EFFECT OF FLIPPED LEARNING FACETS ON PRIMARY SCHOOL PUPILS' ACADEMIC ACHIEVEMENT IN SCIENCE IN ABOTHUGUCHI CENTRAL DIVISION, MERU COUNTY

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UNIVERSITY OF NAIROBI

DECLARATION

This research project is my original work and has not been presented to any other university or institution of higher learning for academic award.

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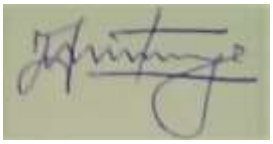
Sign:  Date: 5th August 2020.
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DEDICATION

This research project is dedicated to my beloved parents for instilling in me the value of education at a tender age and for their spiritual, moral and financial support throughout my educational accomplishments. To my wife Martha Makena and our children Elaine Karimi and Travis Mwirigi for their unbound love, support and trust in me which made the journey more worthwhile during the time spent in my studies.

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ABSTRACT

Flipped learning is a learner-centred instructional approach whereby pupils are pre-deposed to new materials and content outside of the classroom and apply them in the next classroom meeting with the teacher playing the role of a facilitator. The pupils are expected to do their research at home and while in the classroom, actively engage in brainstorming, collaborating and reflecting on the concepts with guidance of the teacher. The primary aim of flipped learning is to increase pupils' achievement through enhancements to homework, to bolster the attitudes surrounding homework, to increase the proportion of pupils submitting quality homework and to foster independent learning. The purpose of this study was to establish the effect of flipped learning facets on class seven pupils' academic in science in Abothuguchi Central Division, Meru County. The study sought to address the following objectives; establish whether there is a significant difference in the science subject mean scores of pupils taught using educational videos and traditional methods; examine whether there is a significant difference in the science subject mean scores of pupils taught using out-of-class text reading and traditional methods; evaluate whether there is a significant difference in the science subject mean scores of pupils taught using video and out-of-class text reading and traditional methods; determine whether there is a significant difference in the science subject mean scores of pupils taught using blended learning and traditional methods. The objectives were formulated into four hypotheses. The sample consisted of 4 teachers, 4 head teachers and 103 class seven pupils from the 4 primary schools sampled for the study. The instruments used to collect data were: questionnaires for science teachers and pupils, interviews for the head teachers, observation schedule and pre and post achievement test. The objectives were analysed via inferential and descriptive statistics and presented via frequencies and percentages while the hypotheses were analysed through use of a computer program, SPSS version 23 and Microsoft Excel 2010. An independent-samples t-test was conducted to determine whether there was a statistically significant difference between the means in the control and the experimental groups. It is expected that the outcome of the study will be beneficial to both stakeholders and policy makers in matters of education. One of the key findings of the study was that flipped learning improved academic achievement in science. The key recommendation of the study is that the Government through the Ministry of Finance and Ministry of Education should allocate adequate funds for acquisition of IT resources in school.

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ABBREVIATION AND ACRONYMS

DLP – Digital Learning Programme

ICT – Information Communication Technology

ISTE - International Society for Teaching in Education

IT – Information Technology

MOEST – Ministry of Education Science and Technology

SAT - Standard Achievement Test

SCDE- Sub-County Director of Education

CHAPTER ONE

INTRODUCTION

This chapter covers the background of the study, statement of the problem, purpose of the study, objectives of the study, hypotheses, significance of the study, limitations and delimitations of the study, assumptions of the study, operational definition of terms as well as organisation of the study.

1.1 Background to the Study

Flipped learning is a pedagogical approach which uses technology to reverse the traditional teaching environment by providing learning through educational videos as homework and opening up the next class period for interactive learning (Tucker, 2012). Learners are introduced to pre-recorded concepts (via the Internet, videos, out-of-class text reading or teacher' audio-visual recordings) outside of the traditional instructional space (Alvarez, 2012; Bergmann & Sams, 2012a; Fulton, 2012a). Pupils are expected to complete homework, analyse, explain, interact and use the concepts they learn from the pre-recorded content during class time under flipped learning (Bergmann & Sams, 2014). The teacher prepares a catalogue of online activities before class and incorporates digital technology into the instruction material (Brunsell & Horejsi, 2011). What the learners were usually doing at home becomes (flipped) what the learner is doing in the classroom, and vice versa. According to Ngaruiya (2002), Mathematics homework take an average of thirteen minutes accounting to 33% of the mathematics lesson consequently consuming time for the current lesson development thus depriving off tuition time. With flipped learning, the classroom is freed, thus enabling the teachers to focus on comprehensive teaching approaches, problem solving, collaboration and brainstorming hence enabling pupils to get interested and engage themselves in learning.

The idea of flipped learning emerged in 2006 and has since developed impacting the terminological dimension of the word according to The Flipped Learning Network (2014). Originally, flipped classroom was based on the use of video as a medium of content delivery, while the teacher was the centre of instruction. In the next developmental stage, the concept called 'the flipped mastery model' continued to focus on the teacher's transfer of knowledge, while focusing on the learner's pace through addition of more features to the videos. The final stage of evolution, bore the term 'flipped learning' aimed at learner-centered pedagogy for deeper and long-term understanding while using technology and media to capture content in form of audio, graphics, text or video for learners to access at their own convenience and present knowledge acquired. A teacher needs to know when, why and how to use technological tools and this requires prompt support, time to experiment and continuous professional development in order to improve pupils' academic achievement in science (Ison et al., 2004).

Worldwide, substitutes to traditional learning are being implemented whereby technologies, discovery learning, teacher facilitation and learner collaboration have been integrated to promote pupils' academic achievement in science (Rycik, 2012). For instance, Blended learning, an approach that combines multimedia tools such as electronic presentation support systems, world-wide web based courses and online software with face-to-face classroom, has been widely used over a period of time (Singh, 2003). In the recent past, Flipped leaning as a pedagogical approach to blended learning where classroom activities and homework are swapped, is gaining popularity globally (Tucker, 2012). Many educators are slowly adopting this novel learning approach to advance acquisition of concepts in diverse disciplines (science, humanities and medicine).

Flipped learning was first introduced at Woodland Park high school in Colorado, USA by two chemistry teachers Jonathan Bergmann and Aaron Sams with the goal of restoring missed lessons from their lectures. The lectures were registered and posted on-line (Bergmann & Sam 2012). Subsequently, flipped learning has been the topic of several studies.

Love, Hodge, Grandgenett and Swift (2014) in Nebraska flipped through a linear algebra class and a conventional lecture class. At the end of the semester exams the students were tested on material comprehension and expectations of the course. The findings showed higher mean scores for students in the flipped classroom than for students in the conventional lecture classroom. Additionally, end-of-semester survey results showed that flipped students in the classroom were fairly optimistic about the course.

Kuo-Su et al., (2018) conducted a health science study in Taiwan with population of (n = 32) and non-health science (n = 14) students. The risk of bias was high (36/37 articles). Meta-analyses revealed that the flipped learning had significant better academic achievement than the traditional lecture based method in pupils' examination scores (post-test and pre–test change) and course grades, but not in objective structured clinical examination scores.

Rita et al. (2020) in a study designed to examine Ghanaian teacher's knowledge and usage of flipped classroom instruction strategy, a survey of 109 teachers pursuing master's degree in education was used. The results found out that majority of the teachers approved the reputation of student-centred instructional approach like flipped classroom model. However, many agreed that they have not experienced or been introduced to this instructional strategy. Cecelia et al. (2017) in their study on flipped classroom model as an instructional tool for effective teaching learning of leather work, recommended to the Ghana Education Service together with other education

stakeholders to allow students to use electronic gadgets preferably tablets, mobile phones and laptops in schools to aid in education though with regulations.

Kenyan educators are now promoting the transition of technology into education. Mixed curricula that direct instruction from mob learning to learner-centred learning are currently in use leading to a self-motivated, interactive learning environment in which the instructor guides learners as they apply concepts and engage creatively and actively in the subject. Kenyan education is shifting from the traditional "I Do", "We Do", "You Do" strategy to "You Do", "We Do", "I Do" instead, which is a learner centred approach (The Flipped Learning Network, 2014). Dewey (1910) once argued that "Give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking; learning naturally results" (p. 147).

In Kenya, flipped learning approach has been adopted by the school of business, University of Nairobi. It was introduced in two undergraduate courses namely Business Values and Ethics and Application of Marketing Research by Dr. Owino Joseph. He observed that flipped learning is more effective for teaching a large class than lecture method by creating an avenue for students to closely interact with the learning materials. He also noted that videos were more effective in flipping the class as they are more engaging, less stressful and entertaining to work with (Owino, 2017).

Kenya's Ministry of Education Science and Technology (MOEST) in conjunction with the Ministry of Information, Communications and Technology (ICT) embarked on an ambitious project to introduce tablets and laptops in all public primary schools to jumpstart the process of integrating digital technologies in learning. (MOEST 2013). The first phase of the project cost the taxpayer 17 billion shillings to deliver 1.2 million devices to cover all public primary schools. There were 2555 trainer of trainers (TOTs) drawn from all the 47 counties trained at the counties to train in their

respective counties. The Ministry of Education Science and Technology went on to conduct capacity building for teachers, developed digital content for class 1 and 2 and improved infrastructure in the primary schools. Subsequently, very little has been achieved. For instance, in West Pokot, they have been forced to lock the tablets in cupboards since they cannot work with them in the dust. Furthermore, the infrastructure is poor as the pupils have to sit on stones during class time (Shanzu, 2019). In Nyanza, poor training, constrained access to programme administrators, maintenance of the digital devices as well as poor power supply and interconnectivity are cited as some of the challenges stalking the digital literacy programme (Shanzu, 2019). Meru County has reported mixed reactions of success and failures. A success story is told by class two pupils in Igembe South sub-county who can use a tablet to take a photograph, play videos and do exams. Enthusiasm is evident where tablets are incorporated in classroom; learners appear to be more engaged in learning processes hence improving their academic achievement (Kajrekar, 2012). Through academic performance, the Kenyan government is able to succeed in its overall development strategies which are preservation of the environment for productive gain and sustainable livelihoods, development of quality human resources, realization of universal basic education, development and protection of democratic institutions and human rights. To effectively improve science academic performance, the researcher sought to establish the effect of flipped learning through use of instructional media and technology in order to "blend" in-class and out-of-class content (Reeve, 2006).

For the purpose of this study, the researcher conducted a background check in Abothuguchi Central Division, Meru County to establish the level of DLP programme uptake. The researcher noted that the teachers are shying off using the gadgets by arguing that tablets have little digital content while other teachers lacked technological knowledge to use the gadgets. For pupils to effectively use the tablets in learning, the

researcher further wished to undertake a study on the effect of flipped learning facets on class seven pupils' academic achievement in science in Abothuguchi Central Division, Meru County. Based on Love et al., (2014); Kuo-Su et al, (2018); Owino (2017) and Cecelia et al. (2020) conclusions and recommendations, the findings shall inform the researcher whether this alternative learning approach will benefit class seven pupils in the division and eventually unlock the tablets from the cabinets to the classroom.

1.2 Statement of the Problem

With vision 2030 at hand, the Kenyan economy is eager to see tangible changes towards actualisation of its goals. The government aims at setting the preference of education towards a more science and technology based curriculum. This is evident in the recently launched 2-6-3-3 curriculum which has structured most of its teaching and learning to encompass technology. Kenyan learners may miss out in the global economy too if they do not embrace technology to facilitate science concepts acquisition. With the paradigm shift in pedagogy surrounding technology integration in teaching and learning, scanty information is available on how to effectively infuse technology into the curriculum and consequently improve the acquisition of science concepts among public primary school pupils in the division. This necessitates the need to find out the effect of flipped learning approach in grasping science concepts. This would provide an empirical evidence that may inform the need to utilise the digital leaning devices, which still lie idle yet they can boost pupils' academic achievement in science by exposing them to varied learning experiences thus fostering acquisition of CBC core competences of digital literacy and vision 2030.

