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Impact of Using Graphic Motion Animation in Learning Physics in Kenyan Public Secondary Schools

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Abstract:
This project sought to show the impact of the use of graphic motion animation have in learning of Physics in Kenyan Secondary Schools. Learning materials by use of graphic motion animation which were assembled from different sources. According to Indian J. Sci. Res. 7 (1) : 820-824, 2014; influential factors of graphic motion and visual play a great role in effectiveness of this animations.
A review of relevant literature revealed that among the different kind of animations, graphic motions are used more than any other is in science teaching. The key advantages been, they do not lose real life information required for learning, aligning them with curriculum is easy unlike others that require aspects that are more technical and that no expertise in programming technology is required.
In the research experiment, the project used form 3 students from four sampled schools. Focus group used graphic motion animation while control group used lecture method and any other kind of animation where possible. The focus groups were able to perform given tasks faster than the control group. The concept taught was inertia. The performance was higher in focus group than the in control group on evaluation. Time was also recorded for the tasks completion, where focus groups saved more time.
This implied that graphic animation has greater value addition in teaching Physics in Secondary schools than the rest.

Keywords: *ICT integration, pedagogy, learning skills, students' performance, graphic motion animation, inertia, tasks accomplishment, syllabus coverage, moodle software, physics, and competence based curriculum*

1. Introduction

1.1. Background to the Study

This research project involved the use of graphic motion animations in learning and teaching of Physics in Kenyan Secondary schools. In the write out, ICT tools included devices such as video, computers, television, radio, cameras and internet. The project made use of a subtopic in Physics called inertia (1st Newton's law). It was hoped that the project would show that the use of these kind of animations in Physics classrooms would improve learning and teaching.
At the end of it all, the government of Kenya through the Ministry of Education should consider taking up research findings and incorporate them into school's curriculum. This will make Kenya have a broader integrated platform, where different kind of multimedia can be used to animate content in a professional manner.

It is of great importance to note that the area of ICT integration in education has been researched broadly in recent years. However, research on pedagogy shift towards ICT integration is still sparse, though there is a general agreement that ICT integration helps in learning and teaching (skills and knowledge) hence the project focused on the use of animations in Physics, and in particular in experiments and demonstrations. Reviews on results that have been given by different researchers was included.

As noted in a Socrats paper "effective use of ICT in science education (EU-ISE)" the lack of good quality educational software and appropriate laboratory equipment as well as the low level of teachers' competencies in effective use of ICT has resulted in no improvement in the quality of science education in Poland in the last few years.

According to an OECD (2004) survey, the use of ICT in education in most countries concentrates on sporadic and mechanical information retrieval from Internet. This adds to my area of interest that looks on the way to have well –

coordinated use of graphic motion animations in our classroom teaching and the need to move away from mechanical use of computers and internet resources.

1.1.1. Notes

KICD = Kenya Institute of Curriculum Development
ICT = Information and Communication Technology
CD-ROM= Compact Disk-Read Only Memory
TPD = Teachers Professional Development

Graphic motion animation, Pedagogy, ICT integration

1.2. Research Questions

- What is the contrast and comparison of using graphic motion animations to other type of animations in teaching Physics?
- What are the students' grade variation in their Physics performance when graphic motion animations are used to facilitate Physics teaching and in Physics related demonstrations?
- To what extend does the use of graphic motion animations in Physics using bring enhanced application of learnt skills in Physics and covering of curriculum?

1.3. Research Objective

1.3.1. General Objective

To determine the impact of using graphic motion in learning and teaching of Physics in Kenyan Public Secondary schools.

1.3.2. The Specific Objectives

The specific objectives of the research were as outlined below:

- To research on animations, use in teaching Physics, with a focus on graphic motion animations.
- To find out whether using motion graphic animations in teaching/demonstrations improve performance of Physics and skills acquisition.
- To get the percentage in which motion graphic animations assist teachers in content delivery of Physics curriculum in a timely way compared to a situation that does not use this tool
- To get animated learning materials in graphic motion from various sources for use in learning of Physics concepts Ff

2. Literature Review

2.1. Overview

This chapter discusses different aspects of animation. It endeavours to look into the meaning of the animation and how it has been used in various fields. Some resources and scholar articles will be of great use in this section. The second aspect will be an exploration on graphic animation with its relevance in education area of application. In addition, it will be geared towards graphic motion popularity and effectiveness in teaching science subject, in this case Physics. Lastly, it will bring to focus how graphic motion animation affects performance in Physics and psychomotor skills acquisition. The main focus is on how it affects learner's performance, covering content and skills acquisition.

2.2. Meaning of Animation

According to *(Majini, 1389) 'human been has always animated their pictures to convey special messages to their audience as early as human life. Endeavoring for achievement of a feeling of motion is art that has always been a mental pre occupation for human been from far past to the present*. This is an indicator that properties of images and texts in motion had, from early days been chased, in an effort to improve information processing. These properties form the basis of animation definition.

A variety of explanations and definitions animation from one dictionary to another and from scholar to another have been advanced. For instance, url: https://www.collins.dictionary.com gives definition of animation as manipulation of different images that are generated by electronic device to create more images. However, the definition of animation keeps changing from time to time. Most definition are based on the process and form making theme. It is difficult to have a specific definition, as noted by (wells, B. 2011) Frame of reference towards a definition of animation; animation practice, process and production. I, PP, II 32. In fact, he argues that by formally defining animation it will limit intellectual inquiry. He further identifies key aspects that qualify a media item to be animation that include; visual form, appearance of move or change and combination of sound. These are crucial properties that guided guidelines this project research.

