). These attitudes play a crucial role in shaping a students' linguistic choice when writing. They influence how individuals express themselves linguistically, highlighting the significant influence of attitudes towards language on communication in academic and social contexts.

Animation in instructional materials was found to have a beneficial effect on students' motivation by aiding in the comprehension and formation of concepts (Zheng et al; 2020).In terms of learners' attitudes towards the instructional integration of animation, Kokom's (2019) conducted a study on living values using interactive multimedia in civic education. The majority of the pupils showed enthusiasm for interactive multimedia, considering most components of content, presentation, and multimedia principles as satisfactory.

Su and Liang (2014) found that animated cartoons with subtitles enhanced language learning motivation more than text-based materials

In this study, sobrino et al. (2020) discovered that utilizing augmented reality (AR) as an educational programming tool had a beneficial impact on students' motivation levels.

The project-based learning (PBL) model proved effective in engaging students with real-life challenges, thereby actively involving them in learning processes. This approach facilitated comprehensive educational experiences, encompassing cognitive, affective, and psychomotore domains essential for students' development (Louk et al; 2020; Nurhayati, 2020; Nurtanto & Sofyan, 2015).

Moreover, PBL contributed positively to students' learning outcomes, as demonstrated by research indicating significant enhancements in writing skills following the implementation of multimedia-based PBL strategies (Aji et al, 2018; Hidayati & Nurjanah, 2017). These findings underscore the efficacy of PBL in fostering deep learning skill development among students.

Zetra, Gustimal, and Trial (2019) described their efforts to create PowerPoint-based learning materials for integrated theme education in primary schools. Using a developed research design, they evaluated the qualitative validity of the study with 41 student teacher preparation program at a public university in Pekanbaru, Indonesia. The results showed that students' learning outcomes improved significantly from 68.94 to 76.72.The PowerPoint-based instructional materials also had a positive impact on students, who expressed their satisfaction with using them.

Nazirah and Mohammed (2018) investigated engineering students' perceptions of blended instructional 3D animation. They used a cross-sectional survey approach with 34 engineering students. It indicated that students strongly agreed that 3D animation should be integrated into the curriculum of engineering courses.

In his study, Demirci (2017) observed a substantial disparity in the mean post- attitude scores of the experimental group towards science lessons, whereas no discernible change in attitude was noted among the control group. He concluded that employing active learning methodologies significantly impacts students' attitudes towards science education. Demirci further highlighted that active learning enhances students' cognitive and analytical skills by empowering them to generate knowledge and assume a central role in their academic endeavors.

Muhammed, Nadia, Wadho, Khand and churi (2020) studied the integration of animations into mathematics teaching and learning. They used quasi-experimental design with 60 mathematics students from two secondary schools in Pakistan. The result showed that animation enhances students' conceptual understanding, problem-solving skills, and motivation in mathematics.

In a quasi-experimental study, Mustafa and Tancel (2019) investigated the use of augmented reality in problem-based learning. The study involved 91 seventh-grade students from a northern Turkish province and utilized the FENER software to facilitate PBL activities. The results of the study showed that there was a significant improvement in the academic performance of the students as well as their attitudes towards Physics.

A study on the use of multimedia in education was conducted by Tamara and colleagues in (2020). Examining how medical and allied healthcare students felt about using various multimedia learning tools was the goal of the study. 88.88% of the students (n=136) and 89.19% (n=132) reported a positive experience with cellphones and laptops. In addition, 76.31% (n=116) of students felt comfortable exploring multimedia resources. In addition, Yigal (2009) shows that adding cartoons into instruction alters students' perspectives favorably. The research could have used one multimedia element from a broad perspective of multimedia to observe attitude of the learners when the resources are integrated into teaching and learning.

2.4. Experience of Teachers in Integrating Animation in Teaching

Experience is a broad term which can mean the process of getting knowledge or skills which can be obtained from either doing, seen, or feeling things or else something that happens which has an effect on you. Teachers experience therefore, determines whether, or not animation can be integrated in teaching and learning of the Newton's laws of motion. Many studies have be done all over the world to establish how teachers experience affect animation integration in teaching.

Sif et al. (2020) asserted that the instructional resources deliberately devised and distributed by teachers facilitating students' understanding of the lesson before the teacher's actual demonstration. This strategic approach ensured clarity and enhanced learning outcomes among learners.

Teachers have historically employed specific methodologies to foster and convey knowledge, one of which involves the technique of visualization (Strakhovich, 2014). Visualization entails the utilization of graphical representations to transmit data, information, or knowledge (Ursyn, 2018). Visuals aids assist learners in actively participating in constructing their own learning experiences. Additionally, engaging learners in the active creation of visual representations serves to compel them to interact with educational materials and facilitate the transfer of knowledge. Moreover, the production of visualizations enables learners to showcase their comprehension of acquired knowledge. Animated visual aids learners in crafting these visual representations. These visualizations contribute to the encoding of knowledge into long-term memory and facilities its retrieval as needed.

Su and Liang (2014) investigated students' and teachers' views about using animated cartoons in a cram class. Sixty participants were randomly selected from a school in Kaohsiung County and divided into two groups: The experimental group (34students) and control group (26 students). The study revealed that animated cartoons with subtitles significantly enhanced motivation for language learning compared to text-based tools. Additionally, students viewed comics and received appropriate-paced lectures from instructors. Most learners expressed that pauses in animated videos, followed by explanations, aided their comprehension and improved learning effectiveness. Moreover, animated cartoons were associated with a slight improvement in listening achievement compared to text-based materials.

In another study conducted by Wang, Vaughn, and Liu (2011), the impact of animation interactivity on beginners' learning of basic statistics was examined. A sample of 123 college students was randomly divided into four groups. The animation focused on the Principles of Hypothesis Testing, a challenging subject for novice students. The results demonstrated that animation interaction had a positive impact on students' comprehension development ($p = .006$) and lower-level application ($p = .042$). However, it did not affect students' confidence or perception of the program. It was noted that students' cognitive abilities time constraint mighty hinder the effectiveness of interactive animation.

Prasasti, Situmorang, and Kusumawardani (2018) explored the creation of audiovisual modules and media using Lee and Owen's multimedia creation methodologies. The process involved several stages, staring with needs analysis, followed by preliminary examination, and concluding with a design.

In a study by Su and Yeh (2014), mechanical and civil engineering students who took the Physics course in the 2011 academic year participated. Three significant animations related to Physics were examined and found to be beneficial in enhancing learning outcomes and attitudes towards the topic. The evaluations of applied animations in this study significantly improved students' attitudes and learning outcomes, as evidenced by differences in gender, major, and disposition.

Teachers tended to technological applications that were consistent with their pedagogical strategies and preexisting beliefs about teaching and learning methodologies. This indicates that the integration of technology was closely linked to teachers' viewpoints on the dynamics of classroom instruction. It was argued that effective implementation of educational technology hinges on a thorough understanding of teachers' perspectives on technology use (Watson & Rockinson-Szapkiw, 2021). Therefore, this study aimed to examine teachers' perceptions concerning the benefits, their readiness, attitudes, and obstacles encountered when incorporating ICT into their instructional practices. By gaining insight into teachers' experiences and viewpoints, this research aimed to assist educators in optimizing the use of animation in educational activities, identifying challenges, and aiding policymakers in developing appropriate guidelines.

2.5 Summary of Literature Review and Research Gaps

Numerous studies conducted around the world have highlighted the importance role of animations in the learning process. Musa et al. (2013) explored the importance of animations in education, showing that animation is an important tool in providing multimedia materials to students. The results highlighted the effectiveness of animation in helping students understand and retain educational content. Similarly, Gambari et al. (2014) explored the impact of computer animations on mathematics education, demonstrating that students taught with animated content outperformed their peers using traditional instructional methods.

Yigal (2009) examined how animation-based online learning environments influence knowledge transfer and motivation in science and technology education.

Additionally, Adegbija and Falode (2014) assessed the effects of animation-based CamStudio Physics instruction on secondary school students in Nigeria. The findings improved academic performance in Physics. These studies collectively emphasize the added value of animations in enhancing the learning of scientific subjects.

In science classrooms, effective instruction demands active engagement to achieve optimal learning outcomes (Swan, 2012). Incorporating computer animations enhances the relevance and effectiveness of science education (Akpinar & Ergin, 2008). They stimulate multiple senses simultaneously, thereby increasing students' attentiveness during the learning process. These assertions are supported by empirical research. Srisawasdi and Panjaburee (2005) investigated the impact of simulation-based inquiry integrated with formative assessment on students' understanding of buoyancy-driven phenomena. Their findings illustrated continuous improvement in students' conceptual learning from pre-test through retention-test phases, underscoring the benefits of animation-based inquiry in enhancing conceptual understanding. In summary, these studies comprehensively support the valuable role of animations in enriching educational experiences and improving learning outcomes, especially in science education.

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY
3.1 Introductions

This chapter provides an outline of the study's' approach to addressing the research questions, presenting a comprehensive analysis of various elements involved. Specifically, it discusses the research design, study variables, study locale, target population, sampling techniques, sample size, data collection instruments, pilot study, instruments validity and reliability, data collection procedures, data analysis, and ethical considerations.

3.2 Research Design

Research designs play a crucial role in shaping investigations, integrating diverse components to address research questions effectively (Kombo & Tromp, 2006). As highlighted by Kothari (2007), the research design functioned as the structural framework guiding my scholarly pursuit, including data collection, measurement, and analysis strategies. Given the complexities influencing learners' performance in Newton's laws of motion, a quasi-experimental research approach was employed for this endeavor.

A quasi-experimental research design was employed in the study due to the inability to control all physical and human factors affecting learners' achievement in Newton's laws of motion. The design included pre-test and post –test assessment for experimental and controlled groups. Six (6) Form Three classes from different secondary schools were divided into Experimental Group (EG), receiving treatment, and Controlled Groups (CG), without treatment. The EG and CG were selected from schools in geographically distant locations within Kathonzweni sub-county to minimize interaction between study groups. Schools were chosen based on similar teacher expertise, prior experiences and resources. Three schools (A, B, and C) provided learners for the EG, while the other three (D, E, and F) formed the CG. Selecting groups from different locations aimed to control treatment diffusion, as suggested by Suleiman (2011). Extraneous variables were partially controlled by withholding the study's focus from both groups.

A pre-test, sourced from Gas laws to parallel Newton's laws of motion, was administered solely to the experimental groups to assess prior knowledge. Scores were saved for later analysis. The CG received traditional pedagogical instruction on Newton's laws of motion and were tested three weeks. The EG was taught using animated materials for the same duration, with post-test scores recorded. The study topic was Newton's laws of motion, aligned with the Physics curriculum for Form Three and adhered to the schools' scheme of work.

Table 3.1: GROUP PRE-TEST TREATMENT AND POST-TEST

Group	Pre-test	Treatment	Post-test
Boys-County schools	Q1	X	Q2
Girls-county school	Q3	X	Q4
Sub-County mixed school	Q5	X	Q6

Figure 3.1: Illustration of research design for the study

Where: **X=**Treatment for the experimental group: using animations.

Q1=Pre-test for experimental group

Q2=Post-test for experimental group

Q3=Pre-test for experimental group

Q4=Post-test for experimental group

Q5=Pre-test for experimental group

Q6=Post-test for experimental group

3.3 Study Variables

(a) Independent Variable

In the conducted research, the independent variables under scrutiny were the factors affecting the integration of animations in teaching and learning Newton's laws of motion in secondary schools. These factors comprise both teacher-related elements, such as teachers' competencies, teaching experience, and their perception of animation use, as well as school- related factors, including management support, institutional policy, and technical assistance.

(b) Dependent Variable

In this study, as Mugenda and Mugenda (1999) noted, the dependent variable attempts to indicate the total influence arising from the independent variable, was the use of animation in teaching and learning of Newton's laws of motion and its influence on students' achievement in Newton's laws of motion.