1.3 Purpose of the Study

This study's purpose was to investigate the effect of flipped learning on class seven pupils' academic achievement in science in Abothuguchi Central Division, Meru County.

1.4 Objectives of the Study

The study objectives were to:

i. Establish whether there is a significant difference in the science subject mean scores of pupils taught using educational videos and traditional methods.
ii. Examine whether there is a significant difference in the science subject mean scores of pupils taught using out-of-class text reading and traditional methods.
iii. Evaluate whether there is a significant difference in the science subject mean scores of pupils taught using video and out-of-class text reading and traditional methods.
iv. Determine whether there is a significant difference in the science subject mean scores of pupils taught using blended learning and traditional methods.

1.5 Hypotheses

The following hypotheses guided the study;

$H_0$1 - There is no statistically significant difference in the science subject mean scores of pupils taught using educational videos and traditional methods.

$H_0$2 - There is no statistically significant difference in the science mean scores of pupils taught using out-of-class text reading and traditional methods.

$H_0$3 - There is no statistically significant difference in the science mean scores of pupils taught using educational video and out-of-class text reading and traditional methods.

$H_0$4 - There is no statistically significant difference in the science mean scores of pupils taught using blended learning and traditional methods.

1.6 Significance of the Study

The study is foreseen to make recommendations to MOEST and ICT ministry who are the policy makers and especially the Quality Assurance and Standards Department on an alternative approach to integrate technology (DLP tablets) in instruction in public primary schools to improve achievement of science concepts. The study will enable teachers and school heads to design more progressive ICT application aimed at improving the academic achievement in primary schools. The Study is also hoped to be a reference point for other researchers planning to study flipped learning and academic achievement of pupils' in the concepts of science.

1.7 Limitations of the Study

According to Best and Kahn (1993), limitations are conditions beyond the control of the researcher that may place restrictions on the conclusion on the study and the applications to other situations. This study used the quasi-experiment research design to examine whether there was significant difference in science mean scores between learners in the control and experimental groups. The researcher had no control of the different learner characteristics during observation of their reflection, brainstorming and acquisition of science concepts.

1.8 Delimitations of the Study

The study investigated effect of flipped learning facets on primary school pupils' academic achievement in science in Abothuguchi Central Division, Meru County. So, the results of the study cannot be generalized to other regions in the country. The study respondents were class seven pupils since they had high literacy levels and were not a national examination class. This study also involved head teachers and class teachers.

1.9 Assumptions of the Study

The study assumed that:

i) Respondents would co-operate to give valid and reliable data freely

ii) The sample chosen was a representative of the population to necessitate making of inferences on effect of flipped learning on pupils' academic achievement in science

iii) Flipped learning would impact pupils' academic performance in science.

1.10 Definition of the Key Terms

The following terms are used in the study:

Academic Achievement refers to how well a pupil performs/attains knowledge and skills in science as recorded by letter grades and percentages.

Blended Learning refers to instruction that combines videos, out-of-class text reading and traditional classroom approaches.

Constructivism refers to a philosophical epistemology which argues that humans generate knowledge and meaning from their experiences.

Educational Video refers a video meant to deliver a science educational instruction.

Effect refers to the power to change or manipulate individual tendencies.

Facets refers to one among many similar or related yet distinct things

Flipped learning refers to a system of education in which students learn new material by watching video lectures outside the classroom and what used to be homework is done in guided classes instead.

Pupil refers to a learner acquiring knowledge in science concepts in class seven in a school.

Science refers to a subject taught in all the primary schools in Kenya from class five to eight.

Traditional learning refers to an instructional where learners are passive recipients of science knowledge from a teacher during class time. Homework is done by the pupil at home.

YouTube refers to a short video that can be viewed or downloaded from the YouTube website.

1.11 Organization of the Study

This study is organised in five chapters. Chapter one consists of background of the study, the statement of the problem, purpose of the study, objectives of the study, hypotheses, significance of the study, limitations, delimitations, assumption of the study and the definition of key terms. Chapter two covers a review of related literature and the relevant research associated with flipped learning and academic achievement of learners. Chapter three deals with research methodology This includes research design, target population, sampling procedure and sample size, research instruments, instrument validity and reliability, procedures for data collection, data analysis techniques and ethical considerations. Chapter four entails an analysis of the data, presentation and discussions of the findings. Lastly, chapter five gives the summary of the study, conclusions, study recommendations and suggestions for further research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews the literature on the effect of flipped learning and academic achievement in Science. Empirical review covers recent studies regarding flipped learning and themes related to it; Flipped Learning and Science academic performance, use of video and science academic performance, out-of-class text readings and science academic achievement and blended learning and academic performance. Conceptual and theoretical frame works have also been covered in this chapter.

2.2 Flipped Learning and Academic Achievement

Pupils' academic achievement measures the amount of content learnt in a pre-determined time (Caballero, 2010). The level of achievement depends on components such as context, level of knowledge, levels of skills, level of identity, personal factors, and fixed factors. To improve academic performance, learner's mindset, engagement in an enriching environment, and engagement in reflective practice is prudent (Alzain, 2015).

Asiksoy and Ozdamli (2016) define flipped learning as a sort of learner-centred approach where learners actively absorb new information at any time away from classroom by using computers and digital devices. Studies on the implementation of the flipped learning suggest that it promotes pupils' academic achievement as well as enhances learners' creativity and critical thinking subsequently improving pupils' academic achievement (Brunsell & Horejsi, 2011). However, Fulton (2012) says this learning method may not alleviate all the education problems but may provide basis for academic performance. Moreover, Kirkwood and Price (2005) concurs with Fulton (2012) that, while technology enables learning, it does not necessarily ensure learning.

The International Society for Teaching in Education (ISTE) postulates four prerequisite components of a flipped classroom (Bergmann & Sams, 2015).

i) Relationship Building

Relationship building with learners helps to build a classroom community where learners have a good opportunity to listen and ask questions while you understand them better as a teacher. A safe classroom allows for learners to express themselves without fear of ridicule.

ii) Personalized Learning

This is an educational approach that aims to tailor learning for each student's strengths, needs, skills and interests. Teachers need to complement lessons with robust and varied personalized formative and summative assessments to demonstrate learning.

iii) Passion-Based Learning

This allows for heutagogical approach to learning where learners explore their communication desires that is high on Bloom's Taxonomy level, thus creating deeper mastery of the subject matter. The primary benefit of incorporating this strategy is to enable the learners to tackle schoolwork by working from their interests and capacity with active learning.

iv) Project-Based Learning

Learners work on a project over an extended period of time engaging in solving real-world problems. This allows learners to apply their skills practically within the context of real-life situations. Eventually, learners develop profound content knowledge as well as critical thinking, collaboration, creativity and communication skills.

2.2.1 Integration of Technology into the Flipped learning

Integration of media and technology into the flipped learning model include selection and design of activities depending on the learning objectives, type of content, and audience. A flipped lesson that uses digital technologies need to focus more on promoting active learning strategies than on presenting traditional didactic teaching practices (Slomanson, 2014). Roblyer (2006) says that technologies can be used to increase learner participation in their learning process by collaborating on projects with other pupils, solving problems individually or with others, exchanging knowledge, or discussing critical issues to improve pupils' academic performance. Modern tablets and smartphones have been utilised to mitigate the shortage of books and other educational materials. The most significant progress has been noted in South Africa, Uganda and Kenya (Kubickova, 2019).

Technology in flipped learning supports learner autonomy by giving learners the opportunity to reach the information anywhere and anytime (Talbert, 2012). Furthermore, technology supports customized learning speed and styles as well as learning the content prior to practice; allowing students to take more responsibility of their own learning; and creating a more transparent learning environment carrying learning outside the walls of a classroom setting to improve academic achievement (Bergman & Sams, 2012; Miller, 2012; Herreid & Schiller, 2013).

Tully (2014) cited some hindrances that educators may face when flipping their lessons; i) technological divide leading to lack of devices and software for recording and preparing lessons, ii) absence of teachers' with skills in expending the technology proficiently to develop a flipped lesson, iii) the maintenance of status quo by teachers to follow the traditional method in their teaching practice.

2.3. Educational Videos and academic Achievement

Educational videos allow educators to reach pupils using a channel they are used to. Pupils today are digital populace, they spend most of their time online reading the texts in social media, watching videos, playing video games and surfing the net. Sams et al. (2014) notes that videos can also be used to interact with the parents and pupils away from the confines of the classroom and can be a great enabler in increasing pupils' academic performance. The teacher embeds a video (or adds a link) into the learning platform (e.g. PowerPoint) and let learners watch it at home (Ozdamli & Asiksoy, 2016). Schell (2013) says when digital educational videos are incorporated into learner-centred activities, it increases pupils motivation, enhances learning experience, deepens learning of the subject, develops learner independence, enhances team working and communication skills consequently improving pupils' academic performance. Gagne apexes nine values of video in teaching and learning. Videos gain attention of the students, inform learner of the objectives, stimulate recall of prior learning, present the content, provide learning guidance, elicit achievement (practise), provide feedback, assess achievement and enhance retention and transfer (Gagné, et.al., 1992)

In 1946, Dale introduced the "Cone of Experience" concept which was intended to provide an intuitive model of the correctness of various kinds of audio-visual media. According Dale, when selecting teaching and learning strategies, the more senses that are involved in learning, the more and the better learning will be (Dale, 1969). We remember 50% of what we see and hear thus the justification on the use video in learning.

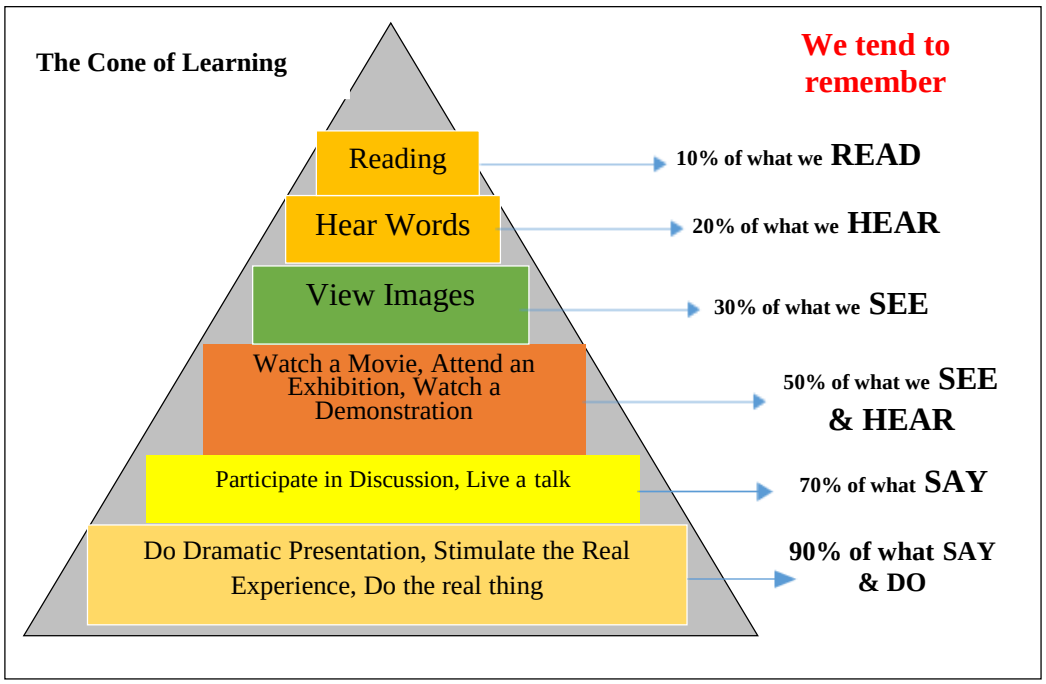

Figure 2.1 Dale's cone of experience. Source: (Edgar Dale, 1969)

Shoukot (2019), conducted a study on impacts of watching video on academic achievement at Daffodil International University. The study sought to analyse the effect of educational videos on university students' academic activities and performance. The study was based on the qualitative approach, and a sample survey had collected data. The majority of the respondents used mobile phones and laptops to watch videos. The study revealed that watching videos had a positive impact on academic activities and performance. Further, it established most respondents preferred short length videos and animated educational videos. Since this study was conducted at the university level, it was necessary to conduct a study at public school level to ascertain the impact it would have on the pupils.