According to (Omor, 2015, pp. 42-5) he writes 'one of the main arguments that dismisses distinguishing animations is that because digital moving images are generated from information the images are dissociated from the index of their photographic record and their real time movement (clark, 2005, 143, since 1996:28,34) because of this dissociation, it is argued that all digital moving images become modes of animation (cholodenko, 2006: 34, 36; clark)

2005: 143, 144, 147.) this is the course that the research took. Recorded videos were taken as part of animations and specifically motion graphics. The key is that the media, whether text or digital video has a form of movement then we cannot shy away from associating it as animation. In fact, a journal by (Jeff, 2014 Vol. 9) he writes, As the etymology of the term implies, form and practice. He does not stop at this but adds in another part that 'movement seems to be more a concept by means of which we understand other phenomena that a concept that is understood in its own right, PP 73.

2.3. Advantages of Animations

Many resources have given different fashions of importance of animations. Through an extensive review I found out some advantage that connects well with day to day classroom teaching. A resource by the link www.fractuslearning.com/animations has illustrated in a broader way, advantages of animation into five areas. Some of importance of use animations according to the link include among others the following:

- Community Interaction
- Use of animations helps to build up network and socialize in a society. For example, graphic motion animations give a brilliant and innovative methods that get original form of ideas and concepts to better understanding and encouragement to the learners and educators at large.
- Building bridges
- A website with some animations such as Kerpoof helps to deplete language barrier from people across the world.
- Self expression
- Traditional methods of art can be of huge challenge. However, animated character helps students to retain the creative reins by choosing everything from plot to speech. Zimmer Twins is a good example.
- Technical skills
- A tool such as anion allows learners to perform algebraic and calculus functions. It also helps to teach on its computer skills improvement.
- Presentations
- Animations provide an exciting and dynamic platform to encourage students to give interesting and engaging class presentation. An example is Go animate 4 schools. Taking the above areas as importance of animations, the main areas of this research project are taken care of. That is, performance, skills and knowledge acquisition.

2.4. Categorization of Animations

According to Bloop, through a link https://www.bloopanimation.com animations can be classified into five major categories using the style that accompanies them. As I mentioned earlier, animation is an area that may not have a specific way of grouping or defining, as many scholars may use different methods to do the same. However, I found this resource useful as it has broadly looked at the best methods to classify the same. It has also included the technological advancements, from the first kind of animation to the current genre. Aspects such as the programs used have also been considered in their categorization.

The first type, traditional animator frames are drawn and a sequence of the drawings are screened one by one in fast succession movement, second one, referred as 2D or vector based. This kind of animation is framed on surface that is flat, but adapts more of the characteristics of first one, 3D follows where images are generated by use of computer graphics. Series of these images form an animation. In modern science, these kinds of animation are used mostly in advanced institution where they have necessary expertise and technology to make them. The other kind of animation is a stop motion (cut outs). They take a form of photos of objects. They are taken just like normal photos but move one photo and taken another in a sequence that is continuous. It is just like a tradition one just uses real images.

The last category is motion graphic animations. This is where graphic elements or text are creatively moved in a coordinated manner. Here animations take a form of explainer videos and text or even logos. This is the kind of animation that most of YouTube videos and text are in. Through my research and classroom experience I have found most learners and teachers use this tool in teaching. Few use the other type as they are old in technology or require more skills and complex software to make such as the 3D animations. It is in light that our focus to motion graphic animation use in teaching Physics in Kenya Secondary schools came in.

2.5. Graphic Motion in Classroom

As earlier mentioned creation of motion, sound and alphabetical characters form a solid foundation of graphic motion as an animation for teaching and learning. Delete_ Specific benefits of graphic motion compared to other types include: Replace with_ Apart from Graphic motion animation, other kind of animations, have the following challenges

- Animations usually lose some real life information required for learning.
- The animation programs may function well from a technical point of view but aligning them with curriculum is difficult.
- They require expertise in some programming technology in order to cater for different level of students. Subject teachers do not get it easy for this extra knowledge or skills requirement.
- There is requirement for an extensive memory and storage space. This is because, there are graphic objects and mathematical calculations in them.
- They require special equipment for quality presentation, since good animations need specialized software and programming.

- They don't depict actuality and facts like videos. The other types of animations are an artisticrecreation. It does not depict actual events or reality as videos do.

According to Indian J. Sci. Res (1): 820-824, 2014; the role of motion graphics in visual communication by Mohsen FathiDerashiral and MostafaOsadollahi, methods of motion graphics, influential factors of graphic motion and visual factors play a great role on the effectiveness of this kind of animation for messaging or learning content. In addition, graphic animation requires continuous presence, getting used to it and waiting for it is key to making the audience to like it and for better effects to be felt.

From (Doran, 2018, pp 23), *images hold great power for organizing the knowledge of Physics*. This conclusion cannot be an understatement as images that are moved in an organized manner given a better understanding of abstract concept in classes.

From a journal by (Dan Cooper, 2017) and a you tube link www.youtube.com/watch?v= HOETmFh88, there are some tips of creating animations for classroom that include;

- Technology fear should be avoided for a good teaching and learning animation.
- Students should make some of the animations used for learning.
- Consider the curriculum when making animations.

These actions are tailored towards activity oriented activity as envisioned in inquiry based learning (IBL). Combining it with graphic motion animation results to optimal knowledge acquisition. In addition, when all these activities are streamlined in accordance to syllabus students will always excel.