(c) Intervening Variable

An intervening variable was created by the independent variable and influenced the dependent variable. In this case, the intervening variable is learners' attitude, teachers' attitude, and school environment in the use of ICT

3.4 Location of the Study

The study was carried out in Makueni County, Kenya, situated in the south eastern part of the nation, spanning an area of approximately 8176.7 km^2. It borders Machakos County to the North, Kitui County to the East, Taita Taveta to the South, and Kajiado to the West. Makueni County comprises nine sub-counties: Mbooni West, Mbooni East, Nzaui, Makueni, Mukaa, Kathonzweni, Makindu, Kibwezi East and Kibwezi West. The main economic activities in these sub-counties are mixed farming, and the population is 987,653 as per the 2019 census. The study specifically focused on six secondary schools in Kathonzweni Sub-County, chosen due to their representative nature and adequate ICT infrastructure. The accessibility of Kathonzweni Sub-County within Makueni County facilitated efficient data collection.

Moreover, the selection was influenced by the low performance of learners in Physics in KSCE examination, the variety of schools in the area, and the researcher's familiarity with the sub-county, minimizing logistical challenges during school visits. The six schools were in possession of computer hardware, software, and infrastructure conducive to integrating animation into teaching Newton's laws of motion (Kombo & Trop, 2006).

3.5 The Target Population

In this study, all 38 public secondary schools within Kathonzweni sub-county were selected for research. The population, as defined by Ogula (2005), encompasses any group of institutions, individuals, or objects sharing common characteristics from which the sample is drawn. The study focused on Form Three Physics learners, which are 1520 in number, and all teachers in these public secondary schools. Form Three students were chosen due to their exposure to Newton's laws of motion at this academic level, as well as their commitment to Physics as a subject for examination in the Kenya Certificate of Secondary Education (KCSE). By targeting this group, the study aimed to mitigate extraneous variables such as students' interest and attitude. Moreover, it was assumed that the teachers in Kathonzweni sub-county possessed prior-experience in computer skills. The selected schools included both county and sub-county schools because they are only the category of schools found in the sub-county.

3.6 Sampling Technique and Sample size

3.6.1 Sampling Techniques

The process of sampling entails skillful selection of a representative subset from a larger population for inclusion in a research study (Ogula, 2005). The study focused on the need to draw inferences about a large population from a subset of that population, using two groups: the Experimental Group (EG) and the Control Group (CG). Both groups had similar priorexperience and were equally equipped with resources. The study sample comprised six schools with computer hardware, software, animation resources, and infrastructures. Purposive sampling techniques were employed to select these schools, ensuring representation from all school categories in Kathonzweni Sub-County: county boys, county girls, and sub-county mixed schools.

3.6.2 Sample Size

A sample represents a well-organized subset of the population under study. Six out of thirty-eight public secondary schools were purposively selected for the study, consisting of two county boys' schools, two county girls, and two sub-county mixed day and boarding secondary schools. This selection represented 15.79% of the total number of public secondary schools in the sub-county. According to Mugenda and Mugenda (2003), they proposed that a sample size ranging from 10% to 50% was deemed acceptable. Additionally, a total of 152 out of 1520 Form Three students, representing 10% of Physics students in the sub-county, were included in the study. Furthermore, six out of thirty-eight Physics teachers, constituting 15.75% of the total, were also sampled. Table 3.2 shows the summary of the study sample.

Table 3. 2: Population and Sample Frame

Population description	target population	sample size	sample size in %
Schools	38	6	15.79
Physics teachers	38	6	15.79
Physics students	1520	152	10
Totals	1596	164	11.03

Source SDE Kathonzweni Sub-County 2023

3.7 Research Instruments

The data collection involved the use of the following instruments.

(a).Physics Achievement Test (PAT)

The Physics achievement test (PAT) was utilized in past studies to assess students' understanding of Newton's laws of motion. Through the incorporation of animations, researchers aimed to enhance comprehension and retention of the principal explained by these laws. Prior to the intervention, a pre-test focusing on Gas laws of motion was conducted to evaluate the prior-experiences of the learners.

Scholarly research supports the notion that animation can significantly influence students' understanding of complex scientific concepts, such as Newton's laws of motion. For instance, smith et al. (2020) found that integrating animations into Physics instruction led to notable improvements in students' conceptual understanding and problem-solving abilities related to Newton's laws. This underscores the effectiveness of employing multimedia tools like animation to explain abstract scientific principles.

(b) Questionnaires

To collect data, questionnaires were distributed to Physics teachers and students across the three experimental groups. The questionnaires were designed to gather insights into the effectiveness of integrating animation in teaching Newton's laws of motion. They included items probing participants' perceptions, understanding, and engagement with the materials presented using animation. Orodho (2003), argued," Questionnaires are valuable tool for collecting data as they allow for the systematic gathering of information from a large number of participants in a relatively short amount of time." (P.45).

i) Physics Teachers' Questionnaire

This study on integrating animation in teaching Newton's laws of motion aimed to investigate the impact of visual aids on comprehension and retention of Newton's laws of motion. It employed a mixed-methods approach, combining quantitative analysis of pre- and post-test scores with qualitative insights from participant feedback

The three experimental groups were exposed to varying levels of animation usage, allowing for a comprehensive assessment of its educational efficacy.

ii). Physics Students' Questionnaires (PSQ)

The questionnaires employed in this study mirrored the format of the teacher questionnaires and aimed to collect data from Physics students in the experimental groups only (Appendix VI). It gathered information on various aspects, including students' backgrounds, their perspectives regarding the effectiveness of animation in comprehending Newton's laws of motion, the frequency of animation utilization in classroom teaching, as well as perceptions regarding management and technical support associated with its implementation.

(c) **Lesson Observation Schedule (LOS)**

The schedule for lesson observations involved the acquisition of data through the process of observing individuals' conduct to acquire insights into the targeted phenomena (Jonhson & Christensen, 2004). Observation entails the systematic collection of data regarding both physical and social domains as they unfold directly through sensory perception rather than relying on secondhand accounts. It is an essential means of validating information obtained through self-reporting by participants

The lesson observation instrument furnishes insights into whether the physical instructor employed animations during teaching and the learners' reactions to such an instructional approach (Appendix VIII). This tool holds significance as it furnishes insights into the actual behaviors exhibited by those under scrutiny.

(d) Teachers Interview Guide (TIG)

The interview guide utilized a structured approach to unveil insights regarding the utilization of animation in teaching Newton's laws of motion. Firstly, the interviewer established the background knowledge of the participants, probing into their familiarity with both Newtonian Physics and educational methodologies. Subsequently, the discussion delved into the specific application of animation in the teaching process.

Questions were designed to ascertain the participant's understanding of the conceptual challenges inherent in Newton's laws of motion and how animation could effectively address these challenges. This included inquiries into the visualization of abstract concepts, such as inertial, acceleration and action-reaction pairs, through animated representations.

Moreover, the interview sought to uncover the participant's experiences with integrating animation into their teaching practices. This encompassed inquiries into the selection criteria for animations, the alignment of animations with instructional objectives, and assessment of students' learning outcomes facilitated by animated instruction.

Furthermore, the interview guide aimed to elicit reflections on the efficacy of animation as a pedagogical tool in conveying Newton's laws of motion. Participants were prompted to discuss instances where animation enhanced students' engagement, comprehension, and retention of key concepts.

3.8 Pilot Testing

A pilot study is a small-scale investigation used to test research procedures, sample recruitment strategies, data collection instruments, and other methodologies before conducting a large-scale study (Mugenda & Mugenda, 2003). The pilot study aimed to evaluate the reliability and validity of the research tools. It involved two public schools in Kathonzweni sub-county, which were not initially included in the study. Those schools were purposely chosen, comprising one county boys' school and one county girls' school. The study included 60 Form three students and two teachers. Additionally, five Physics lessons were observed in Form Three as part of the study. Following the pilot phase, various deficiencies in the instruments were detected, prompting essential adjusting and modifications to guarantee their validity and reliability**.**

3.9 Validity of Research Instruments

Validity refers to the accuracy with which an instrument captures the desired result. It is rare for an instrument to be perfect. The score recorded by the instrument must pass the test of construct validity, ensuring that it is important, meaningful, helpful, and serves a purpose. In this study, the integration of Newton's laws of motion in Physics teaching was considered using the Physics Achievement Test (PAT). The Physics Teacher Interview (PTI) validated to represent the teachers' abilities to incorporate animation in Newton's laws of motion instruction. The findings from the pilot study supported (PAT) and (PTI). To validate the research tools, the subject matter experts discussed with the researchers the findings.

3.10 Reliability of Research Instruments

Reliability pertains to the capacity of an instrument consistently yield the same results when measured repeatedly under identical conditions. In this study, the reliability of the research instruments, namely the Physics Achievement Test (PAT), Physics Teachers' Questionnaires (PTQ), and Physics Students' Questionnaires (PST) was assessed during the pilot phase by computing cronbach's alpha, a measure of internal coherence, was calculated to be 0.80, 0.79, and 0.78 for PAT, PTO, and PSO, respectively. A value of 0.75 or high was deemed acceptable.

3.11 Data Collection Procedure

Preliminary visits were conducted to each of the sampled schools before commencing the study. These visits aimed to establish a positive rapport with the teachers and students, wherein the purpose of the study was explained. This approach helped mitigate the hawthorne effect. The researcher obtained Form Three class timetables from the three experimental groups to plan school visits effectively. During familiarization, the researcher observed learning in the classrooms without taking notes, fostering a relaxed atmosphere for both teachers and students.

During the data collection phase, teachers underwent training on integrating animation into teaching Newton's laws of motion. This training encompassed loading, unloading, and navigation through various animation resources. Questionnaires were administered to Physics teachers and learners after post-test in the experimental groups, which received treatment. Data collection occurred over a three-week period and was subsequently processed. Statistical Package for the Social Sciences (SPSS) version 17 was utilized for data analysis, with results presented through tables, graphs, and pie charts. The study's findings were reported, conclusions drawn, and recommendations made based on the analysis.

3.12 Data Analysis Plan

The data analysis plan encompassed conduct a pre-test exclusive on three experimental schools and a post-test on all six schools participating in the study. Statistical Package for Social Science (SPSS) version 17 was utilized for data analysis, employing descriptive statistics such as percentages, means, and frequency tables. Additionally, questionnaires for both teachers and students in the experimental schools were precisely scrutinized to ensure complete responses.

Moreover, teachers from the three experimental schools underwent interviews to delve deeper into their perspectives.

To gauge the extent of animation utilization in teaching Newton's laws of motion, pertinent items from the PAT, PTQ, PSQ, LOS, and TIG were computed and interpreted according to a predefined guide. Furthermore, the analysis aimed to ascertain the attitudes of both teachers and students towards the use of animation in teaching Newton's laws of motion.

Respondents were required to express their views, categorizing their stance as strongly agree (SA), Agree (A), Disagree (DG), undecided (UD), or not sure (NS). Mean scores were calculated for both positive and negative responses to facilitate data triangulation. Moreover, Pearson Product- moment correction analysis was employed to identify factors influencing the use of animation in teaching Newton's laws of motion, as it is one of the primary measures of association or correlation among variables in educational research (Cohen et al, 2011).

3.13 Data Collection Instruments

Preliminary visits were conducted to each of the sample schools before commencing the study. These visits aimed to establish a positive rapport with the teachers and students, wherein the purpose of the study was explained. This approach helped mitigate the effect. The researcher obtained Form Three class timetables from the three experimental groups to plan school visits effectively. During familiarization, the researcher observed learning in the classrooms without taking notes, fostering a relaxed atmosphere for both teachers and students.

During the data collection phase, teachers underwent training on integrating animation into teaching Newton's laws of motion. This training encompassed loading, unloading, and navigating through various animation resources.