2.4. Out-Of-Class Text Reading and Academic Achievement

Reading is a set of strategies that support all the learners to process and interpret written language. Comprehending the written word is one way the mind grows in its ability to recall learnt content. Reading helps leaners develop their language skills, imagination, listening and focusing on what the teacher is communicating hence higher academic performance. (Ison, et al., 2004). Poor readers often have low self-

esteem. They feel isolated and may possess behavioural disorders some time in their lives and their achievement in subjects is poor because they cannot read and understand the concepts (Ison et al., 2004). Having books at home is more important than parents' education levels as a marker for academic success in school (Jerry, 1996). Worthy and Roser (2010) states that out-of-class reading is a unique academic activity that provides students with access to a wide range of gratifying reading materials such as books, magazines, comic books, blogs, and fan sites. Across the curriculum, reading brightens and strengthens every after-class, before-class and holiday learning program. Guthrie (2008); Worthy and Roser (2010) agree that enthusiastic readers of all backgrounds are academically high achievers than students who rarely read after classes. According to Allington (2012), reading independently and voluntarily in class and out of class leads to high levels of academic achievement and without extensive reading practice, reading proficiency delays. Low achievement in reading also is also a fundamental pointer to school discipline, attendance and dropout matters. Bartholet (2013), in a study, impact of reading ability on academic performance at the primary level, which included records from 95 students from second through fifth grade, found out that there was a strong correlation between reading performance and mathematics performance when looking at the entire elementary spread. This study is also supported by another study by Vilenius-Tuohimaa et al., (2008) which found out that text comprehension skills were related to ability of students to solve mathematics word problems. With this premise, further studies are necessary to establish whether reading ability will influence academic performance in other subject areas.

2.5. Blended Learning and Academic Achievement

Blended learning is a composite of different learning approaches and resources synchronised to help learners meet their own educational objectives more effectively

than learning in traditional environments. Garrison and Vaughan (2007) defined blended learning as the mixing of face-to-face teaching and internet learning. Learners have some choice over where they study though the teacher has the mandate to decide the extent of the choice, as well as which components of the learner's education are technologically accomplished and which components are completed in the class (Heather & Michael, 2012). Blended learning approach promotes advanced scholastic achievement via an active mix of traditional learning and internet activities (Hattie, 2012). Blended learning methods promotes high levels of pupils' academic achievement compared to traditional learning (Heather & John 2012). Staker (2011) adds that deliberate integration of technology makes it easier for teachers to access and analyse real-time learning data so that teachers and learners can monitor their progress and adjust instruction to improve academic performance. Teacher pedagogy, educational technology, and blended instruction all play significant roles in the application of the flipped classroom and eventually improve academic achievement (Alzain, 2015). Blended learning reduces time spent lecturing and more time is spent working with individual learners answering student questions and giving individual feedback. A study by Kintu and zhu (2016) investigating the possibility of blended learning in a Ugandan University, found out that learners attitudes towards blended learning were significant to leaner satisfaction and motivation and knowledge construction eventually influencing academic achievement positively. Shraim and Khlaif (2010) note in their research that 75% of the students and 72% of the teachers lacked skills and experience in computer and internet applications which may lead to failure in blended learning. This argument is sustained by Selim (2007) who opined that learners need to have time management and computer skills necessary for effective blended learning. When pupils manage their time well, it leads to better performance and their ability to tailor the ideal learning environment to suit blended

learning. This study seeks to leverage technology to support acquisition of science concepts in the public primary schools. Teachers and pupils prowess in computer skills (manipulating the DLP tools) is envisaged to trigger effective blended learning thus improving the academic performance in science.

2.6. Traditional Learning and Academic Achievement

In traditional learning, learners receive a prescribed pattern of traditional instruction. The instruction includes the teacher introducing a concept by lecturing, the teacher giving examples of the introduced concept, and homework being assigned on the concept. Learners complete homework independently at home, learner work is graded for accuracy, returned to him/her for brief reflection, and another concept is introduced and the cycle is repeated over and over (Dewey, 1938). This type of learning occurs mostly in public schools in what John Dewey describes as being "imposed from above and outside", where learners are expected to passively and submissively receive and believe these fixed answers.

2.7 Theoretical Framework

Jerome Bruner's Constructivism theory was used in this study. Constructivists describe learning as an active process by which the learner inwardly constructs knowledge through experience (Jonassen, (2006). Learning occur when one constructs both mechanisms for learning and his or her own unique version of the knowledge, coloured by background, experiences and aptitudes (Roblyer, 2006). The learner selects and transforms information, construct ideas and makes decisions relying on a cognitive schema to do so. This discovery learning promotes motivation, responsibility, encourages active engagement, autonomy, and independence in learners. Constructivists classroom encourage active participation, creation of products, and the opportunity for each learner to create his or her knowledge (Jonassen, 1991). For learners to be successful, teachers need to prepare a nurturing

classroom environment and use strengthening and reprocessing strategies to allow all learners to connect with the materials. Knowledge is thus constructed but not transmitted and learners make new knowledge through activities, experiences, and experiments. Learners born beyond 2002 are less tolerant of lecture-style pedagogy since they have been nurtured on rapidly developing technologies. Though educators complain about these learners' inabilities to focus, Prensky (2001), notes that their attention capacities have not changed, but their tolerances and needs have. Prensky suggested that educators must make a paradigm shift from teacher centred pedagogies to learner centred ones in order to reach and involve today's learners. This informed the choice of flipped learning, a learner centred approach which can capture the attention todays learners.

2.8 Conceptual Framework

The conceptual framework helps to identify the concepts included in the area of the study and shows their interrelationship among components. In this study, educational videos, out-of-class text reading and blended learning are the independent approaches that have been manipulated (flipped) to scrutinize the outcome of dependent variable (pupils' academic achievement in science in Abothuguchi Central Division, Meru County). Teachers in public schools' aptitudes in technological, pedagogical and content knowledge act as intervening variables which may positively or negatively influence the outcome of this study.

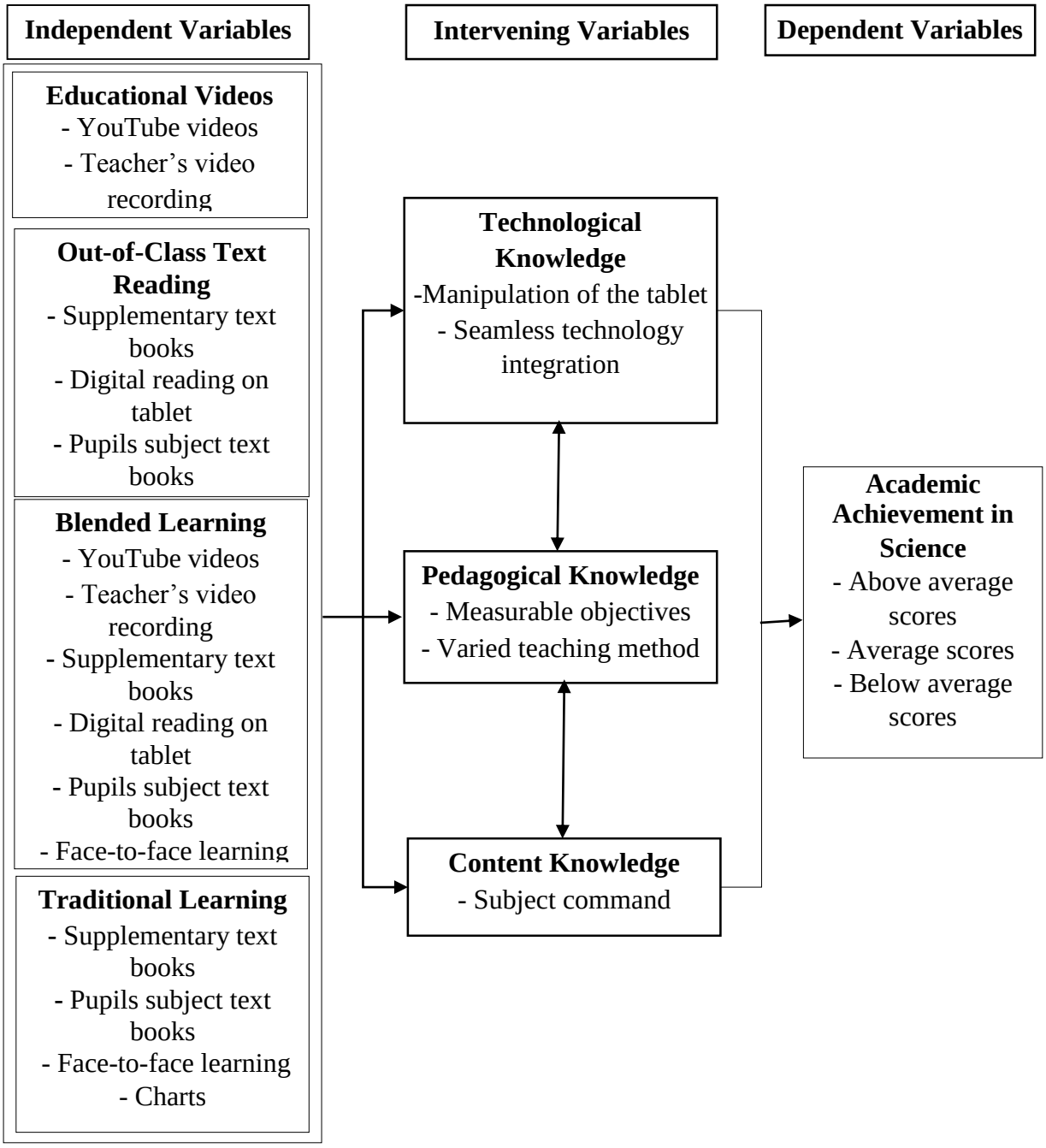

Figure 2.2 Conceptual Framework

2.9 Summary of the Literature Review

From the literature review, studies by Roblyer (2006), Schell (2013) and Alzain, (2015) have shown that technologies can be used in flipped learning to increase pupils' academic achievement through participating in their learning process by collaborating on projects with others, solving problems individually or with others, exchanging knowledge, or discussing critical issues. This motivates the learner and eventually promotes his academic excellence. However, these studies failed to show

how technologies can be used in primary schools to achieve pupils' academic achievement in science concepts. It is the intention of this study to establish whether flipped learning has any effect on pupils' academic achievement in science through use of digital educational videos, out-of-class text reading and blended learning.

The concept of flipped classroom pedagogical approach is perceived to have evolved owing to rise of blended learning approaches in the last twenty years (Arnold-Garza, 2014; Strayer, 2012). It was however popularized by two secondary-school chemistry teachers Johnathan Bergman and Aaron Sams (2012) and has since been propagated to the rest of the world. Positive themes have emerged from the literature review that the flipped classroom seems to provide opportunities such as increased academic achievement in science, increased interaction between pupils and teacher, increased class time for active and practical-based learning and heutagogical learning (Bergmann, 2012; Overmyer, 2014). On the contrary, deterrent themes have also arisen from the literature, predominantly in respect to implementation of the flipped learning. Cautious, constant preparation of both in-class and out-of-class undertakings ought to be done to safeguard significant and pertinent learning skills for pupils (Tully, 2014)

Empirical study by Alzain (2015) indicates that the level of academic achievement depends on components such as context, level of knowledge, levels of skills, level of identity, personal factors, and fixed factors of the learner. With the traditional pedagogical approach, teachers may not be aware of pupils' shortcomings. Utilizing the flipped learning, instructors have greater understanding into student strengths and weaknesses as a result of increased teacher-to-pupil interactions (Fulton, 2012). Previous studies have entirely focused on use of videos in flipped learning within higher levels of learning with scanty details if any on flipped learning in primary level learning. Rather than limiting the research to only use of videos, the current study is

aimed at exploring the effect of flipped learning using out-of-class text reading and blended learning vis a vis traditional learning mode.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focuses on the research design, target population, sampling procedure and sample size, research instruments, instruments validity and reliability, procedure for data collection, data analysis and ethical considerations.