This is in conformity with 21st century pedagogical skills in learning in which the Ministry of Education in Kenya is concerned with. Marianna Keen, 2014 in a link www.innovatemyschool.com titled; seven ways animation can help enhance learning in the classroom, says 'one of the fantastic advantages of animation in teaching is that it is an engaging method that can be embraced for any subject and from any location. Whether working in class, in library or at home, if a student has access to effective animated videos they can be motivated to learn and improve. In view of this, one can comfortably argue that animation does not only support knowledge acquisition but also saves time. Learning space and period is increased as it goes ambiguity. Marianna, 2014 adds, "The multi-sensory aspect of animation also makes it appealing to a broad range of learning types. Almost all gaps in teaching could be closed with captivating tool, well designed, effectively implemented animated videos that are supported by other teaching tools have great potential to motivate and enhance learning material across the board".

In an experimental project as published by Tempus Public Foundation (Oct. 2017) and in link https://tka.hu learners and trainers from Handler Nandor Vocational school and HansagiFerenc vocational / Secondary for catering and tourism of Szeged, students were able to cover a considerable part of content in animation creation. They were able to get good results and do some related tasks. In a part the author writes., 'students' progress various parts of curriculum through animation making process, by creating short movies in a certain topic. At the end of the creative process, they get instant visible results which they can share and do'.

2.6. Empirical Review

2.6.1. Performance

Several empirical studies showed promising results of using animation on learning. Trevisan, et al (2009), compared two groups of learning. One group used video of traditional lecturer and the other group used animation as the learning material. The topic was follicular dynamics in physiology. The students were invited from six universities in USA. An immediate one off test was used as the evaluation instruments. The results in general showed that those who used animation got significantly higher marks. This research project focused on the process of teaching in a blended class of eLearning. The students got the simulated materials that helped them in their learning.

Hays (1996) reported a study of using three different media, animation, static graphics and textual materials. Students were divided into groups of high and low spatial ability. A test was administered at the end to compare the learning performance of the students in each group. The results showed that animation was effective to help students who were low in spatial ability.

However, Morrison, et al (2000), reviewed more than 12 previous studies that were about the comparison of static graphics and animation, with follow up tests and tasks as indicators. They concluded that real benefits in terms of student's scores of learning were found in at least four of the studies. Even for the studies that students who used animation out performed those who did not. They thought that they are benefit additions that follow animations. These included:

- Additional or information while static graphic did not.
- The number of static graphics used was not enough since the molecular steps of processes were not shown.
- The method of study was not well designed.

In my view, these are the cornerstone aspects that make graphic motion animation key in the output of learning. There is a correlation of performance and how dynamic the animation is. Additionally, the videos and texts in motion with a good narration helps in teaching Physics concepts. Since, there is no need for expert programming knowledge; teachers can design a good instructional product using this kind of animation.

2.6.2. Skills Attainment

According to CG Pundit publication – link https:www.cgpundit.com/animation –in-education, use of animations enables students to apply imagination and rational thinking. It also assists to strengthen high school student's talent and skills that are set.

According to https://opentextbc.ca/teachinginadigitalage/chapter/5-4-managing-content/ when digital content is in use, a lot of work is done. In doing so, the learners get the required skills and the covers the desired content in course of learning. This goes along with the motion graphic instructed classroom. They wrote: 'In order to solve problems or make decisions, you need access to facts, principles, ideas, concepts and data. To manage knowledge, you need to know what content is important and why, where to find it, and how to evaluate it'

Most of the learners would keep in memory, practice and apply a lot of information that is obtained in entertained way. When developing animations in video and text, teachers caution to prepare good classroom content. The visual movement enables learners to do more out in their society as they got from the animated materials.

Wimot et al (2012), showed that when a digital video is used in course of learning with learners been hand-on, there is a strong inspiring and engagement evidence in different aspects. These include higher marks, a source of evidence relating to skills and provide future resources of cohorts and development of learners' autonomy. This echoes what the research endeavored to achieve as far as skills attainment is concerned. Students' get confident of engaging in activities related learning materials or content. Therefore, leaners can attain the skills of problem solving.

Lastly, it is important to quote an article that dealt on the student YouTube learning by (Mathew, 2012, pp10) where it said, 'the more focused topics in upper level undergraduate courses would require additional detail in assignment to parallel the course difficulty, content and objectives. Technology will continue to revolutionize the college classroom and new pedagogical skills will evolve while accomplishing the same goal of teaching problem solving skills.

2.6.3. Saving Time / Syllabus Coverage

A graphic animation accelerates the learning process since there is a change in behavior of the learner towards better acquisition of knowledge and skills. This aspect, in turn helps the content to be learnt faster and in timely manner. It is true that if a tool like this is well organized more content is covered. According to task affected them by (Rosemary Deaney et al, 2003 pp 141-165) it was noted 'this theme concerns the contribution of ICT use to effecting tasks encountered within academic work. Pupils in all year groups and schools reported how use of ICT tools enabled them to carry out such tasks with ease, quickly and to a high standard; therefore, in applying the right pedagogy, motion graphic animation goes along way into easement and saving time. The amount of work covered is a lot compared to the traditional lecture method or other type of animations.

In a case study, "the effect of ICT usage on the classroom management", by (Ali Sabanci et al, 2014) he concludes, "the findings also indicated that when all kinds of teaching materials used with and in ICT are designed to meet student's interests and needs, undesirable behavior are likely to decrease and teachers can focus on the students learning better. On the other hand, teachers complained of the central character of the education system about planning the content and they believe'.