According to Denzin and Lincon (1994), research instruments are the means through which information is gathered for a study. The Physics Achievement Test (PAT) was used to compare students’ performance in Newton’s laws of motion in Form Three class. Questionnaires were administered to Physics teachers and learners after the post-test in the experimental group, which received the treatment. The lesson observation schedule (LOS) played a crucial role in enhancing teachers’ experience in teaching Newton’s laws of motion. It provides structured opportunities for educators to observe their peers implementing various teaching strategies, allowing them to glean insights, techniques, and best practices. By observing successful implementations and receiving constructive feedback, teachers could refine their approaches, deepen their understanding of the subject matter, and improve their instructional skills. Over time, this interactive process contributed to establishment of a more robust and effective pedagogical framework for teaching Newton’s laws of motion, enhancing both teacher confidence and student learning outcome. Data collection occurred over a three-week period and was subsequently processed. Statistical Package for the Social Science (SPSS) version 18 was utilized for data analysis, with results presented through tables, graphs, and pie charts. The study’s findings were reported, conclusions drawn, and recommendations made based on the analysis.

Table 3. 3: Data Collection Instruments

Objectives	Instrument and test statistics	Nature of data
1. To determine differential effectiveness of learners achievement by school category	1. Use of pre-test and post-test given to the subject. 2. Mean and T-test used during analysis	Quantitative and qualitative data
2. To determine differential effectiveness of learners based on gender.	Use of pre and posttest given to the subject.	Quantitative
3. To establish attitude of the learners towards instructional integration of animation in teaching	Use of learners' questionnaires.	Qualitative
4. Establish experience of teachers in integrating animation in teaching Newton's laws of motion	Use of teacher questionnaires, interview schedules and lesson observation schedules.	Qualitative

3.14 Ethical Considerations

In the past, ethical consideration were paramount in research endeavors conducted under the authorization of several entities in Kenya. Researchers adhered to strict guidelines set forth by Kenyatta University graduate school, the National Commission for Science, Technology and Innovation (NACOSTI), The Makueni County Director of Education, and the Kathonzweni Sub-County Educational offices.

The researcher ensured the protection of participants' rights, confidentiality, and integrity of the research process. As stated by Emmanuel and Eugene (2019), ethical considerations are fundamental in safeguarding the welfare of research participants and maintaining the credibility of the research findings.

Additionally, prior authorization was sought from six principals of schools from which data was to be collected. This ensured that the research was conducted in a transparent and responsible manner, with due respect for the rights and dignity of all involved parties. In the study, the participants were given a guarantee that their data would be exclusively utilized for the research objectives and handled with utmost privacy prior to conducting the interview. The researcher adhered to the established research protocol of the university and guaranteed respondents complete anonymity regarding any information they provided. Proper acknowledgement was given to scholarly articles and the work of other researchers cited in the study.

CHAPTER FOUR
RESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.0 Introduction

The purpose of this study is to investigate the consequence of integrated animate content in Physics classes to improve secondary school students' academic achievement and understanding of Newton's laws of motion. The research was conducted in Kathonzweni Sub-County, Makueni County, Kenya. Data collection includes administration of teacher questionnaires, pre- and post-test student evaluation student questionnaires, teachers' observation plans, and teacher interviews. Data analysis was conducted for research purposes to determine the impact of animation integration on students' understanding of Newton's laws of motion.

1. to determine differential effectiveness of animation integration on achievement of the Learners in Physics based on school category.
2. to determine differential effectiveness of animation integration on achievement of the Learners in Physics based on gender.
3. to establish the learners' attitude towards integrating animation in teaching and Learning of Physics.
4. To establish the experience of teachers in integrating animation in teaching Newton's of Laws of motion.

4.1 Findings

A lot of good data was collected during the study. The bulk of the data was analysed into various categories, as explained in the next paragraph. Similarly, qualitative data was analysed in different categories as explained in the next chapter. Quality data is clean and organized thematically. Excerpts from participants' responses are provided to support qualitative information. Data analysis was carried out in line with research purposes. The results from data analysis are used to test the validity of the developed hypotheses. Based on the findings, the false hypothesis is retained or rejected as appropriate. Collecting demographic and background information about the participant in the research is important in terms of correct interpretation of the collected data in line with the purposes of the study.

Demographic characteristics include school ranking, student gender, student behaviour, and teacher's ability to integrate animation to teach Newton's laws of motion.

Students' gender analysis is shown in the table below.

Table 4.1 students' gender (n=152)

Gender	Frequency	Valid percentage	Cumulative percentage
Male	82	53.95	53.95
Female	70	46.05	46.05
Totals	100	100	100

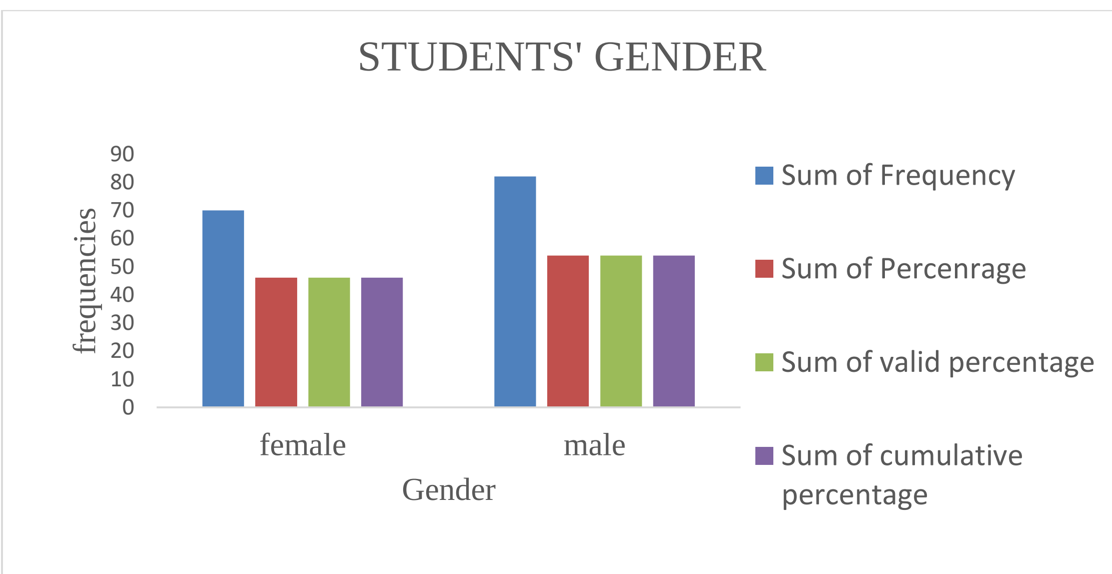

Figure 4.1 Students' by Gender and their Percentages

The bar chart above is analysis of the gender of students and shows that 53.95% are boys and 46.05% are girls. Achievement in Physics increases students' motivation to choose Physics in Form Three and pursue Physics –related careers after Form Four. However, the enrolment rate of women in Physics is low and this can be attributed to their poor achievement in Physics section of the Kenya Certificate of Secondary Education (KCSE) examination and negative attitude towards science, especially Physics**.** This poor achievement resulted in a lower student achievement for girls in Three, despite their strong interest in Physics. As a result**,** fewer girls continues to work in Physics- related jobs after high school. The table below analyzes girls' enrolments in KSCE Physics across the country from 2010 to 2018.

Table 4.2 National Girls Enrolment in Physics

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Physics	15312	16094	16966	19288	21376	23767	23769	25411	29964

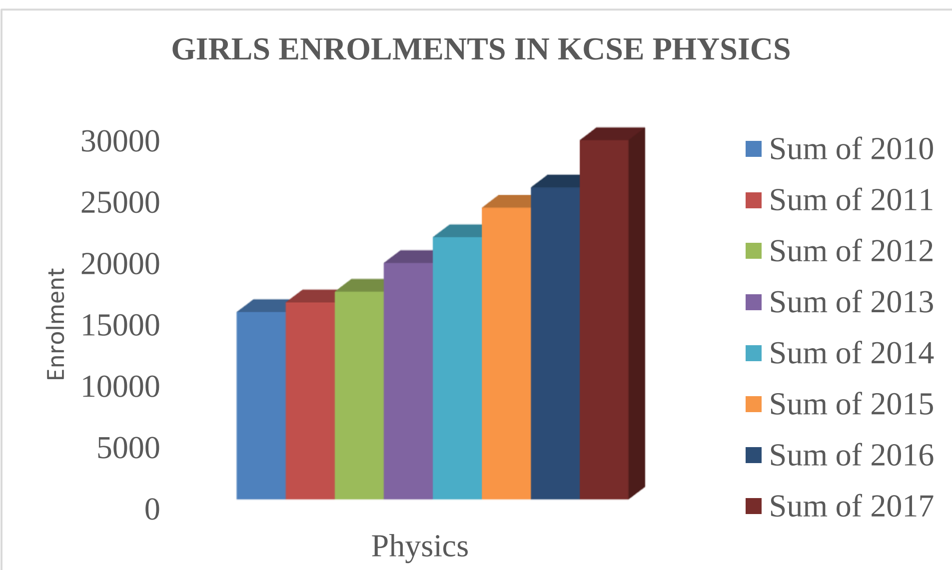

Figure 4.2 Girls enrolment in KCSE Physics

The table below analyzes the national performance in Physics from 2012-2017 for both boys' and girls' students. The results show that boys dominate the performance in Physics.

Table 4.3 National Performance in Physics in KCSE (2012-2017)

Year	2012	2013	2014	2015	2016	2017
Total enrolment	198356	207730	222676	260665	243453	276239
Girls mean score	26.61	29.09	31.43	32.85	39.06	39.04
Boys mean score	30.88	32.28	35.99	35.99	40.81	42.23

The bar graph below indicates the achievement of the girls and boys in Physics in KCSE from 2012 to 2017.

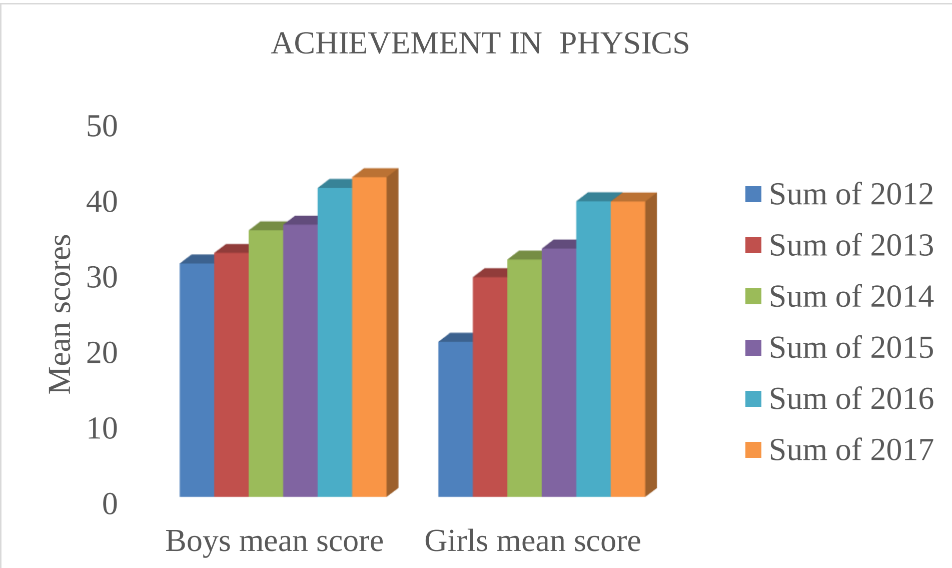

Figure 4.3 National Physics performance

The findings of this study differ from a study conducted by the Alicia and Amparo (2019) on how few women engaged in STEM fields in Latin America. Their study revealed that cultural biases influenced female behavior, leading to low representation in STEM. In contrast, this study found that poor achievement and negative attitudes towards Physics are the primary factors contributing to low enrollment of girls in Form Three, an elective Physics subject.

4.2 Effectiveness of Animation Integration on Achievement of Learners in Physics Based on School Category

The first objective of the study was to examine differential effectiveness of animation integration in teaching Newton's laws of motion and its' achievement on learners based on school category. The inquiry employed pre-test and post-test assessments to gather data from two distinct sets of schools: those integrating animation into their pedagogy (experimental group) and those not (controlled group). The researcher aimed to discern which school category reaped the most benefits following the implementation of the intervention. Specifically, focusing on Form Three Physics students, chosen for their exposure to Newton's laws of motion at this stage.