3.2 Research Design

Kothari (2004) defines a research design as a blueprint for collection, measurement and analysis of data. The study adopted a Quasi Experimental research design because it was more feasible and reduces the time and resources required as opposed to true experimental designs which require extensive prescreening and randomization. The Quasi Experimental design using pre-test and post-test was suitable for this study because the achievement in science of the group taught using flipped learning (experimental group) was compared to the achievement in science of the group taught without (Control group). The researcher had a greater control over the research environment that enabled tailoring of flipping learning model without influencing the classroom set up thus minimizing the Hawthorne Effect.

3.3 Target Population

According to Amin (2005), population is the universe of interest or environment to the researcher. The target population of the study comprised of the 26 Abothuguchi Central Division public primary schools, 26 public primary schools head teachers, 30 class seven science teachers and 684 class seven pupils. The head teachers were chosen for the study due to the supervisory nature of their job in the schools. The teachers are the curriculum implementers, while class seven pupils were considered educationally ready, good in computer skills and not an examination class during the

time of the study. The researcher chose the loci due to familiarity with the environment which created the advantage of creating good rapport with the respondents.

3.4 Sample Size and Sampling Procedure

Sampling is a process of selecting the number of individuals or objects to be used in a study from a population such that the selected group is a representative sample of the entire group (Orodho & Kombo, 2002). According to Mugenda and Mugenda (1999), any sample above 10% of the accessible population is appropriate for a study. For this study, the researcher used a sample of 15% of the manageable population. Purposive sampling technique was used to select 4 public primary schools, 4 teachers and 4 head teachers from the 26 public primary schools targeted for the study. The entire population of 103 class seven pupils in sampled schools was used in the study. 51 pupils were in the control group and were taught traditionally while 52 pupils were in the experimental group taught using flipped learning. The experimental group was purposively sampled according to the availability of Digital Learning Program tablets. According to Orodho (2009), purposive sampling is appropriate where the researcher wants to select a sample that reflects a certain variation or has special characteristic. The special characteristics that were considered in this study included availability of enough and functional DLP tablets for the experimental group and technological knowledge of the teachers.

Table 3.1: Demographic Data of Participants

Variable	Control group	Experimental group	Total
Boys	27	28	**55**
Girls	24	24	**48**
Head Teachers	2	2	**4**
Science Teachers	2	2	**4**
Total	**55**	**56**	**111**

Shadish et al., (2002) recommends that evaluation planning begins in advance of an intervention. Before commencement of the study, the researcher chose a topic in

science on Properties of Matter. The topic was organised into four subtopics each to be taught and tested with a set of five questions fortnightly evaluating each of the study objectives. A pre-test to establish normality between the control and experimental groups was administered before teaching of each subtopic and each correct response on an item earned a single point. A post-test was administered to both groups after teaching and intervention respectively and the results recorded and then data compared. This treatment continued for a period of eight weeks and the results analysed for any significant differences.

3.5 Research Instruments

A research instrument is a tool that a researcher uses to collect data in the field to provide information needed for a study (Orodho, 2005). For the purpose of this study, questionnaires, interview schedule, an observation schedule and pre and post achievement tests were used.

i) Questionnaire

Questionnaires are widely used in educational research to obtain information on current conditions and to make enquiries concerning attitudes and opinions quickly in a precise manner. The researcher used pupils and teachers questionnaires for the study. The use of questionnaires in this study was appropriate because the sampled population is literate and time for collecting data was limited. Closed ended questions were used because they were easy to fill, saved time and kept the respondents fixated on the subject. The questionnaires were divided into sections delimiting personal information, questions about the independent variable and the dependant variable. The questionnaire for the learner was aimed at revealing the effect of flipped learning on pupils' academic achievement in science in the sampled schools. The teachers' questionnaire guided the researcher in establishing the effectiveness of flipped

learning model and its impact if any on pupils' academic achievement in science from the sampled schools.

ii) Interview Schedule

Personal interviewing is asking of questions usually in a face-to-face contact with the other person or persons (Kothari 2004). The researcher used an interview schedule for the head teacher and a recording device for review of responses from the respondents. The interview sought information on the efficacy, benefits, support and challenges of flipped learning in totality during its implementation in the sampled schools.

iii) Observation Schedule

An observation schedule is an analytical form filled out by the researcher and carefully specifies in advance the classification of behaviours or events under scrutiny and under what conditions they should be assigned to those classifications (Cari 2006). This study used the observation schedule to collect data on other factors that affect pupils' academic achievement majorly instructional materials, teachers' welfare, physical facilities, teaching learning resources and respondents natural behaviour. Observations were coded into manageable pieces of information which were aggregated into usable quantified data to establish if they have any effect on pupils' academic achievement in science in Abothuguchi Central Division, Meru County.

iv) Standard Achievement Tests

Pre and post standard achievement tests were used in this study to test if the manipulation of flipped learning caused any change to the respondents mean scores. Since all the pupils were being manipulated in the same way, any likely change across the group of respondents was noted.

3.5.1 Validity

According to Mugenda and Mugenda (2003), validity is the precision, relevance and the degree to which the data obtained by the instrument yields true results representing

the variables of the study. Validity of the instruments was obtained by presenting them to the research supervisors because according to Amin (2005) content and construct validity is determined by expert judgment. Before the actual research, questionnaire, interview, observation schedules and achievement tests were piloted to identify any misunderstandings, ambiguities and inadequacies. Data collected through the interviews and questionnaires was triangulated to build a coherent justification for various themes.

3.5.2 Reliability

Reliability is a measure of how consistent the results from an instrument are after repeated trials (Orodho, 2009). Reliability of the questionnaires was obtained using the test-retest reliability. The study approved the results obtained after piloting the instruments in two schools which were outside the sampled four schools. The results were subjected to Pearson's product correlation coefficient to gauge any existing consistencies. The reliability coefficient obtained was 0.84 which was 0.04 above the acceptable 0.80 Mugenda (1999). Reliability of the interviews was established by reframing the questions differently during the interview and later correlating the responses to evaluate their dependability. There was dependability in the answers which was an indication of reliability. Reliability of observation schedule and the standard achievement test was established by comparing data from different schools. Correlation coefficient to evaluate the regularity of observations and test results was also done by several observers assessing similar elements. The correlation coefficient for the observation schedule and standard achievement tests were 0.710 and
0.940 Respectively. These values passed reliability test since according to Frankel and Warren (2002), an alpha value of 0.7 is considered appropriate to make group conclusions.

3.6 Procedure for Data Collection

Prior to the study, an introductory letter was obtained from University of Nairobi to show intent of undertaking the study. The letter facilitated the researcher to apply for a permit from the National Commission for Science, Technology and Innovation (NACOSTI). Permission was sought from the Sub-County Director of Education, Meru Central sub-county to conduct the research in the sampled schools in Abothuguchi Central Division. The researcher visited the selected schools to train and orientate the respondents on the procedures of the study. Questionnaires, interviews, observation schedules were given in course of the study and agreed on the date of collecting filled questionnaires. The researcher frequented the schools involved in the study to deliver science lessons content, view and reflect on the data, but did not engage in any classroom discussion or in any pedagogical approach to avoid influencing the outcome of the study.

3.7 Data Analysis

The study used qualitative and quantitative data analysis. The questionnaires and interviews were organized and classified according to the formulated questions. The questions were coded for purposes of allocation of the degree of what was to be measured. The coded data was entered into a computer for analysis using the Statistical Package for Social Sciences (SPSS) version 23 and Microsoft Excel 2010, while the other analysis from Observation Check List was subjected to content analysis as per the questions. Qualitative data comprising of closed ended questions answers was quantified where appropriate. Qualitative data tackled attitude and behaviours while quantitative dwelt on numerical representations. The statistical methods employed were t-test and percentiles that explained how data was classified into graphs and table categories. An independent *t*-test was utilised to determine if there was a statistically significant difference in the mean post-test results in pupils' academic achievement.

When comparing data among groups, equal variances must be assumed (Elrod, 2013). Discussion of the results was done as per the research objectives. The level of significance and confidence intervals of post-test mean scores between the control and treatment groups was tested at $p<0.05$ level of significance.

3.8 Ethical Considerations

Quasi-experimental methods offer practical options for conducting impact evaluations in real world setting. Information sought by this research was on voluntary basis though consent for the learners was sought from the guardians. Benefits and risks were clearly outlined. Permission was sought from the local administrators before researcher's acquaintance with the respondents. Respondents' anonymity was maintained at all junctures by concealing their names during exhibition of results. The respondents were assured that the findings of the study will only be used for academic purposes and that they would be furnished with the report once it is finalised.

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of this study, data analysis, interpretation and discussion of the findings. The presentation of the findings is done based on the research objectives which were to:

i. Establish whether there is a significant difference in the science subject mean scores of pupils taught using educational videos and traditional methods.
ii. Examine whether there is a significant difference in the science subject mean scores of pupils taught using out-of-class text reading and traditional methods.
iii. Evaluate whether there is a significant difference in the science subject mean scores of pupils taught using video and out-of-class text reading and traditional methods.
iv. Determine whether there is a significant difference in the science subject mean scores of pupils taught using blended learning and traditional methods.

4.2 Return Rate

The researcher sought for information on the rate at which the questionnaires were returned. This was necessitated by the need to establish whether the filled questionnaires were enough to inform the study. Table 4.1 presents the rate at which questionnaires were returned by the science teachers and class seven pupils.

Table 4.1 Participants Response Rate

Category	Frequency	Percentage
Sample Size	107	100%
Response	102	95.3%
Non-response	5	4.7%

Table 4.1 shows that a total of one hundred and seven questionnaires for science teachers and pupils were used to collect data for the study. There was 100% response rate but 5 (4.7%) were not dully completed. This was attributed to lack of English language command by some pupils. The complete questionnaires were 102 accounting to a response rate of 95.3% of the rolled-out questionnaires. According to Kumar (2010), a questionnaire response and return rate of 50 percent is sufficient to conduct a study efficiently and give the researcher information on the phenomenon under investigation. This overwhelming response rate implied that the respondents were cooperative and fully willing to participate in the study. Two head teachers involved in the flipped learning program were punctual, supportive and very willing to be interviewed. As Kerlinger (1973) asserts, respondents who willingly communicate verbally than in writing, eventually offer information in an interview. The researcher filled in an observation checklist to ascertain adequacy of resources necessary for curriculum implementation in all the sampled schools.

4.3 Demographic Information of the Teachers

This section presents the demographic information of the class seven teachers. The study found it necessary to gather this information as it offered relevant data on the teachers experience and their level of readiness in implementing the flipped learning program on class seven pupils in the public primary schools. The data is presented in Table 4.2.

Table 4.2 Demographic Information of the Teachers

Group	Academic Qualification	Frequency	Percent (%)	Technological Knowledge	Teaching experience
Experimental	P1 Certificate	1	25	No	5 years
	Bachelor's Degree	1	25	Yes	22 years
Control	P1 Certificate	2	50	Yes	24 years
	Bachelor's Degree	0	0	Yes	9 years
Total		4	100		

Table 4.2 indicates that 3 (75%) of the respondents were P1 certificate holders while 1 (25%) had a Bachelors' degree with teaching experience ranging from 5 years to 24 years. This phenomenon postulates that the teachers were pedagogically ready to provide reliable data to inform the study. Kini and Podolsky (2016) point out that as teachers gain experience, their students not only learn more as measured by standardised tests, they are also more likely to do better on other measures of success such as school attendance. All the teachers in the control group had technological knowledge since they had prior training on computer applications software while those in the experimental group, one teacher had the technological knowledge. Despite one teacher in the experimental group lacking the knowledge, he operated a smartphone which showed that he had a fair grasp of technological knowledge. The operation of the smartphone is almost similar to that of DLP tablet save for the interface due to difference in the operating systems hence the teacher required minimal orientation on operation of the tablet.