Since graphic motion is not an isolated component of ICT, its application involves devices that entrenches fast delivery of learning content. In an article by (Ellen, 2000) saying smithley values these pre-class assignments because they save classroom time and improve the quality of discussion' and goes ahead to cite him 'when the students complete their CD assignments, they come to class with a common context. We are able then to discuss particular class dilemmas or teaching dilemmas that everyone has watched, analyzed and reflected up'.

2.6.4. Critique

It is clear from the review discussed that graphic animation has more significance and use than other types of animation. In addition, performance time saving and skills learning are greatly influenced by this kind of animation.
However, most of the researchers have not given each of these parameters deeper look. It would be better to give argument of success of animation using scientific data that is thorough analyzed. By doing so, the educators can see the value of this kind of learning feature very useful.

2.6.5. Summary

Graphic motion animation is popular, easy to use and give a good return for teachers and learners output. The right pedagogical skills must accompany its use.

2.7. Conceptual Framework

The following figure represents the concepts related to this project

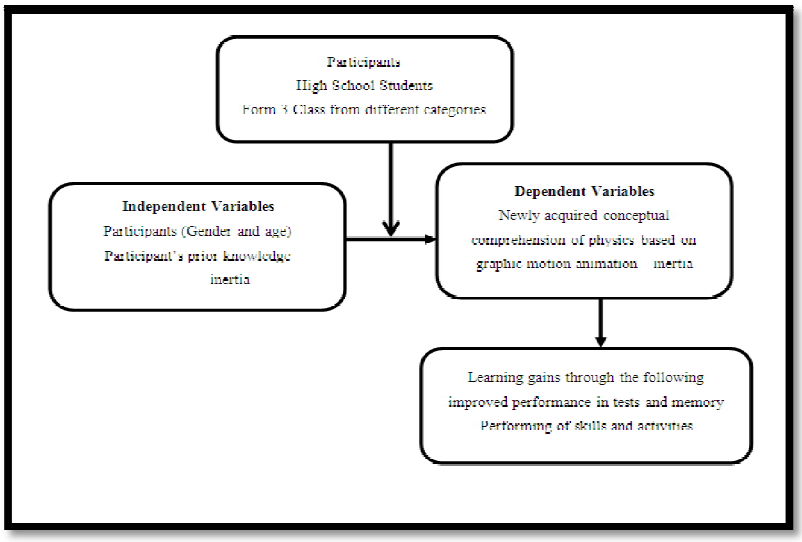

Figure 1: Conceptual Framework

3. Methodology

3.1. Educational Model

The project made use of ADDIE Model. This is one of many model that instructional designer may use to come up with learning content that is then used by the learners and trainers to attain the required objectives. The following are some of the features that make ADDIE a better option compared to other models such as Dick and Carey model, KEMP Design and ASSURE model.

- It has a good quality design
- Has clear learning objectives
- It allows for a good structured content.
- It offers a better feature integrated media.
- It gives relevant students activities
- Its assessment tied strongly to desired learning outcomes.

ADDIE model allows the above listed principles to be identified and implemented on a systematic and thorough basis. Moreover, it allows for a large number of courses of high quality.

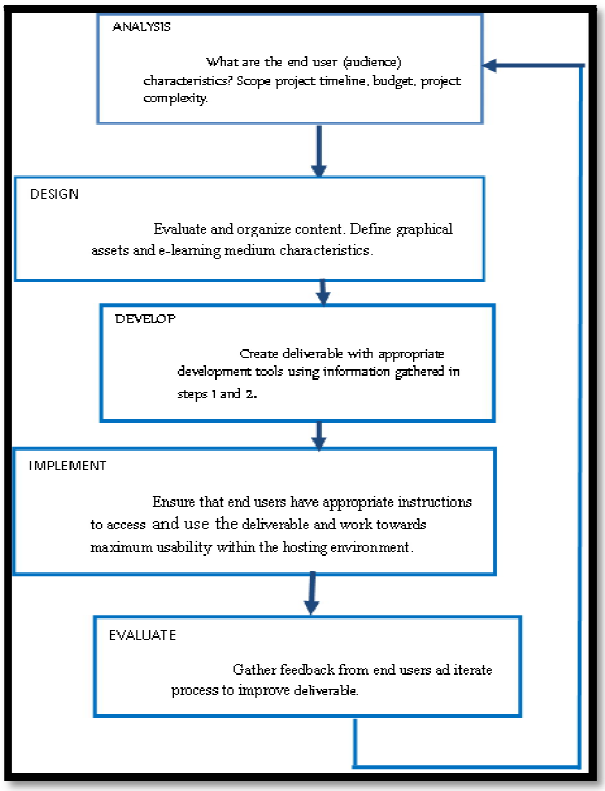

Figure 2: The ADDIE Flow Figure

3.2. Delivery Designing of the Course

The project made use of Moodle for the delivery of the proposed instructional design course.

3.2.1 Reasons for Use of Moodle

Moodle is educational software grounded in a philosophy of collaborative learning – social constructionist Pedagogy. The framework takes learning as a creative social process – where people learn together by investigating, analyzing, collaborating, sharing and reflecting – though the basic learner is an individual.

It has the following concepts that are useful based on:

- Effective learning occurs when learners are actively engaged in constructing knowledge.
- An inquiry based learning (IBL) is effective root to acquisition of knowledge.
- Students learn better with supplemental materials.
- Communal observing and interacting with our peers is crucial for learning and retention.
- Collaborative environment encourages all to be learners and students.
- It has flexible learning environment to satisfy learners needs.
- Creativity and innovations has emotional appeal when everyone has an opportunity to contribute, exercise his or her voice.