The researcher, sought to examine the motives behind their selection of Physics as a subject to be evaluated upon completion of their four year course. Within the experimental group, the boys' county school attained an average score of 92.13%, In contrast to the controlled group's mean score of 66.78%. This 25.15% discrepancy in mean scores suggests that integrating animations into the teaching of Newton's laws of motion significantly enhanced learners' achievements in Newton's laws of motion.

Similarly, the girls' county school garnered an aggregate score of 91.23%, while their controlled group counterparts achieved a mean score of 27.03%. It is evident that female students benefited most from the integration of visual and auditory modalities. The combined achievement mean score of 89.6% underscores the positive impact of integrating visual and auditory modalities, whereas the controlled group managed a mean score of 54.2%.

The achievement differential between the experimental and controlled groups in the mixed-day and boarding schools was 35.4%, suggesting that sub-county schools, typically associated with lower prior experience, derive substantial benefits from the integrating of animation into the teaching and learning of Newton's laws of motion. Therefore, the null hypothesis was rejected which states that there is no significant difference in achievement for learners who use resources with animation and those who use resources without animation based on school category. The alternative hypothesis was accepted which shows that there is significant difference in achievement for learners who use resources with animation and those who use resources without animation based on school category. Therefore, the model should be accepted in teaching and learning.

Table 4.4 -Performance of the students based on school category

Study group	N	Mean
County boys' school	**55**	**92.13**
County girls' school	**35**	**91.23**
Sub-county mixed day and Boarding school	**21**	**89.60**

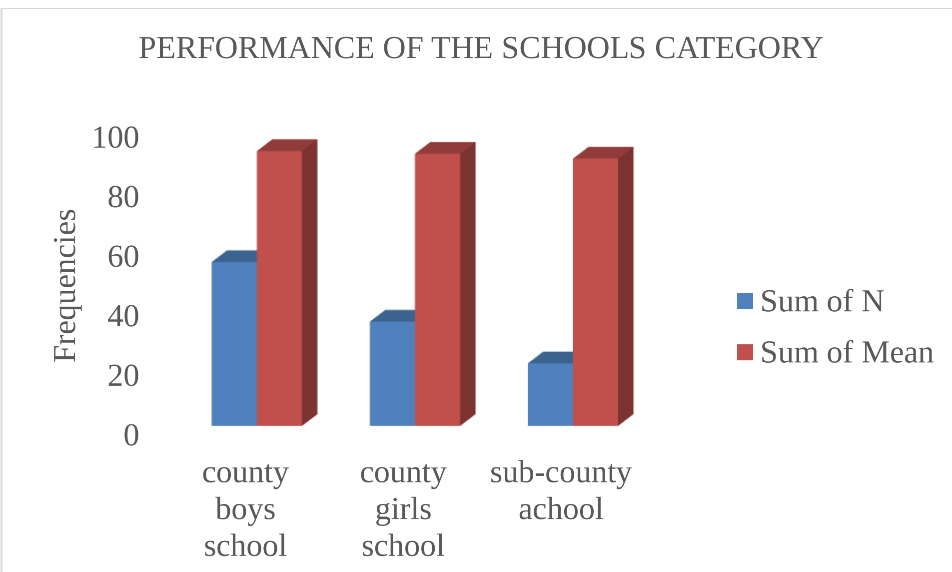

Figure 4.4 Performance of the school

4.3 Effectiveness of Animation Integration on Achievement of Learners in Physics Based On Gender

4.3.1 County- Girls Secondary School

The second objective of this study was to investigate how integrating animations influenced the academic performance of students learning Newton's laws of motion, while also considering gender differences. The research aimed to evaluate the impact of animation on the academic outcomes of Form Three students studying Newton's laws of motion. Both pre-test and post-tests were given to students in both experimental and control groups. The main focus of the study was on how the use of animation affected the academic success of Form Three Physics students. Table 4.5 shows the academic performance levels of students when animations were included in the instruction of Newton's laws of motion in Form Three Physics classes.

Table 4.5 County Girls Schools – performance of learners in the post-test

Study group		N	Mean	Std.	Std. error Mean	T-test
Post-test Score	**Experimental**	**35**	**91.23**	**8.172**	**1.4919**	**3.256**
	Controlled	**27**	**64.20**	**15.397**	**2.811**	**2.8840**

In the post-experimental analysis, it was found that following treatment, the treatment group exhibited average score of 91.23 with a standard deviation of 8.172, while the controlled group displayed a mean score of 64.20 with a standard deviation of 15.397. To ascertain the significance of the disparity in average scores, a t-test was conducted, yielding values of 3. 256 and 2.8840 for the experimental and controlled groups, respectively.

The findings of the post-test unveiled a t-test value of 3.256 and a p-value of 0.001, indicating a substantial difference in average scores between the experimental and controlled groups. Notably, the p-value fell below the predetermined alpha value of 0.005, leading to the rejection of the null hypothesis, which posited no significant variance in achievement among learners utilizing animation-enhanced resources compared to those without, based on gender. Conversely, the alternative hypothesis, suggesting a correlation between the integration of animation in teaching Newton's laws of motion and students' achievement, was accepted.

The main aim of the study was to assess the effectiveness of animation integration into the teaching of Newton's laws of motion in enhancing learners' academic achievement. This endeavor encompassed both pre-test and post-test assessments, aligning with the assertion put forth by Gevemew and Abdissa (2015), emphasizing the cultivation of students' potential to bolster academic outcomes.

Building upon the findings, Dikmenli et al. (2018) underscored a significant distinction between learners exposed to animated films in instruction compared to those without such exposure. Consequently, the integration of animation into Newton's laws of motion instruction is advocated as a potent pedagogical strategy to enhance learning outcomes, particularly among female students in secondary education settings

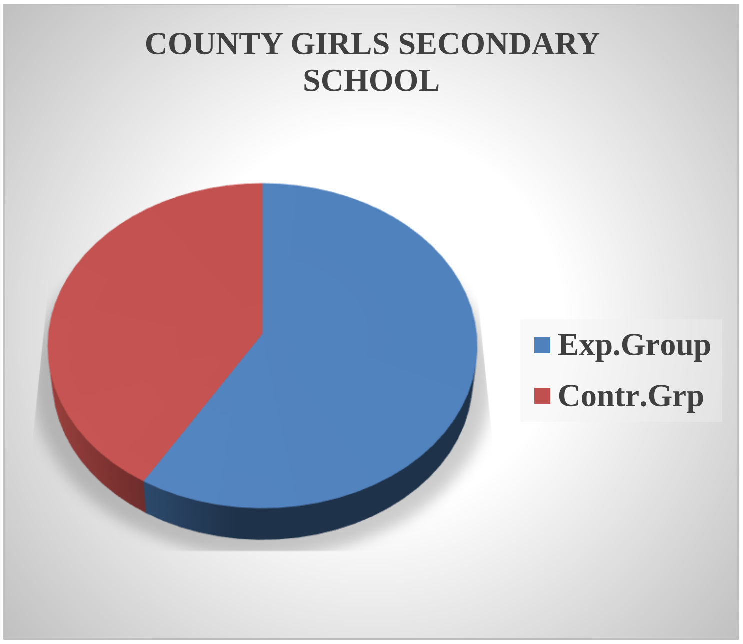

Figure.4.5 County Secondary School (Girls' Analysis)

4.3.2 County School - Experimental and Controlled Groups (Boys' Analysis)

In the after-test analysis, it was perceived that following the administration of treatment, the experimental group exhibited average score of 92.134, accompanied by a standard deviation of 1.432. Conversely, the controlled group displayed a mean score of 66.781, with a standard deviation of 2.173.

To ascertain the significance of the disparity in mean scores between the two groups, a t-test was conducted, yielding respective t-values of 3.261 and 2.784 for the experimental and controlled groups. The resultant post-test outcomes indicated a t-value of 3.261 with a corresponding p-value of 0.001.This findings suggest a substantial discrepancy in mean scores between the experiment and controlled groups.

Notably, the calculated p-value fell below the predetermined alpha threshold of **α=0.005,** prompting the rejection of the null hypothesis, which posited no discernible difference in achievement between learners exposed to animation-integrated resources and those without such exposure, based on gender.

Conversely, the alternative hypothesis, asserting a correlation between the integration of animation in teaching Newton's laws of motion and student achievement, was upheld. These findings imply a notable positive effect of animation integration on the academic achievement of male students, differentiating them from their counterparts in the controlled group.

Table 4.6 County Boys School-performance of learners in the post-test

	Study group	N	Mean	Std.	Std. error	T-test
Post-test Score	**experimental**	**55**	**92.134**	**1.432**	**1.432**	**3.261**
	Controlled	**47**	**66.781**	**2.173**	**2.173**	**2.784**

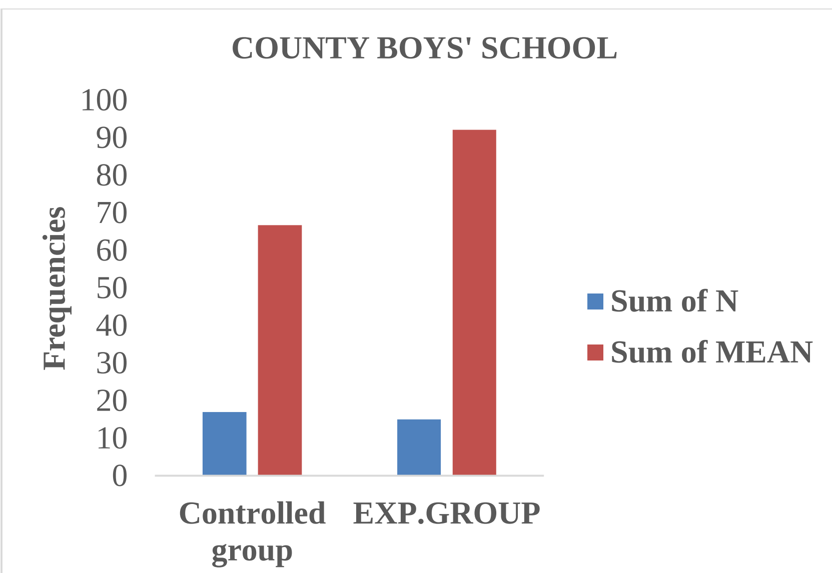

Figure 4.6. County Secondary School (Boys' Analysis)

4.3.3 Sub-County School - Experimental and Controlled Groups (Boys' Analysis)

The sub-county school analysis focused on both boys and girls separately. For boys, the experimental group of 21 students demonstrated average score of 89.6 in the post-test accompanied by a standard deviation of 6.993. Conversely, the controlled group displayed a mean score of 54.2, with a standard deviation of 12.973. To ascertain the significance of the disparity in mean score between the two groups, a t-test was conducted, yielding respective t-values of 3.506 and 0.7475 for the experimental and controlled groups.

The resultant post-test outcomes indicated a t-value of 3.502 with a corresponding p-value of 0.001. These findings suggest a substantial discrepancy in mean scores between the experimental and controlled groups. Notably, the calculated p-value fell below the predetermined alpha threshold of (**α=0.005),** prompting the rejection of the null hypothesis, which posited no discernible difference in achievement between learners exposed to animation-integrated resources and those without such exposure, based on gender.

Conversely, the alternative hypothesis, asserting a correlation between the animation integration in teaching Newton's laws of motion and students' achievement, was upheld. Thus, the model is be accepted in teaching and learning.