4.4 Findings on Science Mean Scores of Pupils Using Educational Videos and Traditional Methods

The first objective sought determine the effect of using educational videos and traditional methods on pupils' science subject mean scores, The control group was

taught using traditional methods while the experimental group was taught using educational videos. The pupils were evaluated out of five points with a similar test on the first topic of the Properties of Matter. The mean scores for the control and experimental groups are presented on Table 4.3.

Table 4.3 Science Test Mean Scores of Control and Experimental (1) Groups

		N	Min.	Max.	Mean	Std. Dev.	Skewness
Control	Pre-test	51	1	3	2.14	1.98	-.22
Group	Post-test	51	2	4	2.89	1.25	-.47
Experimental	Pre-test	52	1	3	2.34	1.73	.31
Group	Post-test	52	2	5	4.29	2.52	.38

Table 4.3 shows that the control group posted a pre-test mean score of 2.14 with a standard deviation of 1.98 and a post-test mean score of 2.89 with a standard deviation of 1.25. The experimental group posted a pre-test mean score of 2.34 with a standard deviation of 1.73 and post-test mean score of 4.29 with a standard deviation of 2.52. The experimental group posted a higher mean score than the control group. This implies that educational videos positively influenced the learning of science concepts by the pupils. The variance in achievement could be credited to the hands-on nature of educational videos giving the pupils genuine model experience that was not simulated in the traditional classroom. This research finding is consistent with Cisco (2008) on the effects of video on students' academic performance who found that adding visuals to verbal learning can result in significant gains in basic and higher order learning. Similarly, a study of Rockman et al (1996) on impact of home and school viewing of educational videos showed that learners who watched the videos were able to deliver more thorough and composite explanations of scientific concepts after viewing the videos.

The pupils in the experimental group were requested to indicate their effort in learning of science concepts during the previous term while using face to face learning (traditional method) and their responses are as shown in figure 4.1.

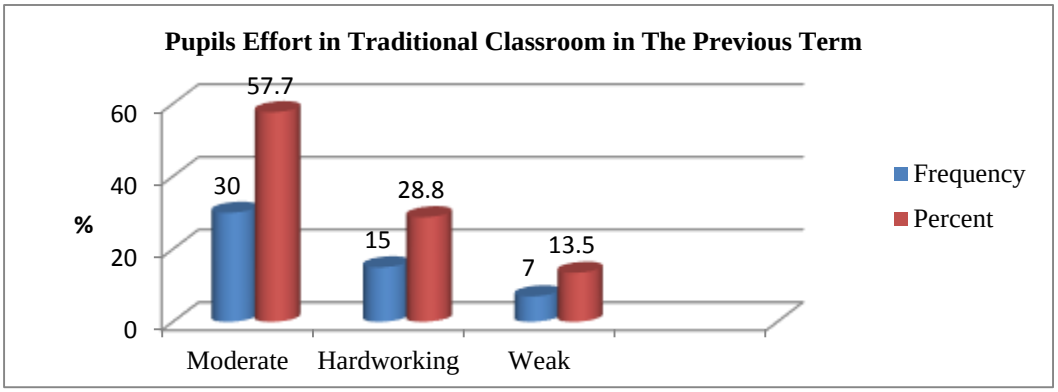

Figure 4.1 Pupils' Previous Term Effort in Science in a Traditional Classroom

Figure 4.1, shows majority of the pupils' (57.7%) effort was moderate, 28.8% was hardworking while 13.5% were weak. This low approval of pupils' effort on traditional class in the previous term could be attributed to their dismal performance before the introduction of educational videos in teaching (flipped learning) and the benefits realized henceforth in the current term.

To compare pupils' effort in learning of science concepts through the current term while using educational videos with the previous term learning traditionally, the pupils in the experimental group made responses as shown on figure 4.2.

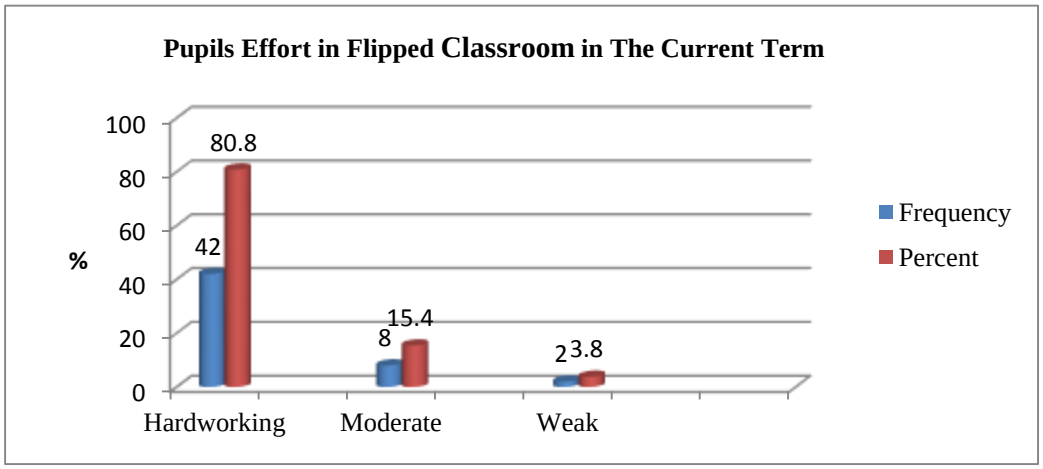

Figure 4.2 Pupils' Current Term Effort in Science in a Video Classroom

Figure 4.2 indicates that 80.8% of the pupils were hard working compared 15.4% and 3.8% who indicated they were moderate and weak respectively in the flipped learning classroom where educational videos were used. This steady rise in effort among pupils could be attributed to the paradigm shift in use of technology where educational videos were integrated in teaching science. These pupils viewed themselves as hardworking since they were actively engaged in manipulating knowledge, taking notes, creating and applying knowledge to similar contexts with peers rather than passively listening to the teacher. These findings concur with Willmott et al. (2012) who found that there is a strong evidence that digital video learning can inspire and engage learners when incorporated into pupil centred learning activities by increasing pupil motivation, promoting higher marks, developing learner autonomy and enhancing team and communication skills.

Science teachers were asked to describe their class experience while using educational videos and the question received the following feedback.

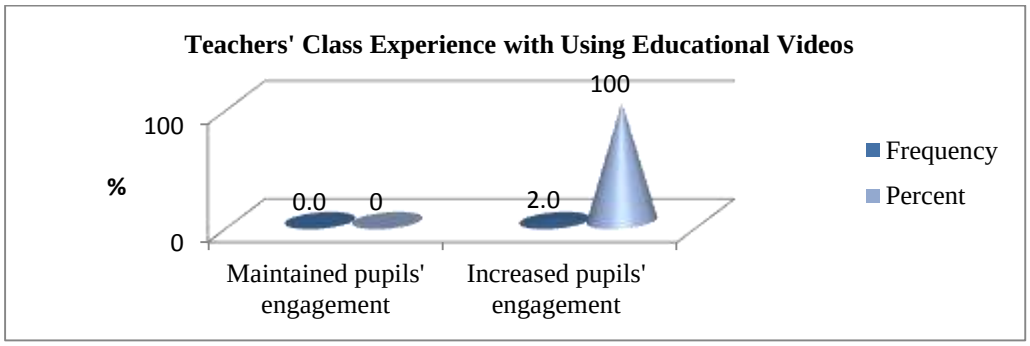

Figure 4.3 Teachers' Class Experience While Using Educational Videos

Figure 4.3 reveals that 100% of the science teachers agreed that use of educational videos increased pupils' engagement in the class and that it helped pupils acquire understanding and insight in science concepts. These revelations too, adapt the findings of Shoukot, (2019), Schell, (2013) and Gagne et al. (1992) who noted that when digital educational videos are incorporated into learner-centred activities, this

increases pupils motivation, enhances learning experience, deepens learning of the subject, develops learner independence, enhances team working and communication skills subsequently improving pupils' academic performance. Traditional classroom had limited opportunities that could allow pupils devote classroom time to learning. Activities focused on applying the instructional material (such as working through problems and engaging in collaborative learning) with the guidance of the teacher as stated by Roehl, Reddy, and Shannon (2013) which created limited learning opportunities for the pupils.

When asked to comment on benefits of flipped learning, one head teacher was quick to note that performance in science had significantly improved. She further alluded that flipped learning program through the use of education videos was easily accepted by the pupils and integrated the outside world into classroom which made it very easy for the teacher to create authentic, unique and fun lessons. The head teacher also noted that class seven pupils' discipline had significantly improved since they were engaged beyond the school hours thus deterring them from behaviour delinquency.

Null Hypothesis ($H_0$1)

There is no statistically significant difference of using educational videos and traditional methods on pupils' science subject mean scores.

To address research hypothesis 1, the researcher compared the mean difference in science post-test scores between the control and experimental groups. An independent samples t-test was conducted to determine if there was a statistically significant difference between pupils' science post-test mean scores from the experimental group, using educational videos and control group taught traditionally.

Table 4.4 Independent Samples t-test for Pupil Post-test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	.114	.738	2.462	43	.018	-1.110	.451	-2.019	.201
Equal variances not assumed			2.488	42.213	.017	-1.110	.446	-2.010	.201

There exists a difference in the mean between the experimental (Mean =4.29 N=52, SD 2.52) and the controlled group (Mean=2.89, N=51, SD 1.25) in the Post-test overall score. Table 4.4 shows there was a statistically significant difference in the Post-test mean scores between experimental and control, t (103) = 2.462, p =.018. There was a statistically significant difference between means ($p<.05$) hence the null hypothesis was rejected and it could be concluded that educational videos influenced pupils' science mean scores.

4.5 Findings on Science Mean Scores of Pupils Using Out-of-Class Text Reading and Traditional Methods

The second objective sought to examine the effect of using out-of-class text reading and traditional methods on pupils' science subject mean scores. The control group was taught using traditional methods while the experimental group was taught using out-of-class text reading. The pupils were evaluated out of five points with a similar test on second subtopic of the Properties of Matter. The mean scores for the control and experimental groups are presented in Table 4.5

Table 4.5 Science Test Mean Scores of Control and Experimental (2) Groups

		N	Min.	Max.	Mean	Std. Dev.	Skewness
Control	Pre-test	51	1	3	2.09	1.87	-.21
Group	Post-test	51	2	4	2.94	2.33	-.43
Experimental	Pre-test	52	1	3	2.47	1.43	.41
Group	Post-test	52	2	5	3.98	2.74	.58

Table 4.5 shows that the control group posted a pre-test mean score of 2.09 with a standard deviation of 1.87 and a post-test mean score of 2.94 with a standard deviation of 2.33. The experimental group posted a pre-test mean score of 2.47 with a standard deviation of 1.43 and post-test mean score of 3.98 with a standard deviation of 2.74. The mean scores of experimental group was higher than the mean scores of control group. This implies that out-of-class text reading positively influenced the learning of science concepts by the pupils. This significant effect in science mean scores can be attributed to increase in one's vocabulary and imagination, increasing the verbal and writing abilities consequently broadening one's horizon. The researcher noted that it is important for pupils to adopt a reading culture away from the class for improved academic performance. Cromley (2009) conducted a study on secondary students focusing precisely on reading and proficiency in science with an international perspective. Cromley found that there was a very high correlation between reading comprehension and science proficiency, with the mean for all of the nations being .819. Cromley noted that the 2006 tests used in this study to measure science achievement, the Programme on International Student Assessment (PISA), was designed to require reading, which emphasizes the high correlation between reading and science achievement.