The overall organization and design of the Moodle interface supports the learner and learning tasks not the technology or tools. One can organize a course material in any of the following formats.

- Traditional topic format.
- Weekly format – content chronologically done.
- Social format – less formal and have more discussions.

Therefore, MOODLE have all the standard features of a LMS, with a suite of tools to promote interaction and social networks. One can create a rich textured course including but not limited to Video and Audio. These tools are of paramount importance in motion graphic animation content. In addition, it promotes other channels of collaboration such as journals, wikis, glossaries and RSS. Moodle provides timely feedback and response. Teachers can also give both quantitative and qualitative feedback.

Lastly but not the least, Moodle is a Virtual Learning Environment (VLE) that has an online support for any one's course. This made it effective to teach the inertia concept for this project.

3.3. Designing of the Course

The following areas were considered in the overall design.

3.3.1. Content Outline/Specific Goals

The course categorized into two modules each with its timelines and the expected outcomes.

3.3.2. Media Choice

In delivery of the course, animated multimedia in graphic motion were used mostly; text, video, graphics and photos. CD-ROM for synchronization were used to take care of scenarios where there was no Internet.

3.3.3. Course Duration

It is estimated the course will take 1hr 20mins. this time includes learning time, studying the materials, active participation, and doing assignments.

3.3.4. Materials

Course content was just enough for learners to get the right skills. Examples, tests and printable materials were available.

3.3.5. Communication

- All communication of the course will be within the course content.
- Both asynchronous and synchronous communication tools were used.
- Forums and closed social media groups were encouraged.

NB: Video conferencing was used because it was hard to bring all students in to at the same time.

3.4. The Technology Matrix (TIMS)

The research project considered five characteristics for meaningful learning using technology, according to TIMS that guides and checks online and eLearning content delivery.

The characteristics were as follows: -

- Active students actively engaged by using technology rather than just receive information from it.
- Collaborative – the students were encouraged to collaborate with others and teachers by sharing materials and information and they did so.
- Constructive – here the students used new information to connect with prior knowledge.
- Authentic – students used technology tools to link learning activities to the world beyond instructional settings rather than working on de-contextualized assignments.

- Goal directed students did not just complete assignments without reflection, but they used technology tools to set goals, plan activities, monitor progress and evaluate results.

3.5. Data Collection / Gathering

3.5.1. The Goal

The research sought to get data intended to respond to the research questions. The main areas were:

- Student performance in relation to using graphic animation as compared to situation where we have other types of animation or none.
- The acquisition of the required skills-on completion time of the given task. Time factor was crucial.
- Several learning graphic/video materials were sourced from different sources and used during the data collection activities.

3.5.2. Videos Used

These were the videos / You Tube links used for the purpose of the research.

Video / YouTube	Description	Duration	Capacity
https://www.youtuvbe.com/watch?v=6gzCeXDhUAA	It was published by sick science on Dec. 16, 2006. The first part demonstrates inertia by use of eggs placed on a plate. The plate is put on top of glass with some water. On hitting the plate horizontally the eggs drops down in the glass.	3 min 22 s	3MB

Table 1: Inertia and Egg Plate

Video / YouTube	Description	Duration	Capacity
https://www.youtuvbe.com/watch?v=6gzCeXDhUAA	Titled inertia magic and published Feb. 13, 2014, the video demonstrated a variety of activities to demonstrate inertia. Most of them involved pulling of clothes which were under some bodies.	3 min 34 s	3.1MB

Table 2: Inertia Magic

Video / YouTube	Description	Duration	Capacity
https://www.youtuvbe.com/watch?v=yAKEDEgwFC4	Published on Feb. 3, 2014 by Professor Julius Miller the video used masses to demonstrate the concept of inertia. Showed how inertia is actually a measure of body's mass.	15 min 13 s	7.4MB

Table 3: Concept of Inertia

Video / YouTube	Description	Duration	Capacity
https://www.youtuvbe.com/watch?v=erghLWXDScI	Published in August 30, 2008 by Bryaneye the You Tube uses text in motion and graphic to illustrate inertia	4 min 23 s	3.85MB

Table 4: Inertia and Motion

Video / YouTube	Description	Duration	Capacity
https://www.youtuvbe.com/watch?v=NYVMlml0BPQ	Published in Oct 7, 2014 by Amrita University, the video gives a narration of motion graphics of a ball and a tug of war to explain inertia. It gives day to day use of inertia of bodies in a stationary and moving bus.	5.20 min 20 s	4.0MB

Table 5: Inertia of Stationery and Moving Bodies

Video / YouTube	Description	Duration	Capacity
https://www.youtuvbe.com/watch?v=NYVMlml0BPQ	Published on Oct. 5, 2011 by Tiros Educational, Objects in 3D animations are used to explain inertia. It explains the effects of removing friction and gravity to explain what happens to a moving body.	13 min 13 s	6.2MB

Table 6: Inertia and Gravity

3.5.3. Data Required

Students' scores and duration for the completion of planned activities

The scores of students were recorded and video capturing a certain activity on inertia where time of completion was recorded.

- Number of activities well done
- The videos captured were analyzed and the number of well-done activities recorded.

3.5.4. Techniques Used

The research used the following techniques

- Focus group – this group of students used graphic motion animations.
- Control group-used none but were at liberty to use 3D animation
- Observations – Activities were observed and recorded video appropriately.
- Documents and records – previous student's marks will be looked at when sampling.