Table 4.7 Sub-County school –performance of learners in the post-test (Boys analysis)

	Study group	N	Mean	Std.	Std. error	T-test
Post-test	**experimental**	**21**	**89.6**	**6.993**		**3.502**
Scores	**controlled**	**19**	**54.2**	**12.972**		**0.7475**

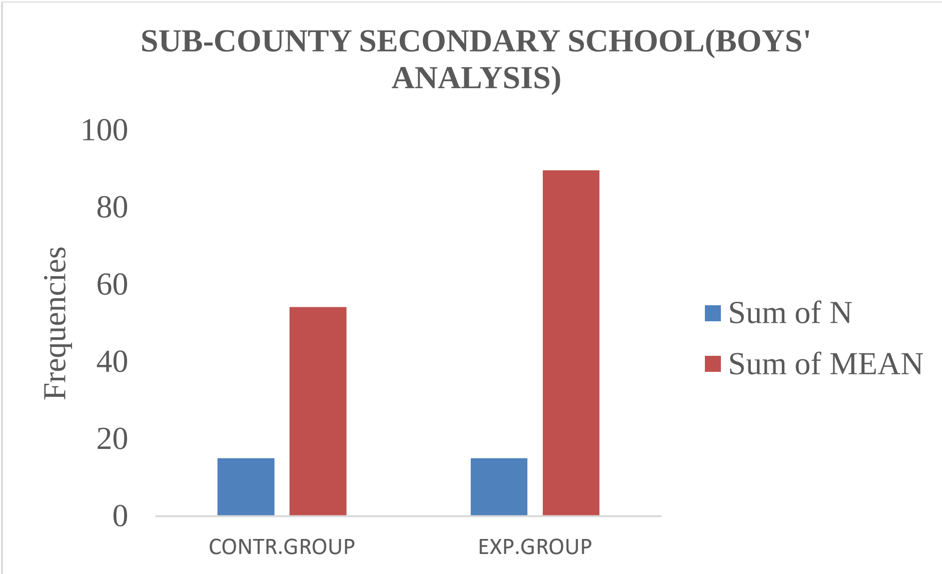

Figure 4.7. Sub-County Secondary Schools (Boys' Analysis)

4.3.4 Sub-County School - Experimental and Controlled Groups (Girls' Analysis)

The study objective was to investigate the achievements of girls in sub-county schools with limited prior-experience. The research employed pre-experimental test and post-experimental test of the experimental group and post-test of controlled group as data collection instruments. The gathered data was then subjected to statistical analysis to ascertain any notable distinctions between the experimental and controlled groups in response to the applied invention.

The experimental group underwent pre-testing and received instruction utilizing animation resources prior to the administration of the Physics Achievement Test (PAT) as the post-test measure. Conversely, the control group, consisting of girls from a sub-county school, did not undergo pre-testing or receive instruction with animation resources, but were taught Newton's laws of motion over a span of fifteen lessons before taking the PAT.

The post-test mean scores for the experimental group, comprised of fifteen girls, were recorded at 90.0, while those for the control group, consisting of thirteen girls, were 52.2. The narrow dispersion of grades around the mean, denoted by a relatively low standard deviation of 6.960 and a standard error of the mean of 1.787, further affirms the efficacy of this instructional approach. Subsequent analysis employing a t-test yielded a result of 3.378 for the experimental group, accompanied by a corresponding p-value of 0.001. It is noteworthy that the calculated p-value (0.001) fell below the predetermined alpha threshold of 0.005, leading to the rejection of the null hypothesis positing no significant disparity in achievement between learners utilizing animated and non-animated resources, based on gender. Conversely, the alternative hypothesis, suggesting a correlation between the incorporation of animation in teaching Newton's laws of motion and student achievement, was upheld.

Table 4.8 Sub-County School-Experimental and Controlled Groups (Girls Analysis)

	Study group	N	Mean	Std.	Std. error	t-test
Post-test	**experimental**	**15**	**90.0**	**6.960**	**1.787**	**3.476**
Score	**controlled**	**13**	**52.2**	**11.932**	**3.367**	**0.567**

Source: From Researcher

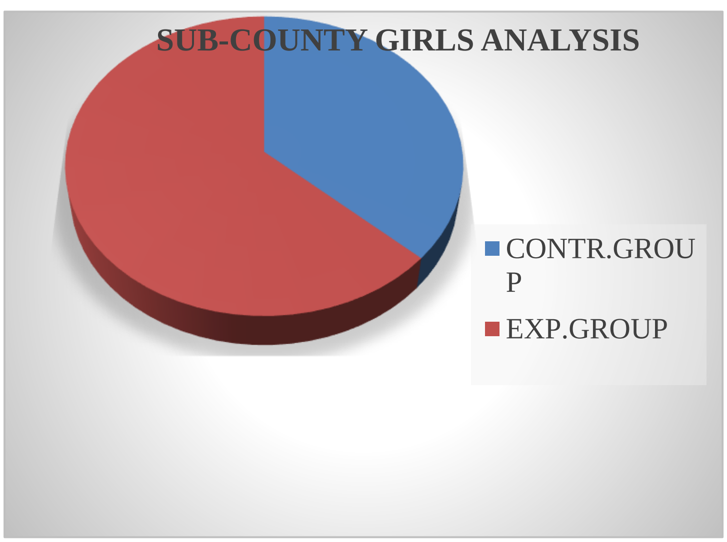

Figure 4.8. Sub -County Mixed Secondary Schools (Girls' Analysis)

4.4 Learners' Attitude towards Integrating Animation in Teaching and Learning Physics

The third objective of the study sought to determine the attitude of learners when animation was integrated in teaching and learning of Newton's laws of motion. The significance of attitude lies in its potential to impact students' achievement, particularly in the context of integrating animation within the teaching of Newton's laws of motion. The study aimed to assess how students' attitudes were affected by the inclusion of animation in educational context. Feedback gathered from learners in the experimental group reflected favourable views towards the utilization of animation. This statement was extracted from a learner's feedback within county girls' experimental groups.

"The *physics animation digital content in Newton's laws of motion*

has proven highly beneficial, particularly to those dedicated to

Studying. It has significantly improved comprehension and visualising

of the laws, making them more tangible and clear."

Another learner from the EG in the county boys school." *The animation content encouraged me to visualize this abstract content of how vehicles collide, fuse together and move either in one direction or different directions into concreteness."*. Another learner from EG in the county girls school stated. "*Learning is more cultivating and enriching when animation content is used in learning Newton's laws of motion."* Another learner from EG in mixed day and boarding school in sub-county school state.*" I was able to relate how action and reaction are equal when I saw a person firing a gun, the action force pulls the bullet outside the gun, and the reaction force pushes the gun backward was brought on the computer screen."*

Conversely, students in control schools, lacking animation in their instructional materials, demonstrated diminished interest levels and struggled to engage meaningfully with the content. Their limited enthusiasm was evident in suggestions by one of the learners in the county boys controlled school which he says," *I think use of projector can be used to enhance content engagement because those abstract content are brought on the computer screen."* This statement implies still those learners face change when cognitively visualising this abstract content into concreteness despite the fact that their prior-experience is good.

It became apparent that, high-quality animation, alongside other multimedia elements, served to motivate and sustain learner's interest throughout the learning process. This heightened motivation, consequently, correlated with improved academic achievement in Newton's laws of motion and the broader discipline of Physics. Notably, scholarly research underscores the significance of enhancing learners' attitudes and motivation as pivotal indicators of science education quality.

Table 4.9 attitude of the Respondent

	Frequency	**percentage**	**valid percentage**	**cumulative percentage**
Positive	30	83.33	83.33	83.33
Negative	6	16.67	16.7	16.7
Total	100	100	100	100

The researcher was curious about establishing the attitude of the learners when animation was integrated into teaching Newton's laws of motion. Thirty students out of the 36 who participated in the study (representing 83.33 percent) attested that when animation was integrated into teaching Newton's laws of motion, they developed positive attitude towards learning Physics. They confirmed that the animation helped them to visualize abstract concepts and transform them into concrete understandings. Moreover, they emphasized that the integration of animation in teaching Newton's laws of motion made the lesson more interactive and captivating.

The students also expressed that they were able to grasp the concept better compared to when they were only reading textbooks. These findings support the argument made by Papanastatious and Zembylas (2002) that students' attitudes and beliefs influence their performance in mathematics. Therefore, the animation model is deemed significant in shaping attitudes and should be adopted.

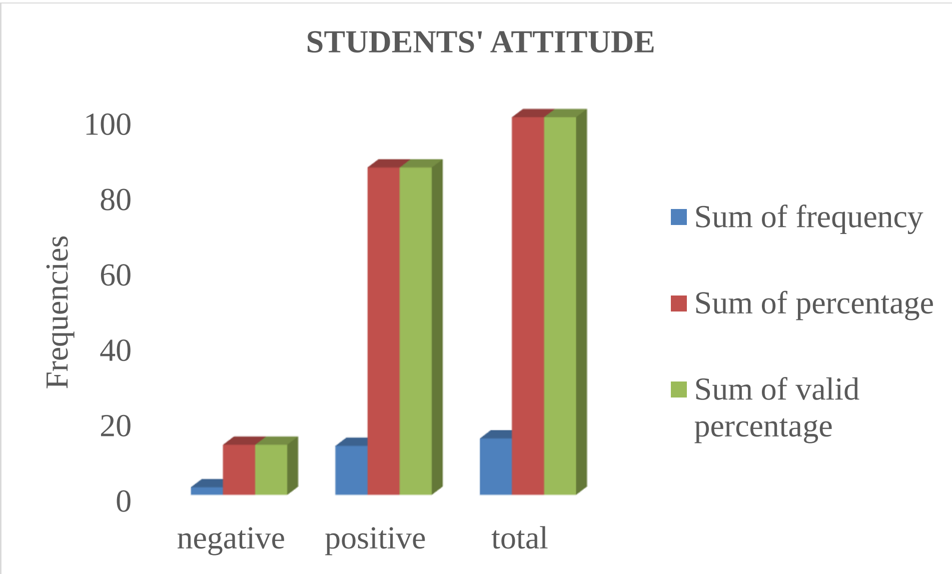

Figure 4.9. Students' Attitude

4.5 Teachers' Experience in Integrating Animation in Teaching Newton's Laws of Motion in Physics

In the realm of Physics education, an absorbing landscape Unfold. The seamless integration of animation holds the promise of unlocking a world of learning possibilities. It is within this context that our research embarks on an expedition to unearth the first-hand experience of educators as they embark on the exciting journey of infusing animation into their pedagogical practices on Newton's laws of motion. By adopting a multifaceted methodology comprising,

1. Teachers' questionnaire
2. Lesson observation schedule

3. Teachers' interview

The study endeavours to shed light on the captivating insights of three teachers from county and sub-county schools, who form the core of our experimental group. The objective is to glean valuable insights into their competency, curiosity, and enthusiasm as they embrace this transformative approach to physics instruction.

4.5.1 Teachers' Questionnaire

The objective of the teachers' questionnaire was to assess the skill levels of the three educators in the experimental group when integrating animation models into their instruction of Newton's laws of motion. These questionnaires were exclusively administered to the three teachers within the experimental group, consisting of both county schools (boys and girls) and sub-county schools. The aim was to gather insight into their experiences while incorporating animation as a pedagogical tool for teaching the laws of motion proposed by Sir Isaac Newton.

During the course of this study, the three teachers exhibited a profound sense of curiosity and enthusiasm towards integrating animation into their instructional practices. Notably, their competency in utilizing ICT equipment showed notable improvement. These findings align with the previous work of Hennesy et al. (2005), which emphasizes the significance of a teacher's prior experience with ICT as a determining factor in its successful integration within the teaching and learning process.

Incorporating animation materials from a diverse multimedia resources played a pivotal role in enriching their teaching methods. As a result, they were able to effectively elucidate abstract concepts of Newton's laws of motion, fostering a deeper and more concrete understanding among their students.

Furthermore, the participating teachers acquired valuable computer skills through specialized workshops organized by educational institutions. These workshops equipped them to seamlessly navigate and utilize ICT and multimedia hardware and software, eliminating any potential difficulties in the integration of technology into their teaching methodologies.

It is evident from this investigation that the strategic integration of animation into teaching Newton's laws of motion not only fostered a positive attitude among educators but also enhanced the overall learning experience for the students. These insights underscore the significance of incorporating innovative pedagogical tools to empower educators and elevate the quality of science education in classrooms.

Table 4.10 Teachers' Education Level

qualification	**frequency**	**percentage**	**valid percentage**	**cumulative percentage**
Degree	0	0	0	0
Diploma	1	33.33	33.33	33.33
Certificate	1	33.33	33.33	33.33
Workshop	1	33.33	33.33	33.33

The graph below indicates the teachers' acquisition level of computer literacy.