Class Seven Pupils in the experimental group were requested to describe their class experience using out-of-class text reading and the question obtained the following feedback.

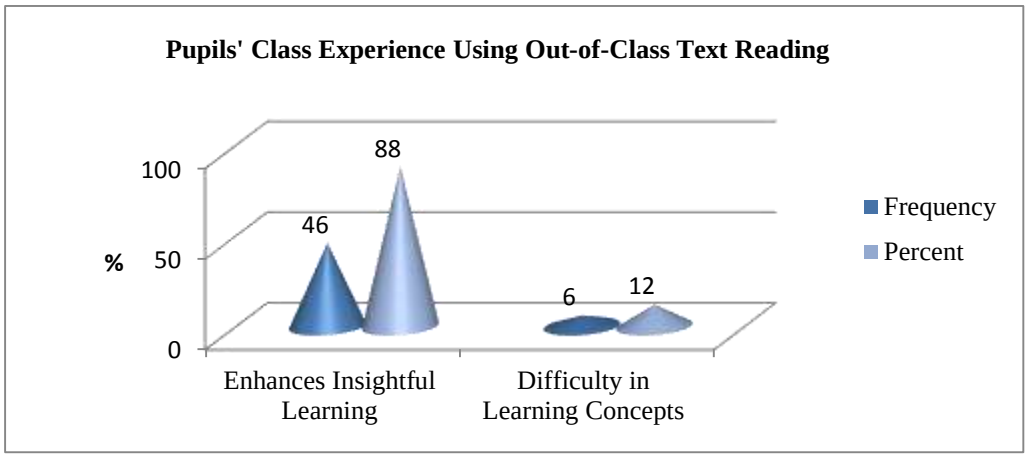

Figure 4.4 Pupils' Class Experience Using Out-of-Class Text Reading

Figure 4.4 shows that majority of the pupils 46 (88%) indicated that out-of-class text reading helped them enhance insightful learning as opposed to 6 (12%) who indicated that they had difficulty in learning of science concepts. This revelation shows that this strategy helped pupils acquire understanding after reflecting on the written texts thus enabling them develop astute knowledge in science subjects. Studies have shown that fluent oral reading enhances performance thus leading to engagement and enjoyment by pupils (Rasinski & Hoffman, 2003). "Through independent reading, pupils gain a wealth of knowledge about a variety of things, absorb the essentials of English and expand their vocabularies and other subject matter" (Strauss, 2014, p.19). In the traditional classroom, the teacher directs the learners to memorisation and recitation techniques there by not developing their critical thinking, problem solving and decision making skills ultimately influencing their academic performance in science negatively (Sunal et al., 1994).

Teachers in the flipped classroom were asked to describe their class experience with out-of-class text reading. A teacher indicated that the compulsory reading promoted heavy reading consequently improving the pupils' communication skills, writing skills

and abilities in science. Another teacher said that low performing pupils had a lower interest in reading, while higher performing pupils had a greater interest in reading. Espin and Deno (1993) in their study involving 121 tenth-grade students in a rural school in a small mid-western community found that a relationship exists between basic reading literacy and student academic success. Their study was based on the link between a learner's reading amount and that learner's score from a classroom study assignment, grade point average, and achievement test results. On challenges affecting the flipped learning implementation, the teachers lamented the inadequacy of the supplementary text books and difficulty in reading by a few pupils. The implication of this assertion was that majority of the teachers had difficulty in assigning reading home works thus jeopardising pupils' ability to read independently and consolidate their reading skills and strategies which could adversely affect their science mean scores.

The head teachers on benefits of flipped learning, alluded that the obligatory reading had instilled a reading culture among the class seven pupils and this was likely to have a ripple effect to the rest of the school. A head teacher noted that class seven pupils no longer made noise in the class as they were pre-occupied during free time with reading activities. On resources in the schools, the head teachers admitted shortfall of supplementary books and the need to address the issue to improve the learning outcome in their respective schools.

Null Hypothesis ($H_0 2$)

There is no statistically significant difference of using out-of-class text reading and traditional methods on pupils' science subject mean scores.

To address research hypothesis 2, the researcher compared the mean difference in science post-test scores between the control and experimental groups. An independent samples t-test was conducted to determine if there was a statistically significant

difference between pupils' science post-test mean scores from the experimental group, using out-of-class text reading and control group taught traditionally.

Table 4.6 Independent Samples t-test for Pupil Post-test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	35.507	.000	2.714	43	.010	.320	.118	.082	.558
Equal variances not assumed			2.554	28.037	.016	.320	.125	.063	.577

There exists a difference in the mean between the experimental (Mean=3.98 N=52, SD 2.74) and the controlled group (Mean=2.94, N=51, SD 2.33) in the Post-test overall score. Table 4.6 shows that there was a statistically significant difference in the Post-test mean scores between experimental and control, t (103) = 2.71, p =.010. There was a statistically significant difference between means (p<.05) hence the null hypothesis was rejected and it could be concluded that educational videos influenced pupils' science mean scores.

4.6 Findings on Science Mean Scores of Pupils Using Educational Video and Out-of-Class Text Reading and Traditional Methods

The third objective of this study sought to evaluate the effect of using educational videos and out-of-class text reading and traditional methods on pupils' science subject mean scores. The control group was taught using traditional methods while the experimental group was taught using educational videos and out-of-class text reading. The pupils were evaluated out of five points with a similar test on third subtopic of the

Properties of Matter. The mean scores for the control and experimental groups are presented in Table 4.7

Table 4.7 Science Test Mean Scores of Control and Experimental (3) Groups

		N	Min.	Max.	Mean	Std. Dev.	Skewness
Control	Pre-test	51	1	3	2.29	2.18	-.72
Group	Post-test	51	2	4	3.03	2.55	-.37
Experimental	Pre-test	52	1	3	2.42	3.53	.46
Group	Post-test	52	3	5	4.68	3.05	.98

Table 4.7 shows that the control group posted a pre-test mean score of 2.29 with a standard deviation of 2.18 and a post-test mean score of 3.03 with a standard deviation of 2.55. The experimental group posted a pre-test mean score of 2.42 with a standard deviation of 3.53 and post-test mean score of 4.68 with a standard deviation of 3.05. The experimental group posted a higher mean score than the control group. The implication of this finding is that educational videos and out-of-class text reading positively influenced the learning of science concepts by the pupils. Reading articles and watching videos engages two different brain processes. The brain gets a much better workout when reading and watching and the process requires a longer attention span and deeper cognitive efforts Liraz, (2017). Further, Machin (2002) states that the learners' attention can be captured by presenting real-life situation the learner is accustomed with. While video might seem to be the best tool to reflect a realistic setup, books can also address the setup by presenting pictures in combination with a narrated text. These attributes lead to grasping of science concepts translating to significant academic achievement.

Pupils in the experimental group were requested to indicate the effect of using both video and text reading and results are tabulated in Table 4.8

Table 4.8 Effect of Educational Videos and Out-of-class Text Reading

Statements on effect of educational videos and text reading	Agree f (%)	Neutral f (%)	Disagree f (%)	No response f (%)	Total f (%)
I like lessons with videos and text reading.	43 (82.7)	5 (9.6)	4 (7.7)	-	52 (100)
Educational videos with text can help me remember things for a long time	46 (88.5)	6 (11.5)	-	-	52 (100)
Pupils do not remember what they learnt while using educational video with text when they move on to paper and pen tasks	9 (17.3)	5 (9.6)	38 (73.1)	-	52 (100)
The use of educational videos with text creates ideas and experiences which pupils can discuss amongst themselves	47 (90.4)	-	5 (9.6)	-	52 (100)

Table 4.8, shows the major effects of using educational videos with text reading in flipped learning. Several pupils (82.7%) indicated that they liked lessons with videos and text while 88.5% showed that educational videos with text could help them remember things for a long time. Majority of pupils (90.4%) overwhelmly agreed that educational videos with text created ideas and experiences which they could discuss amongst themselves, however, a few (9.6%) of them disagreed. This percentage could represent the shy and the poor in English language command. Table 4.8 also shows that 73.1% of the pupils disagreed that they do not remember what they learnt while using educational video with text when they move on to paper and pen tasks. This was in accord with Raths, (2014) who opined that a combination of text reading with watching the video first about the science topic gave them a solid understanding of the concept.

The science teachers were requested to describe their class experience with videos and out-of-class text reading. They noted that reading texts develops pupils' literary skills.

It improves vocabulary, grammar and reading skills which are equally necessary in facilitating science academic performance. A teacher highlighted that the blend of educational videos and out-of-class text reading creates an edge over the traditional learning because there are many free videos out there compared to rarely free books. Moreover, educational videos can be readily captured from our environments.

The head teachers, when asked to highlight the benefits of flipped learning program, they indicated that educational videos clips strengthened the ability to role play procedures leading to acquisition of science concepts while reading was a timeless source of edutainment. When asked about the challenges they encountered when actualising the program, one was quick to pin point the scarcity of enough supplementary books which deprived the teachers' opportunity to tailor lessons to the specific attributes and interests of the pupils.

Null Hypothesis ($H_0$3)

> There is no statistically significant difference of using educational videos and out-of-class text reading and traditional methods on pupils' science subject mean scores.

To address research hypothesis 3, the researcher compared the mean difference in science post-test scores between the control and experimental groups. An independent samples t-test was conducted to determine if there was a statistically significant difference between pupils' science post-test mean scores from the experimental group, using educational video and out-of-class text reading and control group taught traditionally.

Table 4.9 Independent Samples t-test for Pupil Post-test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	11.280	.002	2.716	42	.010	.0655	.241	.168	1.141
Equal variances not assumed			2.452	22.312	.022	.0655	.267	.101	1.208

There exists a difference in the mean between the experimental (Mean=4.68 N=52, SD 3.05) and the controlled group (Mean=3.03, N=51, SD 2.55) in the Post-test overall score. Table 4.9 shows that there was a statistically significant difference in the Post-test mean scores between experimental and control, t (103) = 2.71, p =.010. There was a statistically significant difference between means ($p < .05$) hence the null hypothesis was rejected and it can be concluded that educational videos and out-of-class text reading influenced pupils' science mean scores.

4.7 Findings on Science Mean Scores of Pupils Using Blended Learning and Traditional Method

The fourth objective sought to assess the effect of using blended learning and traditional methods on pupils' science subject mean scores. The control group was taught using traditional methods while the experimental group was taught using educational videos, out-of-class text reading and traditionally (face to face) interactive sessions. The pupils were evaluated out of five points with a similar test on the fourth sub topic of the Properties of Matter. The mean scores for the control and experimental groups are presented on Table 4.10.

Table 4.10 Science Test Mean Scores of Control and Experimental (4) Groups

		N	Min.	Max.	Mean	Std. Dev.	Skewness
Control	Pre-test	51	2	3	2.44	1.28	-.64
Group	Post-test	51	1	4	2.74	2.10	-.33
Experimental	Pre-test	52	1	4	2.56	1.41	.26
Group	Post-test	52	2	5	4.76	2.16	.88

Table 4.10 shows that the control group posted a pre-test mean score of 2.44 with a standard deviation of 1.28 and a post-test mean score of 2.74 with a standard deviation of 2.10. The experimental group posted a pre-test mean score of 2.56 with a standard deviation of 1.41 and post-test mean score of 4.76 with a standard deviation of 2.16. The experimental group posted a higher mean score than the control group. The implication of this finding is that blended learning positively influenced the acquisition of science concepts by the pupils. The test results concur with Omiola (2012) who claimed that respondents in the experimental group or blended learning environments exhibited higher mean scores and therefore we can infer that such blended environments have the prospective to reinforce the basics of teaching and learning, to provide the pupils with enough opportunities to learn in an enjoyable manner.

Science teachers were required to indicate the resources present in primary schools that could sustain traditional learning. A cross tabulation of the responses yielded Table 4.11.