3.5.5. Methods

In this research project stratified sampling was used. Records of previous performance of the students were observed and considered. The students in even numbers according to the performance ranking were put in focus group while the odd ones put in control group.

The reasons behind using this method are: -

- Cost – it is less costly as only sampled schools are used.
- Time results is obtained in a short period of time and analysis is also short.
- Response burden – fewer students' activities and quiz
- Control simple not many are involved and monitoring of the students is easy

The first task was to identify schools for the research project. The research project used four schools cutting across different categories as follows:

- National boarding girls' schools
- County boys boarding schools
- County girls boarding schools
- Day mixed school

In each school – ten students in form 3 were randomly selected for the research project in liaison with host teacher as explained earlier. Five students for the focus group while the other five students for the control group.

3.5.6. Activities on Inertia

The tasks performed by both groups was to learn a concept of inertia as part of Physics content in high school. It is a subtopic in Newton's laws in Form 3 Secondary Physics in Kenya. For the focus group; they have an integrated ICT class using materials collected for this project hosted on Moodle platform. The link is https://www.onlineedu.moodlecloud.com and also from downloaded YouTube's.

For the control group they used traditional teaching methods and attempted to use other animations apart from the graphic motion one. By the end of the learning processes which took a few days – there was a common quiz to both groups. The quizzes were marked and recorded. The total marks were given in percentage. The mean was calculated for each group. All these was done for all schools combined. Another activity that was done was to record performance of simple inertia demonstration activities by both groups. The four activity items were as shown in the appendix. The students used a video to capture demonstrations, the recordings were used for assessment of task completion and time analysis.

3.6. Limitations

Some of the limitations encountered included:

3.6.1. Activities Scheduling

Allocating time to do research in schools was not easy. Arrangements of a cooperating teacher was key. However, depending with the school's calendar some work of the research had to be rescheduled. For the case of day school, consideration for going home was important. It was not easy to find time in normal teaching time. Lunch time period came in handy.

3.6.1.1. Students Discipline Grouping

Some students in some schools, though not part of the research groups joined their fellow students as such we had to stop some activities and sort out the selected students for the research and ask the others to leave the activities places, in a professional manner in some cases, the students took away some materials used in the experiment. The isolated cases were handled professionally, however, these didn't affect the outcome of the experiment.

3.6.1.2. Electronic Gadgets – Recording

Preparing materials was not easy, as at times internet downloads slowed. There was a challenge of Video cameras storage capacity at some instances. A task had to be repeated as a result of that. The quality of video depended on the features of the video camera used. One clip was taken with the image facing downwards but still it served the purpose.

3.6.1.3. Poor Records of Previous Marks

Some mark books were not well organized and took time for one to get appropriate records of students' marks for stratified sampling. Some students missed some tests for some schools. In some cases, marks for new students were not available. These were some of the challenges in identifying and selecting the students for the project.

4. Data Findings and Analysis

4.1. Performance Analysis

Spreadsheet excel software was used for data analysis. The mean score, deviations and variance worked up for both focus and control group. The marks were not recorded in any preferred order. The quiz marks were given in percentage. The following table consists of the data collected and their corresponding analysis.

Focus Group		Control Group	
Student	Percentage Marks Attained	Student	Percentage Marks Attained
1	70	1	60
2	20	2	60
3	70	3	50
4	90	4	40
5	90	5	20
6	90	6	60
7	90	7	70
8	100	8	80
9	70	9	70
10	100	10	50
11	60	11	5
12	50	12	50
13	80	13	5
14	90	14	0
15	80	15	5
16	80	16	30
17	80	17	20
18	100	18	60
19	70	19	70
20	70	20	40
Mean	77.5		42.25