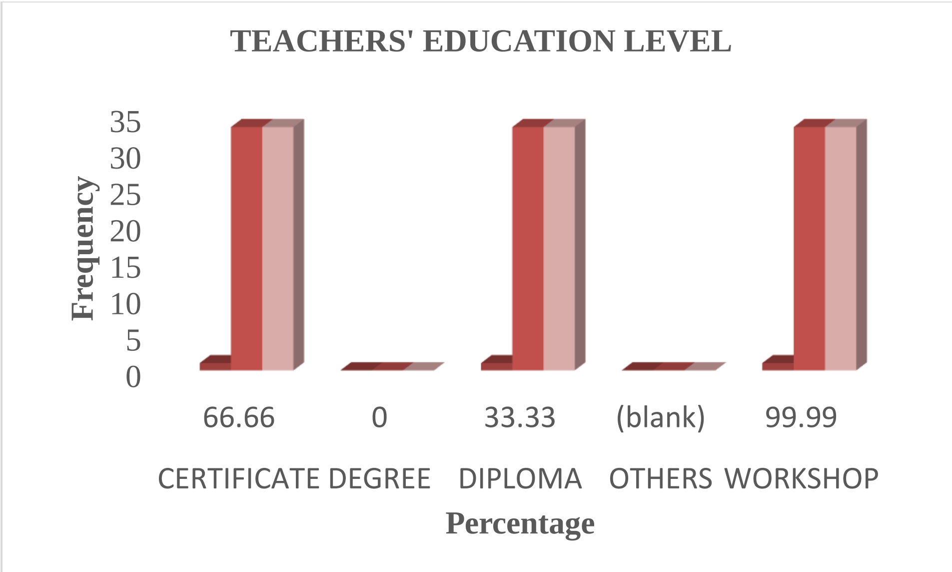

Figure 4.10 Teachers' Qualification in ICT Use

Similarly, questionnaire question five (5) of the teachers' questionnaire aimed to establish teachers' attitude when integrating animation in teaching Newton's laws of motion. The three teachers in the experimental group developed a positive attitude towards integrating animation in teaching Newton's laws of motion. They were able to mentally visualize how vehicles collide, fuse, and move together. Abstract concepts become tangible, allowing them to present the material without difficulties as the concepts are brought into concreteness on the computer screen.

Furthermore, they confirmed that their teaching pedagogy was also sharpened. These findings align with previous research conducted by Francisco, Guillen and Maria (2020), where they asserted that the attitude of the teachers towards integrating ICT in teaching and learning has a determining impact on university innovation. Additionally, Daad et al (2019) revealed that teachers generally hold positive attitude towards technology, learning technology integration with moderate experience in integrating learning technology.

Similarly, Karle et al. (2013). In their research, they discovered that the successful integration of ICT by teachers depended on their attitudes, adherence to subject norms, and self-efficacy. The present study sought to explore the effects of implementing an animation model in teaching Newton's laws of motion on teachers' attitudes. Depending on their perceptions of the animation model, teachers' attitudes could either become positively or negatively influenced

The data on teachers' attitudes in the three experimental schools was computed and analyzed in the table below.

Table 4.11 Teachers Attitudes toward Animation Model

Attitude	**Positive**	**Negative**
Points	**30**	**0**

The bar graph below shows teachers' attitude towards integrating animation model in teaching Newton's laws of motion:

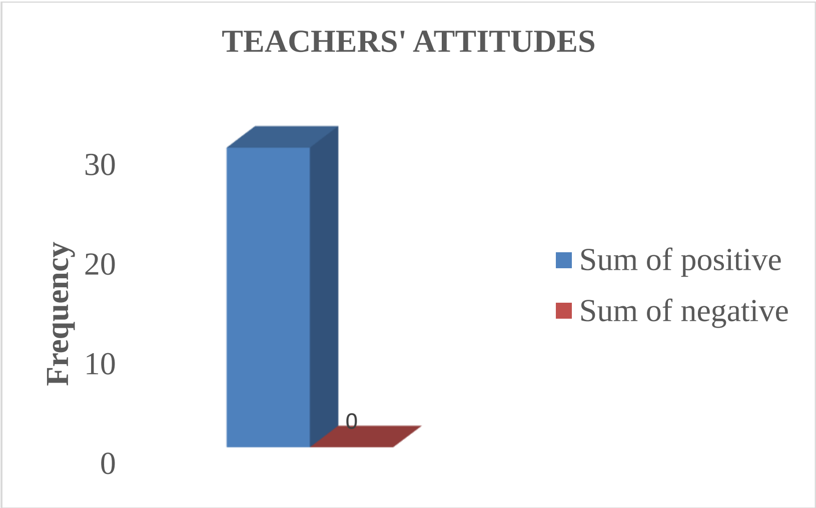

Figure 4.11 Teachers' Attitude

In the same way, question 4 of the teachers' questionnaires aimed to investigate which part of the lesson development animation model was incorporated and how frequent ts was used. Most teachers integrated animation in the lesson development phase, with only a few using it in the introduction of the lesson to stimulate students, thinking and in the conclusion to summarize the concept. This could be explained by the significant amount of time dedicated to the lesson development.

This study investigated how teachers were able to integrate the animation model into teaching Newton's laws of motion and found that teachers' attitudes improved as conceptual understanding increased, enhancing procedural knowledge when solving problems related to Newton's laws of motion. The collected data was analyzed in the table below.

Table 4.12 Frequency of Animation integration in the lesson development

Row labels	**sum of activity**	**sum of twice**	**sum of never**
Introduction	1	0	25
Development	*2*	37	0
Conclusion	3	0	12.5
Grand total	6	37	37.5

The pie chart below analyzed how frequently the animation model was used in different parts of the lesson development, including the introduction, development, and conclusion.

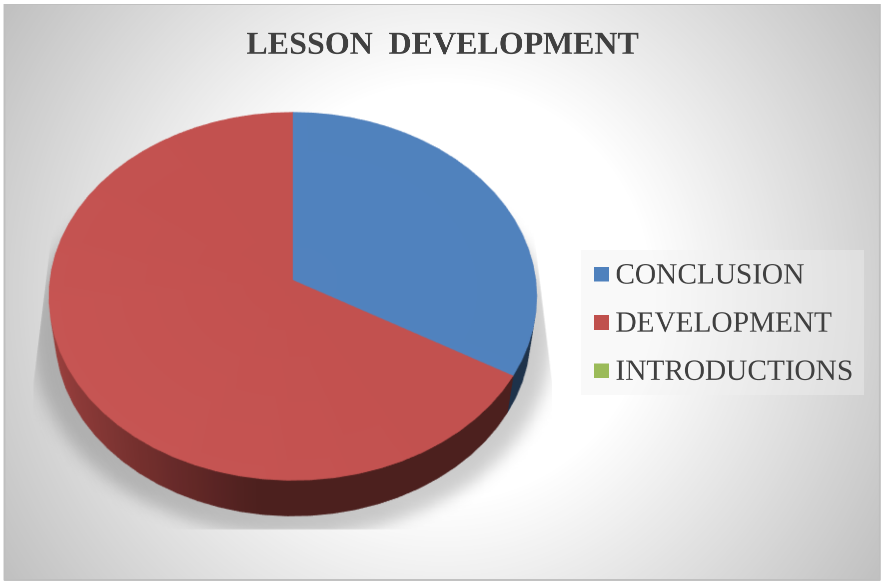

Figure 4.12. Lesson Development

The study employed a teachers' questionnaire to investigate the perceived impact of integrating animation on the academic performance of female students and across various school categories. A teacher from a school participating in the experimental group also shared his views on the topic of Newton's laws of motion. This statement was provided by a Physics teacher at a county boy's experimental school;

"incorporating animation to teach Newton's laws of motion has transformed my classroom dynamic. By visually illustrating concepts such as inertia, Acceleration, and action-reaction pairs through engaging animations, the students Not only grasp the theoretical aspects but also develop a deeper understanding Of the practical implications. For instance, using animated simulations of object In motion allows students to observe and analyze the application of Newton's Laws of motion in real-world scenarios, fostering a more interactive and immersive

Learning experience. Moreover, the ability to pause, rewind, and change these animations. During discussion encourages active participation and critical thinking among students, making complex Physics principle more accessible and memorable."

Another teacher from the experimental group of county girls asserted that, "*animations were effective in clarifying abstract ideas and improving retention compared to static visuals".* A teacher from an experimental group in the sub-county school attested that, "*animation is engaging and intuitive, enhancing their understanding of complex concepts."*

The data collected through the questionnaires was subsequently represented using a bar graphs, a visually compelling method for displaying the outcomes.

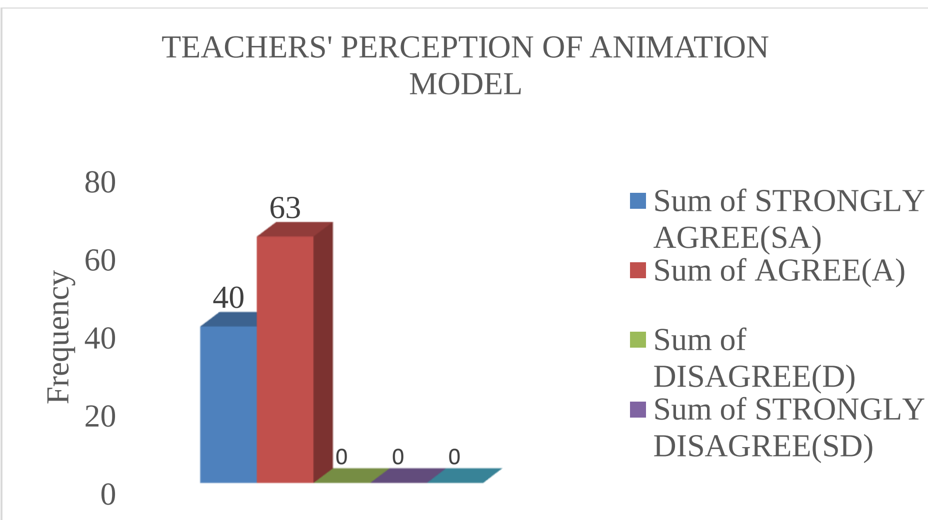

Figure 4.13. Teachers' Perception of Animation Model

4.5.2 Lesson observation schedule

These involved the three participation of the three teachers from the experimental groups. According to their reports, the incorporated of animation in the lessons yielded positive outcomes. The teachers noted that students were able to visualize abstract concepts, maintained high levels of attentiveness throughout the lessons, effectively related the learned concepts to real-world applications, and successfully solved given problems. The lessons were described as interactive, captivating, and instrumental in bridging the gap between procedural and conceptual knowledge.

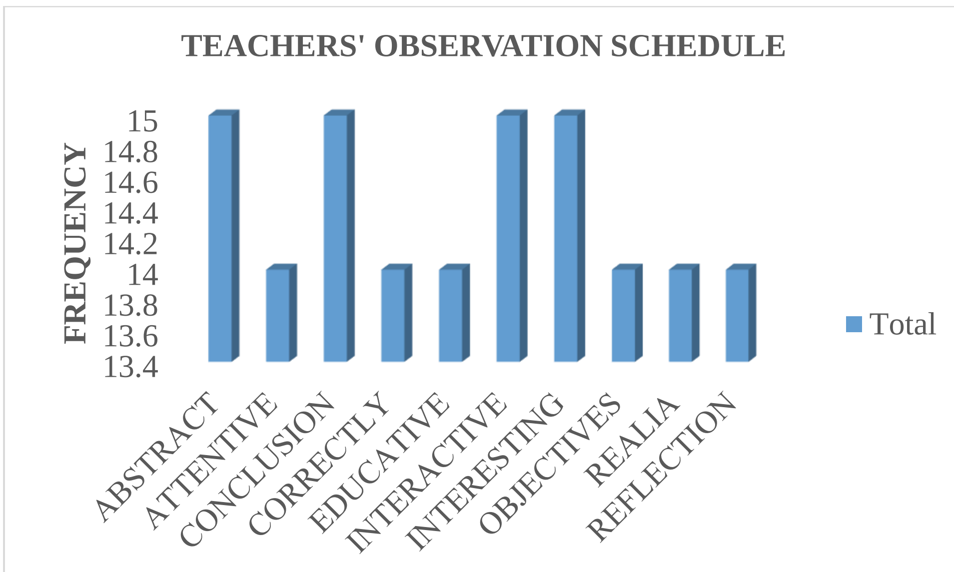

Figure 4.14 Teachers' Observation Schedule

4.5.3 Teacher Interview

The scheduled interviews aimed to gather additional insights from the three teachers in the experimental groups. The teachers confirmed that the animation model helped mitigate the disparity between conceptual and procedural knowledge in learning Physics. They acquired ICT skills, including animation integration, through workshops organized by educational bodies.