Table 4.11 Resources in Primary Schools

Resources in Primary Schools	Control Group Frequency		Experimental Group Frequency	
School	A	B	C	D
Science Supplementary Books	1	1	2	3
Computer Room	-	1	1	1
Conventional Charts	5	7	8	6
Science Text Books	1	1	2	3
Science Kit	-	-	-	1
DLP tablets	17	23	22	28
Power connection in class	NONE	NONE	NONE	YES

Data captured in Table 4.11, show that science text books and conventional charts were the main resources present in public primary schools in the division. All sampled schools had the DLP tablets but 75% were not in use because either the school lacked a teacher with the requisite technological knowledge or the computer room was lacking or was being used by a regular class. 75% of the schools had power connected to computer room but only 25% of them had power extended to the classrooms making it a herculean task to sustain blended learning in most of the public primary schools in the division. The schools lacked supplementary books to sustain out-of-class text reading that would have reinforced the efforts made in the regular classroom. 75% of the schools lacked science kit which is a very useful resource in teaching and learning of science in primary schools.

Teachers were asked to comment on the effect of blended learning in teaching and learning of science concepts as opposed to traditional learning. Their responses were as shown on figure 4.5.

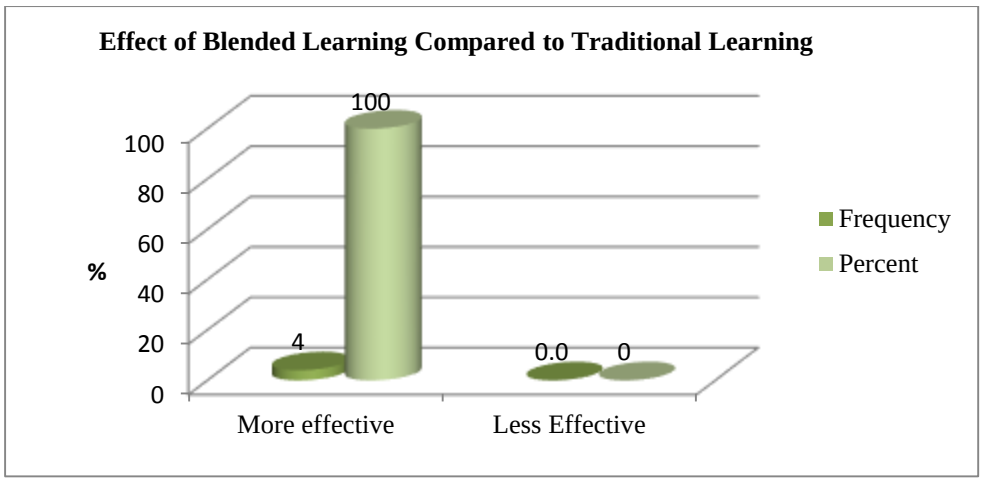

Figure 4.5 Comparisons between Blended Learning and Traditional Learning

Figure 4.5 shows science teachers (100%) totally agreed that blended learning was a more effective learning method compared to traditional learning and this was attributed to the many benefits accrued for integrating face to face interactions, educational videos and out-of-class text reading. This helped pupils acquire understanding and insight of science content a finding that resonated with Heather and John (2012) that blended learning approach provides an active mix of traditional learning with mobile learning and online activities thus promoting high levels of pupils' academic performance compared to pure traditional learning.

On experience with blended leaning, the teachers noted that in a simple question and answer session, pupils would have a lot to say which would culminate into a whole class discussion. One was quick to admit pupils' prowess in handling technology was better than his, to some extent, some pupils could suggest search of answers from the internet. This exposure to technology through blended environments improves pupils' enthusiasm towards learning eventually improving pupils' science mean scores. These revelations seemed to conform to the findings of Ceylan and Kesici (2017) who concluded that blended learning environment had generates a significant difference in students' academic performance.

When asked if they would implement blended learning in their schools, head teachers equivocally agreed they would out of personal interests while others lamented the

technical aspect and the cost implication which could only be mitigated through board of management and ministry of education supported means.

With traditional classroom, learners' preferences are not taken into account as they are merged into a "one-size-fits-all" curriculum. Almurashi (2016) noted that pupils feel drowsy and uninterested when they are taught with same routine. Pupils indicated that it does not encourage questioning and that they talk only when necessary as opposed to blended lessons which are very interactive.

Null Hypothesis (H_04)

There is no statistically significant difference of using blended learning and traditional methods on pupils' science subject mean scores.

To address research hypothesis 4, the researcher compared the mean difference in science post-test scores between the control and experimental groups. An independent samples t-test was conducted to determine if there was a statistically significant difference between pupils' science post-test mean scores from the experimental group, using educational video, out-of-class text reading and traditionally (face to face interactions) and control group taught traditionally.

Table 4.12 Independent Samples t-test for Pupil Post-test

	Levene's Test for Equality of Variances		**t-test for Equality of Means**						
								95% Confidence Interval of the Difference	
	F	**Sig.**	**T**	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**Lower**	**Upper**
Equal variances assumed	7.062	.011	4.740	43	.000	1.610	.340	.925	2.295
Equal variances not assumed			4.543	32.033	.000	1.610	.354	.888	2.332

There exists a difference in the mean between the experimental (Mean=4.76 N=52, SD 2.16) and the controlled group (Mean=2.74, N=51, SD 2.10) in the Post-test overall score. Table 4.6 shows that there was a statistically significant difference in the Post-test mean scores between experimental and control, $t(103) = 4.74$, $p = .000$. There was a statistically significant difference between means ($p < .05$) hence the null hypothesis was rejected and it can be concluded that blended learning influenced pupils' science mean scores.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings, conclusions and recommendations. It also presents suggestions for further research.

5.2 Summary

The study investigated the effect of flipped learning facets on primary school pupils' academic achievement in science in Abothuguchi Central Division, Meru County. This was compelled by the desire to establish if this alternative teaching approach to the traditional learning, had any effect on pupils' science mean scores through the use of educational videos, out-of-class text reading, educational videos and out-of-class text reading and blended learning. The study adopted quasi-experimental research design. Purposive sampling technique was used to select a sample 4 teachers, 4 head teachers and 103 class seven pupils from public primary schools used for the study. The data was collected via pupils and teachers questionnaires, head teacher's interview schedules, observation schedules and pupils' standard achievement tests.

5.2.1 Effect of Educational Videos on Pupils' Science Mean Scores

The findings revealed that 30 (57.7%) of pupils effort during the previous term was moderate, 15 (28.8%) was hardworking while 7 (13.5%) were weak. However, there was a remarkable increase in the number of pupils liking the science lessons in the current term since 42 (80.8%) of the pupils indicated they were hard working compared to 8 (15.4%) and 2 (3.8%) who indicated they were moderate and weak respectively in the flipped learning classroom where educational videos were used.

The study also found out that 2 (100%) teachers fully supported the use of educational videos in teaching of science concepts. They all agreed that videos increased pupils' engagement in the classroom thus contributing towards their overall rise science mean

scores. The findings agree to Schell, (2013) and Gagne, Briggs and Wagner (1992) who noted that when digital educational videos are incorporated into learner-centred activities, rejuvenates the disposition in the classroom. Hence, this has a correlation to critical thinking and problem solving, communication and collaboration, imagination and creativity consequently increasing the science mean scores.

The study reveals that the traditional classroom had restricted opportunities that barely motivated the learner to acquire science skills optimally leading to the low mean scores.

The findings on benefits of educational videos as revealed by 2 (100%) of head teachers indicated that class seven pupils' discipline significantly improved since they were engaged beyond the school hours thus deterring them from misbehaviour, a connection that was conspicuously missing in traditional classroom.

The study found Educational Videos to have a significant effect on pupils' science mean scores. The experimental group using educational videos posted a higher mean score (M=4.29) than the control group (M=2.89) taught traditionally. There was a statistically significant difference ($p<.05$) in the Post-test mean scores between experimental and control, $t(103) = 2.462$, $p = .018$.

5.2.2 Effect of Out-of-class Text Reading on Pupils' Science Mean Scores

The study reveals that 46 (88%) of class seven pupils using out-of-class text reading embraced this mode of study by asserting that it enhanced insightful learning. Only 6 (12%) had an objection to this strategy by alluding that they had difficulties in learning science concepts. It is evident that this approach helped pupils acquire understanding through reflection of the written texts. On challenges affecting application of this strategy, the 2 (100%) teachers singled out lack of enough supplementary text books as the greatest impediment to this strategy. This claim, was supported by 2 (100%) head teachers who were interviewed. However, the head teachers were quick to note

that the few that were available, had been prudently used to sustain out-of-class text reading activities and that the classes were quieter in absence of the teachers. The study shows that using out-of-class text reading had a significant difference on pupils' science mean scores. The experimental group using out-of-class text reading posted a higher mean score (M=3.98) than the control group (M=2.94) taught traditionally. There was a statistically significant difference ($p<.05$) in the Post-test mean scores between experimental and control, $t(103) = 2.71$, $p = .010$.

5.2.3 Effect of Educational Video and Out-of-class Text Reading on Pupils' Science Mean Scores

The study found out that 43 (82.7%) of the pupils liked lessons with educational videos and text reading while 4 (7.7%) disliked them. It was also revealed that majority 46 (88.5%) of the pupils remembered things for a long time when they used educational videos and text reading. Only 6 (11.5%) had a neutral opinion on the same meaning that they neither disagreed to this revelation nor did they fully support it. The results of the study also reveal that majority of the pupils 47 (90.4) acknowledged that the use of educational videos with text creates ideas and experiences which they can discuss amongst themselves. However, 5 (9.6 %) of them disputed this claim by the majority. The study also found out that 38 (73.1%) of pupils disagreed that they do not remember what they learnt while using educational video with text when they move on to paper and pen tasks. This connotes that majority of the pupils supported learning of science concepts using educational videos and text reading.

The study also found out that 2 (100%) teachers endorsed this approach since it had an edge over the traditional learning in terms of science mean score results and that videos were readily available from the environment. This was clearly supported by 2 100% of the head teachers who agreed that educational video clips and text reading

strengthened the ability to role play scientific procedures culminating to edutainment while acquiring scientific concepts.

The study revealed that using educational videos and text reading had its challenges. 1 (50%) head teacher from flipped classroom school pin pointed scarcity of supplementary text books which when mitigated, better results would be witnessed.

The findings revealed that using educational videos and out-of-class text reading had a significant effect on pupils' science mean scores. The experimental group using educational videos and out-of-class text reading posted a higher mean score (M=4.68) than the control group (M=3.03) taught traditionally. There was a statistically significant difference ($p<.05$) in the Post-test mean scores between experimental and control, $t(103) = 2.71$, $p = .010$.

5.2.4 Effect of Blended Learning on Pupils' Science Mean Scores

The study found out that 3 (75%) schools have never used the DLP tablets in teaching and learning of science due to lack of teachers versed with technological knowledge to handle the gadget. Moreover, only 1 (25%) of the schools had power extended to the classrooms which further hampered integration of technology in the teaching and learning of science concepts.

The study also identified that only 1 (25%) school had a science kit which contains all apparatus necessary in learning of science concepts. This implies that pupils either skipped conducting experiments or relied on demonstrations method of teaching which does not free up pupils time to communicate and collaborate with each other.

The findings revealed that science teachers (100%) unanimously ratified flipped learning using blended learning as a more effective learning method compared to traditional learning mostly because pupils' science mean scores had increased significantly. Moreover, use of DLP tablet helped pupils to beat the limitation of

distance and time thus freeing up interaction time with science content thus enhancing acquisition of science concepts eventually improving their mean scores.

The findings also revealed 2 (100%) of teachers endorsed blended due to its interactivity nature and enthusiasm it elicited from the pupils during class sessions and its ability to improve science means scores too.

The findings on bended learning implementation in primary schools reveal 50% of the head teachers supported the initiative due to its accrued benefits and personal interests while the rest (50%) acknowledged its efficacy but lamented the technical aspect and cost implication which if mitigated would make blended learning the best approach among the rest of the flipped learning methodologies.