Table 7: Mean Marks Comparison between Focus Group and Control Group

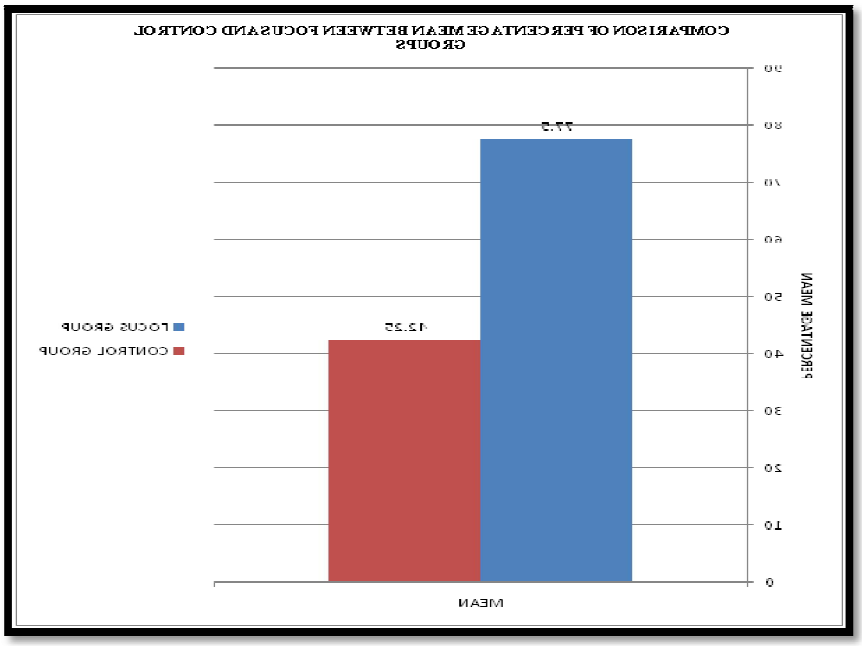

Figure 3: Mean Marks Comparison between Focus Group and Control Group

	Focus Group		Control Group	
Students	Marks (%)	Expected	Marks (5)	Expected
1	70	77.5	60	42.25
2	20	77.5	60	42.25
3	70	77.5	50	42.25
4	90	77.5	40	42.25
5	90	77.5	20	42.25
6	90	77.5	60	42.25
7	90	77.5	70	42.25
8	100	77.5	80	42.25
9	70	77.5	70	42.25
10	100	77.5	50	42.25
11	60	77.5	5	42.25
12	50	77.5	50	42.25
13	80	77.5	5	42.25
14	90	77.5	0	42.25
15	80	77.5	5	42.25
16	80	77.5	30	42.25
17	80	77.5	20	42.25
18	100	77.5	60	42.25
19	70	77.5	70	42.25
20	70	77.5	40	42.25
Mean	77.5		42.25	
SDVT	19.15999121		25.41627121	
VAR	367.1052632		645.9868421	

Table 8: Analysis for Mean, Standard Deviation and Variance

One of the key aspects that the project sought to find out is the results performance between control group and focus group. Consequently, it necessitated an evaluation quiz that was marked for all forty students. Twenty of them were in control groups and the other twenty in the focus group. The results obtained were as shown in the above table and recorded as percentage for each student. From the data, the mean score for the focus group was 77.5% and that of the control group was 42.25. This implied that there was a huge difference of 35.25% which is remarkable high marks difference.

The standard deviation as it was calculated for the standard deviation for the focus group and control group was 19.15999121 and 25.41627121 respectively. For the variance, it was 367.1052632 for the focus group and 645.9868421 for the control group. See table above.

This was an indicator that the scores distribution for both groups were well spread. It confirms the stratified sampling was appropriate as student's abilities spread out, cutting across from high performers to low performers.

4.2. Time Data Analysis

Completion period of performing assigned tasks/activities was crucial part of the research project. There was video recording on the control and focus group performing tasks assigned to them and time was recorded from the videos clips.

The table below shows time spend by all groups per school. The mean was calculated and the difference in time of the two groups was 203 seconds. To simplify and relate to our research focus, the time difference was taken as the time saved for one week was then calculated. This was then auto calculated for an average 11 weeks per term. There are three terms in a year, hence the time saved was calculated for a year. Taking a lesson to be 40 minutes, the total number of lessons saved was auto calculated as shown in the table 9. The graph for each school's groups was done as shown on figure2. The control groups spend more time than the focus group as shown clearly from the figure.

School Name	Focus Group	Control Group	Dev (In Lesson)	Time Saved Weekly	Time Saved Termly	Time Saved Yearly	Minutes Saved Yearly	No Lessons Saved Yearly
	TIME (S)	TIME (S)	TIME (S)	TIME (S)	TIME (S)	TIME (S)		
A	170	353	183	915	10065	30195	503	13
B	59	180	121	605	6655	19965	333	8
C	78	148	70	350	3850	11550	193	5
D	56	259	203	1015	11165	33495	558	14
						MEAN	397	10

Table 8: Analysis of Time Saved from the Videos Recorded between the Two Groups.

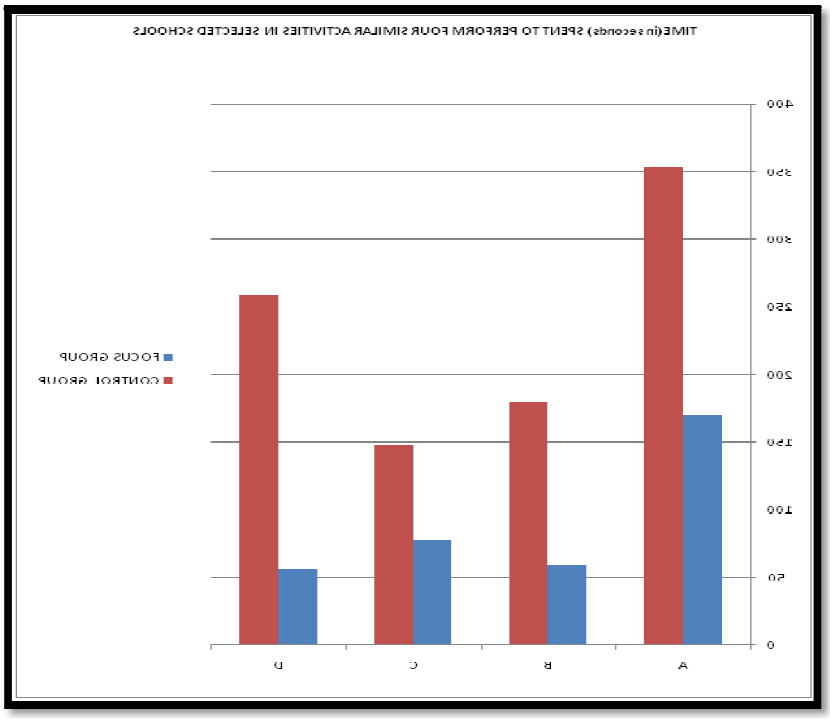

Figure 4: Time Spent for Activities by the 2 Groups

4.3. Task Completion Analysis

It was again, from the four tasks given to the learner's that the teachers and the researcher assessed the number of tasks well performed and completed for each group for the four schools. See table 10 and figure3

It is important to note that none of the control group was able to complete the four tasks properly. The difference, calculated weekly and then yearly showed that there is a difference of 248 simple tasks done by the focus group than the control group in a year.