The teachers faced challenges such as large class sizes and power outages, which hindered the seamless integration of animation content. Nevertheless, the teachers recognized the value of animation in simplifying the understanding of Newton's laws of motion and actively sought high-quality animated resources to enhance their teaching practices.

Overall, the study provides support for the utilization of animation models in teaching Newton's laws of motion, highlighting their effectiveness in visualizing abstract concepts, improving students' performance, and bridging the gap between conceptual and procedural knowledge. The teachers exhibited positive attitudes towards the integration of animation in teaching approaches, despite encountering certain challenges.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS
5.0 Introduction

The primary emphasis of this study was on assessing the impact of incorporating animations in the instruction of Newton's laws of motion and its influence on the academic achievement of Physics students. The research utilized a quasi-experimental design, dividing participants into a Control Group (CG) and an Experimental Group (EG). In this chapter, conclusions drawn from the study's findings are presented, accompanied by recommendations for further research opportunities.

5.1 Summary of the Findings

5.2.1 Research Hypothesis 1

There is no significant difference in achievement for learners who use resources with animation and those who use resources without animation based on school category.

The analysis following the post-test revealed a significant advantage for the Experimental Group (EG) over the Control Group (CG). Learners from mixed-day and boarding schools in the sub-county category demonstrated notable improvements when exposed to animation during the integration of Newton's laws of motion into teaching, compared to their counterparts in county boys' and girls' experimental groups

5.2.2 Research Hypothesis 2

There is no significant in achievement for learners who use resources with animation and those who use resources without animation based on gender.

The girls exposed to animation exhibited significantly different results compared to girls not exposed, whereas boys in county schools did not show significant differences compared to boys not exposed to animation. A comparative analysis of their means revealed that girls benefited more, with an improvement of 27.03%, compared to boys who were exposed to animation with

25.35%. The improvement in girls' achievement was higher than that of their male counterparts, supporting the notion that females learn best when multiple modalities are engaged concurrently, facilitating better visualization of abstract concepts.

The findings aligns with previous research by Wael et al (2018), who demonstrated that the integration of ICT in teaching and learning had a more pronounced positive impact on female students' achievement compared to males, particularly when audio and visual modalities were synchronized.

In contrast, Janet et al (2018) observed only minimal achievement differences between genders, noting that boys slightly outperformed girls in mathematics. They recommended further investigation to address this disparity. Thus, integrating animation into teaching and learning is beneficial for enhancing the visualization of abstract concepts, particularly for female students.

5.3 Research Questions

5.3.1 What was the learners' attitude towards integrating animation in teaching and learning Physics?

The research revealed that students exhibited a favourable outlook towards lessons incorporating animation. The engaging quality of these instructional sessions promoted active students' participation, enabling them to effectively connect theoretical concepts. Students demonstrated proficiency in problem-solving and the ability to draw accurate conclusions, indicating a profound grasp of Newton's laws of motion. These findings are consistent with the investigation by Helbet and Joseph (2020), which observed that the integration of PhEt simulations enhanced students' conceptual understanding of Physics. This underscores the potential of animation models to enhance comprehension of complex scientific principles.

5.3.2 What was the experience of teachers when integrating animation into the teaching of Newton's laws of motion?

Physics instructors in the experimental group noted enhanced teaching strategies and increased self-assurance when utilizing animations. The animated content offered a more straightforward approach to illustrating intricate theoretical ideas, thereby boosting their internal drive to integrate animation into their instructional approaches. This experience underscored the value of animated tools in facilitating a deeper engagement with educational materials and fostering a more dynamic classroom environment.

5.4 Conclusion

The study findings confirmed Richard Mayer's multimodal learning theory (2009), which suggests that learners achieve optimal learning outcomes when two or more modalities are simultaneously employed.

Furthermore, the study supported the notion that students in sub-county and county schools can perform as well as their counterparts in extra-county and national schools. It also highlighted that female students can equally excel when animation is integrated into teaching and learning

The integration of animation into the teaching and learning of Newton's laws of motion had a significant positive impact on students' attitudes towards physics. Specifically, Students developed a favorable outlook on learning the subject matter. The study further demonstrated that animation helped students gain a better understanding of abstract concepts in Newton's laws of motion by providing them with concrete visual representation.

Moreover, the study's findings indicated that teachers exhibited proficiency in the use of animation equipment and developed a positive attitude towards its integration in teaching Physics. The three teachers participating attested that the animation model successfully captured students' attention throughout the lessons, indicating that students closely followed the instructional content.

The teachers also affirmed that animation bridged the gap between conceptual and procedural knowledge, as students were able to translate abstract content into concrete understanding. This finding supports previous research by Zerihum, Desta and Shemelise (2020), which highlighted a lack of conceptual and procedural understanding among pre-service Physics teachers. The students themselves acknowledged that the lessons were interactive, enabling them to connect conceptual and procedural knowledge and accurately solve given problems.

The study's findings offer valuable insights into pedagogical methodologies for teaching and learning. Therefore, the integration of animation in teaching Physics should be embraced.

5.4 Recommendations

The study yielded the following recommendations;

a. The Ministry of Education should create a conducive environment in the school setup in order to provide a normalized background to enable animation to be integrated into teaching and learning

b. . The Ministry of Education ought to increase in-service training opportunities for Physics teachers to enhance their ICT proficiency and enable them to effectively integrate animation into their instructional methodologies.

c. More extensive investigation is warranted to delve into the incorporation of animation in other topics within the field of physics.

d. The government should ensure the availability of electrical power and/or alternative power sources, as well as animation facilities, in the schools.

e. The government and school administration should collaborate to provide ICT hardware, software, and internet access in secondary schools, enabling teachers to access animation content online and integrate it into teaching and learning.

5.4 Possible Future Research.

Based on the study findings, the researcher recommended for further research on;

i. This study did not establish how animation can be incorporated into teaching and learning in Kenya Secondary Schools and potential challenges that may arise when allocating time within the curriculum. Therefore, future research should focus on implementing animation in teaching Physics in Kenya secondary schools.

ii. Further research should be conducted to determine if teachers are able to select high-quality animated materials from a wide range of multi-media resources.

iii. Researchers can also investigate the enrollment rates of female students in Physics-related courses at colleges and universities, aiming to understand their motivations for choosing such a field of study.

iv. Another area of future research could explore the long-term effects of integrating animation in teaching and learning. While this study examined the immediate impact on students' attitudes and understanding, it would be valuable to assess whether these positive effects are sustained over time, leading to improved academic performance and career outcomes.

v. Future research could examine the effectiveness of animation integration in other STEM subjects and across different grade levels. This broader investigation would determine the generalizability of the findings and the capacity benefits of utilizing animation as a valuable educational resource.

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APPENDICES

APPENDIX I: ASSESSMENT TEST (PRE-TEST).

GAS LAWS

FORM THREE PHYSICS **TIME: 40 MINUTES.**

INSTRUCTIONS.

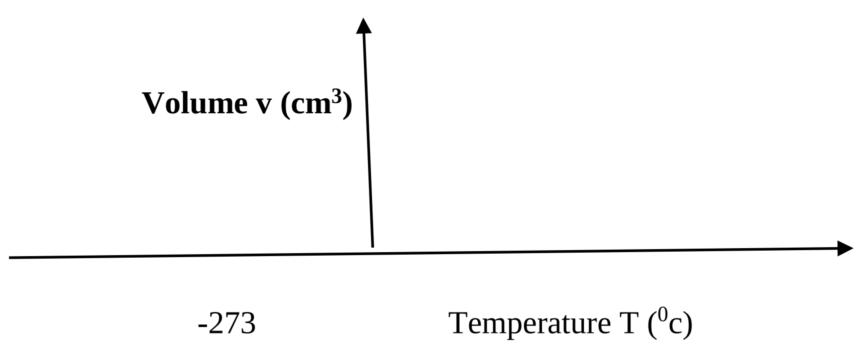
a). Attempt all questions.

b). Calculators may be used were applicable

1. State Boyle's law (2mk).

2. A volume of 400cm^3 of carbon dioxide at 27^{o}C is heated at constant pressure to a temperature of 300^{o}c. Calculate the new volume of the gas (3mks).

3. Sketch a graph of volume V (cm^3) against Temperature T (^{o}c) to indicate absolute zero temperature. (2mks)



4. Name the procedure used to clarify Charles law (6mks)

1. State two differences between boiling point and evaporation (2mks)

Boiling	Evaporation
i).	
ii).	

APENDIX II: PHYSICS ASSESSMENT TEST.
(Pre-test) Marking schemes.

1. State Boyle's law. (2mks)

The volume of a fixed (given) mass of a gas is inversely proportional to the pressure✓, provided that the temperature remains constant✓

2. A volume of $400cm^3$ of carbon dioxide at 27^oc is heated at constant pressure to a temperature of 300^oc. calculate the new volume of the gas (3mks)

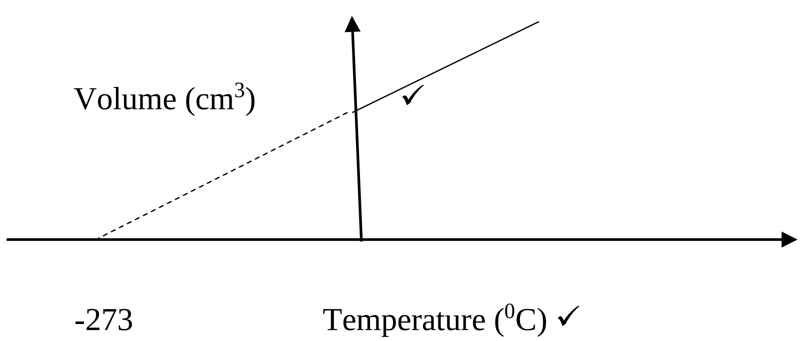
V1=$400cm^3$, T1=27+273=300k, T2=300+273=573k1, v2?

$\frac{v_1}{T_1}=\frac{V2}{T2}$✓

V2= (400*573)/300 ✓

V2=$764cm^3$✓

3. Sketch a graph of volume V (cm^3) against Temperature T (^0C) (2mks)



4. Name the procedure used to clarify Charles law (6mks).

i). Measure the initial temperature of the water and let it be T_1✓

ii). Measure the initial volume and let it be V_1✓

iii). Heat the water bath and measure the final temperature and volume and let it be T_2 and V_2 ✓✓

iv). plot a graph of volume against temperature, it's a straight line with an intercept on the volume axis. ✓✓

5. State two differences between boiling and evaporation. (2mks_

Boiling	**Evaporation**
a).Takes place at fixed temperature	a).Take place in all temperatures. ✓
b).Takes place throughout the surface	b).Takes place on the surface of the liquid. ✓

APPENDIX III:
PHYSICS ASSESSMENT TEST (Post-test)

NEWTON'S LAWS OF MOTION.

FORM THREE PHYSICS TIME: 40 MINUTES.

INSTRUCTIONS.

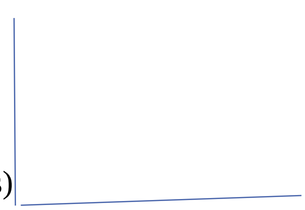
1. Attempt all questions.
2. Calculators may be used were applicable.

1. State the newton's first law of motion. (2mk)

2. A force of 60N acts on a body of mass 12kg.Find the acceleration of the body (3mks).

3. Sketch a graph of velocity against time of viscosity (2mks)

Velocity (m/s)



Time (t) s

4. State and explain three factors used to minimize frictional force (6mks)

a)

b)

c)

5. Mention two differences between elastic and inelastic collision (2mks)

Elastic	**Inelastic**
a).	a).
b).	b).

APPENDIX IV: POST-TEST Marking Schemes.

FORM THREE PHYSICS **TIME: 40 MINUTES**

1. State the newton's first law of motion. (2mk)

Everybody continues in its state of rest or uniform motion in a straight line✓ unless compelled by some external force to act otherwise. ✓

2. A force of 60N acts on a body of mass 12kg. Find the acceleration of the body (3mks)

Solution.

F=ma✓

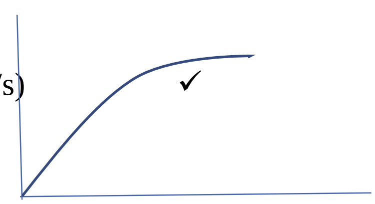
F=60N, M=12kg, a=?

60/12=12a/12✓

$a=5\ m/s^2$✓

3. Sketch graph of velocity against time of viscosity (2mks)

Velocity (m/s)



Time (t) s✓

4. State and explain three factors used to minimize frictional force (6mks)

a) Using rollers✓-rollers are laid down on the surface and the object pushed over them hence reducing frictional force. ✓

b) Lubrication✓-application of oil or grease to the moving parts reduces friction between the two surfaces. ✓

c) Ball bearing✓- applied on rotating axles to reduce friction between the two surfaces. ✓

5. Differentiate between elastic and inelastic collisions (2mks)

Elastic	**Inelastic**
a). Kinetic is conserved	a).Kinetic not conserved✓
b).Momentum doesn’t change	b). Momentum changes✓

APPENDIX V:
COUNTY SCHOOL. (INTERVIEW).

In order to fulfill the criteria for earning a Master of Education degree from Kenyatta University, the interview's goal is to investigate the effects of using animation in physics instruction on students' academic performance in Makueni County. The interview is optional for you, and whatever information you choose to share will be kept private. The research will not include any references to your name or the name of your school. We sincerely appreciate your assistance with this research.

Please share your experiences integrating animation with me.

1. Share with me the role of animation in the physics classroom?

2. Share how you gained skills for integrating animation.

3. Which gadget to you use when integrating animation?

4. Share with me challenges you face when integrating animation in teaching physics.

5. Share with me the attitude of the student when animation is integrated in teaching Newton's laws of motion.

6. Which consideration do you make when selecting animation in teaching Newton's laws of motion?

7. Share with me the challenges faced when selecting and utilizing animation in teaching physics?

8. In your experience, are there any challenge you face when integrating animation in teaching Newton's laws of motion?

9. Tell me about your teaching philosophy in Newton's laws of motion?

10. Share how teachers' experiences affect animation integration in physics

11. In your own experience, share with me how animation integration in teaching Newton's laws of motion influence students' performance in physics.

Opinion	Strongly agree	agree	Not sure	disagree	Strongly disagree
Makes learners' perform better					
Performance of the learners' not influenced					
Learners' performance dropped					

APPENDIX VI: LEARNERS' QUESTIONNAIRE

Name of School:... school category................ Date……

The intent of this questionnaire is to establish the attitude of the learners' when animation is used in teaching Newton's laws of motion. This questionnaire data will be kept confidential and will only be used for research purposes. Your personal information will not be disclosed and will remain anonymous. In case you need clarification feel free to ask.

1. What is your attitude towards integration of animations in teaching and learning of Newton's laws of motion in physics? Positive [ ] negative [ ] none [ ]
2. How do you rate the following statements? (**Scale:** SA- Strongly agree, A-Agree NS- Not sure ,D- Disagree, SD- Strongly disagree)

	Statement	SA	A	U	D	SD
1.	Use of animations can make learning interesting and assist learners to learn abstract concepts easily					
2.	Students have a negative attitude towards integration of animations in teaching and learning					
3.	Animation content in Physics encourages learners to concentrates for a longer period					
4.	Physics animation content engages the learners fully					
5.	Integration of animations in teaching physics improves students' academic performance in the subject.					

4. How often does your physics teacher integrate animation in teaching Newton's laws of motion in the classroom?

Activity	Level	Thrice a week	once/twice a week	Never
1	Introduction			
2.	Development			
3	Conclusion			

Thank you

APPENDIX VII
TEACHERS' QUESTIONNAIRE

Name of School: ....school category...............Date…………

The intent of this questionnaire is to investigate the teachers' experiences when integrating animation in teaching Newton's laws of motion. This questionnaire data will be kept confidential and will only be used for research purposes. Your personal information will not be disclosed and will remain anonymous.

1. What is your competency when integrating animation in teaching? High [ ] low [ ]

(a) If yes, what is your level of computer literacy?

Computer Qualification levels	**Form of training and certificate**	**Name of college**	**Time taken**
1	Degree		
2	Diploma		
3	Certificate		
4	Workshops and seminars		
5	others (specify)		

2. How can you compare your use of animation to more conventional teaching techniques? 0 % 1-5 [ ] 6-25 [ ] 26-50 [ ] 51-75 [ ] above 75[ ]

3. How do you rate the following statements?

(use the key: SA='Strongly agree', A= 'Agree', D='Disagree', SD= 'Strongly disagree', U=' Undecided',

	Statement	**SA**	**A**	**D**	**SD**	**U**
1.	Use of animations can assist learners to visualize abstracts					

	concepts easily hence high achievement					
2.	Teachers of physics should use animations in the teaching of Newton's laws of motion topic.					
3.	Girls benefited most from animations than boys in the same classroom setting.					
4.	Animations incorporation make learning captivating					
5	County schools perform better than Sub-County schools due to limited use of animation in Sub-County schools.					
6.	Integration of animations in teaching physics improves its academic performance.					
7.	The use of animation in teaching Newton's laws of motion improves the quality of teaching.					
8.	Integrating animation in teaching can assist teachers in enhancing their teaching with current and updated materials.					
9.	I am aware of the great opportunities that animation offers for effective teaching of Newton's laws of motion.					

4. How often do you integrate animation in teaching Newton's of motion in the Classroom?

Activity	**Level**	**Thrice a week**	**once/twice a week**	**Never**
1	Introduction			
2.	Development			
3	Conclusion			

5. What is your experiences in integrating animations in teaching on Newton's laws of motion? Positive [ ] negative [ ] none [ ].

6. Which gender of learners benefits more when animation is integrated in teaching of physics?

7. Is there a significant difference in the performance of learners when taught with the integration of animation compared to when taught without animation in Newton's laws of motion? Yes [ ] No [ ]

8. Explain your perception on the change.

____

Thank you for filling this questionnaire!

APPENDIX VIII:
OBSERVATION SCHEDULE USED T0 OBSERVE PHYSICS LESSON.

PART A: Personal data.

School……………………………class………………….category………………

Teachers Experience

Academic qualification………………………date…………………….

The intent of this lesson observation is to establish teachers' experiences when integrating animation in teaching and learning Newton's laws of motion. The data collected will be handled very confidentially and only used for the intended purpose.

PART B: ASSESMENT OF TEACHING AND LEARNING PROCESS

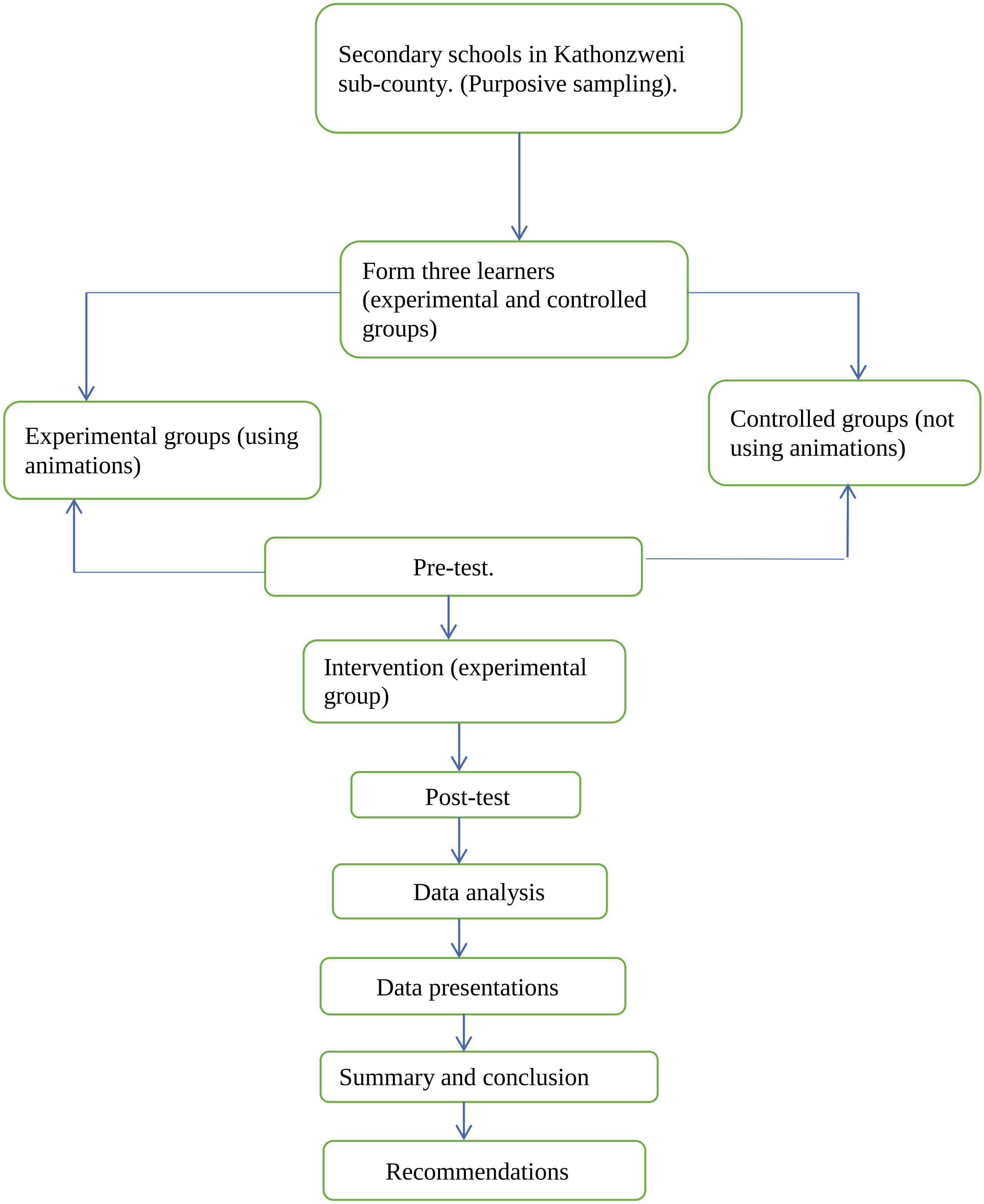
The scale below provides guidance on the statements.

(Scale: 1 - Not at all, 2 - A little, 3 - Somewhat Appropriate, 4 - Appropriately, 5 - Agreed)

Statement	1	2	3	4	5
The animation content was interactive to the learners					
Animation resources used for learning purposes					
Learners remained attentive throughout the lesson when animation was used in teaching.					
Learners appears to be interested when animation was used					
Learners answered the questions correctly					
Learners allowed to discuss abstract content after integration of animation in teaching Newton's laws of motion					

Teacher related objectives to the outcomes					
Teacher placed lesson in real life situation					
Teacher gave time for reflection/ review of the lesson					
Learners made correct conclusion after integration of animation in teaching Newton’s laws of motion					

APPENDIX IX.
RESEARCH PROCESS



NATIONAL COMISSION FOR SCIENCE TECNOLOGY & INNOVATION.

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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Appendix XI

KATHONZWENI SUB-COUNTY