	Focus Group	**Control Group**			
School	Activities Done	Activities Done	Deviation	Weekly	Yearly
A	4	2	2	10	330
B	3	2	1	5	165
C	4	3	1	5	165
D	4	2	2	10	330
		Extra Activities Done	15	75	248

Table 9: Accomplished Tasks

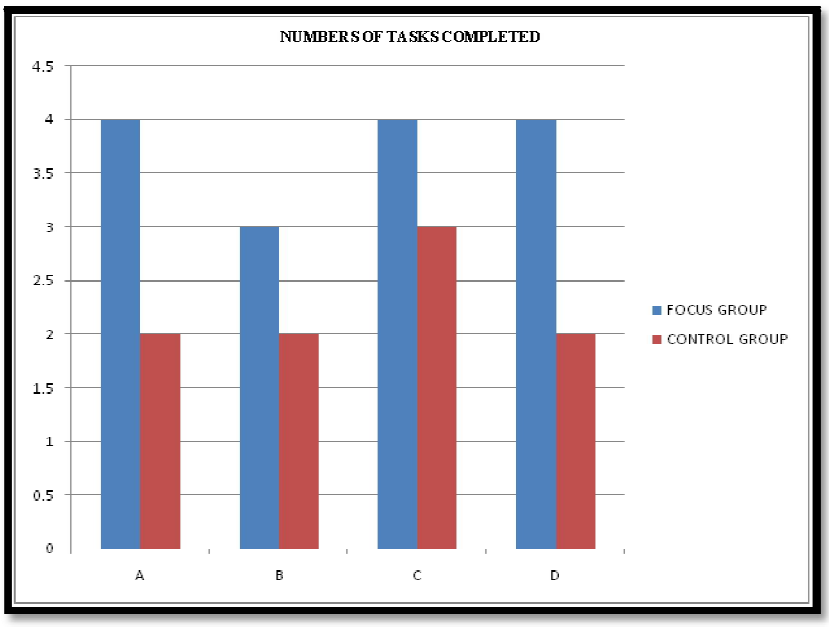

Figure 5: Accomplished Tasks

5. Conclusion and Recommendation

5.1. Conclusion

The challenge of learning and teaching Physics in Kenya Secondary schools cannot be understated. Lack of resources and the right pedagogical skills hinder good learning process from occurring. This trend is consistent and required paradigm shift on the way learning materials are provided to the learner. It also has to encompass methodology used in teaching. The acquisition of knowledge is pegged on how we incorporated all these components of learning. As a core science subject, Physics needs the best approaches and technology for its teaching.

In this project, "impact of using graphic animations in teaching Physics in Kenya public schools", a lot have been unearthed. The research looked at different questions. First, the extend of graphic motion popularity in teaching science. Through literature review, the most commonly used kind of animation that is used in most teaching, not only in Physics but in most of science oriented subjects is graphic motion. As evidenced by the scenarios given in literature review teachers use video, YouTube and animated text in their teaching.

Secondly, the project showed that use of graphic animation is not complicated. It assists in performance improvement of the students. This means that the cognitive achievement in the learning process is positive. The analysis of marks scored by the focus group and control group clearly brings out this. There was a bigger difference in student's scores between the two groups. The focus group that used graphic motion performed far better. It was noted to be the same case for individual schools sampled.

Thirdly, according to KICD new policy of competence based curriculum, examinations will not be abolished but rather be tailored towards accessing the ability of learners to apply learnt skills. The project finding, that graphic motion animations enhances acquisition of skills, aligns with this policy. This was evident from the analysis of tasks performance of the focus and control groups. In this report video records done during the research were stored. In the videos the focus groups had more confidence than the control groups.

The fourth aspect was on syllabus coverage. It has been a challenge for teachers to complete science syllabus on time, especially Physics in Kenya. Hence, time saving is of great importance. If syllabus is covered in time, learners will have enough time for practice and review of learnt concepts. The project was also able to show that use of use graphic animation saved time and 10 lessons saved in a year, through data analysis of time. These topics are just enough for two short topics in Physics. The learners can do more of revision for the saved time.

The Moodle, as a cloud platform was used to host most of the graphic motion materials. It made the learning to be ambiguous. The learning and teaching become vast, everywhere and to all. Most of the materials can be recorded or downloaded from open educational resources available. The Moodle can also be used offline and on hand held such as smart phones were capable for this learning project and if well used in future by stakeholders it can be a good feature for eLearning and computer based learning. This feature makes it reliable and flexible.

Finally yet importantly, the Kenyan Government efforts for 100 percent transition to high school can be enhanced through adoption of the aspects that this project has addressed. Lack of space and teachers can be tackled by the application of graphic motion animations on right cloud based platform such as Moodle. Resources searching for teaching can be eased by having this facility as a compliment.

5.2. Recommendations

This project proved that if graphic motion animations are used and integrated in our education system as a policy, it would be of great importance to education and Kenyans. Education stakeholders can prepare policy framework, with the right technologist in ICT integration to come up with a common platform. The education ministry could pick up, the project and do the backbone action for this project, which is in provision of the required ICT devices in schools. The TSC could also start focusing on the right pedagogy training through their new Teachers Professional Development (TPD) courses.
At the end of it all, Kenyans will benefit a lot by saving funds and skilled manpower hours.

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