The findings revealed that using educational videos and out-of-class text reading had a significant effect on pupils' science mean scores. The experimental group using educational videos and out-of-class text reading posted a higher mean score (M=4.76) than the control group (M=2.74) taught traditionally. There was a statistically significant difference ($p<.05$) in the Post-test mean scores between experimental and control, $t(103) = 4.74$, $p = .010$.

5.3 Conclusions

In this 21st century, technology must be used to leverage academic achievement in science and there is need for educators to possess original and creative skills that augment the science mean scores through promotion of critical thinking and problem-solving, communication and collaboration, imagination and creativity. To help science teachers achieve their endeavour, while meeting the learner's expectations, alternative curricula are currently being used to diminish the ever increasing pupil to teacher ratio and pupil to pupil book sharing ratio problem. This study reveals that when pupils are given an opportunity to show case their aptitudes while learning science concepts, they may secure their future through acquisition of better grades. While implementing

flipped learning, level of learners, teachers' pedagogical and technological knowledge and the ideal content must be reflected upon. Hence, additional study is suggested.

This study was conclusively positive and provides information about the potential of this alternative approach in teaching of science concepts in public primary schools. The advantages derived from the study about this learning approach are the ability to integrate technology in teaching and learning while enhancing the 21st century skills which are critical thinking and problem solving, communication and collaboration, imagination and creativity. These benefits of flipped learning could perhaps increase teacher efficacy in delivering science concepts and thus influencing pupils' science mean scores and ultimately their future.

In the traditional classroom, science teachers are usually confined to a "one-size-fits-all" curriculum. Therefore, there has been a push by the government of Kenya to integrate digital technologies in the public primary schools. With the emerging immergences like the Covid-19 pandemic and the need to maintain the education standards, educators have no options left other than to incorporate alternative teaching and learning approaches to meet these demands.

Flipped learning had its fair share of challenges which could affect its continued implementation in the public primary schools. This was manifested by lack of power extension in the classrooms, lack of technological knowledge among teachers, inadequate supplementary text books, unimplemented ICT policies and lack of IT infrastructure like internet data in the schools.

From the preceding presentation of the findings, it can be concluded that:

1) Use of educational videos improved pupils' science mean scores. Educational videos also promoted critical thinking and problem solving, communication and collaboration and enhanced imagination and creativity.

2) Despite dismal text book availability, use of out-of-class text reading elicited improved academic achievement on pupils' science mean scores. This is because pupils were not limited to only one source of knowledge.
3) Use of educational videos and out-of-class text reading triggered improved pupils' science mean scores. It allowed more classroom time for pupils to engage in learning activities outside the class as opposed to face to face classroom time in traditional classroom.
4) On the effect of blended learning, pupils' science mean scores had significantly improved. It was viewed to be a more effective learning method due to the many accrued benefits from integrating traditional learning with tablets learning and online activities which helped pupils acquire understanding and insight of science content.

5.4 Recommendations

There is need for the government through the Ministry of Education to implement the ICT policy all the way to the schools and roll out an alternative teaching approach that envisages integration of digital technology such as the flipped learning approach. Additionally, adequately equip the schools' libraries with variety of supplementary books in order to alleviate the widening pupils' book sharing ratio in the sciences. This will encourage heavy reading and proficiency eventually increasing the science mean scores. Through the Teachers' Service Commission, the government should organize training courses/capacity building especially on pedagogical-technological knowledge to facilitate use of DLP tablets for flipped learning in the teaching and learning of science topics.

The school through its BOM should mobilize power connection to all classrooms, acquire IT resources such as printers, flash disks, projectors and installation of internet connectivity. The school should ensure their computers, tablets, sockets in the class

are well maintained and operational. The head teacher should create a collaborative time for teachers to work together to plan and create digital content as part of their mentorship role and implementation of the science curriculum in schools. The monitoring of the implementation of curriculum may entail head teachers modelling flip learning in staff meetings as a sensitization exercise or sending teachers to workshop or conferences, or by bringing in trainers or experts for staff development.

Science teachers should be encouraged to attend seminars or go for refresher courses in order to gain more technological-pedagogical knowledge on alternative teaching and learning methods.

Science teachers should consider implementing at least some facets of the flipped classroom as a differentiation tactic.

5.5 Suggestions for Further Research

i. A study on the effects of flipped learning in different subjects other than sciences in public primary schools and learners' achievement in national examinations.
ii. A comparative study on the effects of flipped learning program among learners of different school categorization such as gender, type of school or geographical location.
iii. Studies on the effect of using educational videos to teach science subject topics in the lower primary classes.

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APPENDICES

Appendix I: Permission Form

PERMISSION FORM:

Sub-County Director of Education

September 3rd 2019

Dear Director,
I am a student in the Department of Education Communication and Technology of the University of Nairobi conducting research as part of the requirements for a Master of Education Technology. My research project is *"*effect of flipped learning facets on primary school pupils' academic achievement in science in Abothuguchi Central Division, Meru County*"*. The purpose of this research is to evaluate the effect of flipped learning on pupil academic performance. My request is for your facilitation to conduct this study in Abothuguchi Central Division public primary schools. It will be quasi-experimental in nature and expected to take about eight weeks. Data will be collected and will involve a learner pre-test and post-test.

Respondents will participate in this study by either being in the control group or by implementing the flipped instruction. The flipped classroom teacher will be asked to "flip" the classroom by allowing students to complete classwork at home (via teacher made educational videos, out-of-class text reading, educational videos and out-of-class text reading and a blend learning) and return to the next class period to further discuss these concepts, complete homework, or extend learning through further investigation or application problems. The researcher will be the sole individual involved in data collection.

The data collected will be used to addresses pupils' deficiencies in primary school science subjects and investigate whether this alternative learning will encourage pupil academic performance in science.
Taking part in this study is voluntary, and participants are welcome to discontinue participation at any time.

Thank you for considering my request.

Sincerely,

Kithinji, Alfred Mutethia
Med Technology Student.

Appendix II: Science Teachers Questionnaire

Introduction

This questionnaire seeks for information on effect of flipped learning facets on pupils' academic achievement in science in public primary schools. All the information given will be treated confidentially and for academic purposes only. It is divided into three parts: Part A deals with background information, Part B: Implementation of science curriculum C: Methods for teaching and their relevance. Please respond to all parts by putting a tick (√) against the statement appropriately.

Part A: Background Information

1. What is your gender? Male [ ] Female [ ]

Part B: Implementation of science curriculum

i) What is your professional qualification?

P2 □ P1 □ B-ed. □ Masters □ □ Others (Specify)

ii) How long have you been in this school? Indicate below.

iii) Do you have any technological knowledge on use of ICT resources?

□ YES □ NO

iv) Which of the following science books publications do you use in your class?

K.I.E □, J.K.F □, Moran □, Longman □, EAEP □, K.L.B □, Longhorn □, OUP □..

v) What is the pupil book sharing ratio in your class?

1:1 □ 1:2 □ 1:3 □ 1:4 and above □

vi) Which of the following resources do you have in your school?

Supplementary Science Books □ Science Kit □ Conventional Charts □ Simple Apparatus □ Computer Lab □

Part C: Methods for teaching Science and their Relevance

i) What do you say was your previous commonly used method of teaching science?

_____

_____

ii) In relation to the new approach of teaching science, how would you describe your class experience with using educational videos? _____

_____

_____

iii) In relation to the new approach of teaching science, how would you describe your class experience with out-of-class text reading?

_____

_____

_____

iv) In relation to the new approach of teaching science, how would you describe your class experience with videos and out-of-class text reading? _____

_____

_____

v) In relation to the new approach of teaching science, how would you describe your class experience with videos, out-of-class text reading and face to face learning (blended learning)?_____
_____
_____

vi) How would you describe your pupils' science ability this term?
_____
_____

vii) (a) What challenges did you face while integrating the new teaching methods?
_____
_____

(b) (**If any)** how did you overcome these challenges?
_____
_____

viii) What are your recommendations on the best approaches to improve this teaching approach (flipped learning) based on its practises? (Educational videos, out-of-class-text reading and blended learning)
_____
_____
_____

Appendix III: Interview Schedule for the Head Teacher

'EFFECT OF FLIPPED LEARNING ON ACADEMIC ACHIEVEMENT OF PUPILS IN SCIENCE IN ABOTHUGUCHI CENTRAL DIVISION, MERU COUNTY'.

Introduction to the research or evaluation

My name is Alfred Mutethia, a student from University of Nairobi and I intend to carry out a research in your institution which is part of my exam. As part of the research, I am carrying out face-to-face interview with you as the administrator of the school. The information I gather today will be used to help write the research report which will be used for improving practice in the teaching of science. Please be assured that no teacher or pupils will be named in my report and nothing will be linked back to the interviewee. Therefore, data collected will be treated as confidential.

— The interview should take around 30 minutes.

— Are you happy to take part in the interview today? You are free to withdraw from the interview at any point if you wish to.

— Do you have any questions before we start?

— Just to help me with my notes is it okay to record our conversation?

Questions

Background

1. Please can you briefly outline your job role and responsibilities?

2. How long have you been in your current role?

3. How long have you been involved in the flipped learning programme?

4. What has your experience of flipped learning programme been?

Staff reactions/training and support

5. How has flipped learning programme been received amongst staff?

6. What training/support, if any, have staff received to implement the flipped learning programme?

Benefits and challenges

8. What are the benefits of *flipped learning programme*?

9. What are the challenges of *flipped learning programme*?

Suggested improvements and further developments

10. How, if at all, do you think *flipped learning programme* could be improved?

11. How, if at all, do you see the *flipped learning programme* developing in the future?

12. Would you recommend the *flipped learning programme* to other local Schools?

13. What advice do you have for other local authorities who are looking at implementing *flipped learning programme*?

— Do you have any questions or would you like to add anything else to your responses?

— Thank you very much for participating in this research. I will let you know the outcome of this study once the report is out.

Appendix IV: Questionnaire for Class Seven Pupils

The information given will be treated with utmost confidentiality. However, the usefulness of the information is highly dependent on your honesty.

Part I – personal background

1. Sex (Please tick √) [Male] [Female]

Part II – Effect of using educational video in flipped among the pupils

In the table below, tick {√} in the appropriate column to show your opinion towards the following statements.

SN	**Please provide your most genuine response to the following statements**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	I like lessons with videos.					
2	Educational Videos makes the science lesson livelier.					
3	Educational Videos can help me to acquire understanding					
4	Educational Videos enables me remember things for a short time.					
5	Educational Videos enables me remember things for a long time.					
6	Educational Videos can help me to reason better.					
7	Pupils don't remember what they learnt while using educational video when they move on to paper-and-pen tasks.					
8	Through the use of Educational Video, I learn to communicate about science.					
9	Teachers don't have enough time to use Educational Video in their teaching.					
10	The mixture of Educational Video with other teaching methods is good.					
11	Using Educational Video gives me means to build whole class discussions on the pupils' ideas.					
12	The use of Educational Video creates ideas and experiences, which you can discuss with the students.					

Please tick (√) where applicable

13. How were your science lessons last term (routines, procedures, homework, notes, etc).
    Boring □ Lively □ Collaborative □ Less involving □

14. How are your science lessons this term (routines, procedures, homework, notes, etc).
    Boring □ Collaborative □ Lively □ Less involving □

15. How was your effort in science subject last term?
    Weak □ Hard working □ Moderate □

16. How is your effort in science subject this term?
    Hard working □ Weak □ Moderate □

17. How is your science achievement this term?
    Very Good □ Good □ Average □ Poor □

18. **[For students in the flipped classroom]** Do you watch science educational videos for homework?
    YES □ NO □

    If YES, what do you like about them?
    Enhances critical thinking □ Collaborative □ Promotes creativity and Imagination □

    If NO, why don't you like them?
    Boring □ Distracts my attention □ Time consuming □ Less educative □

19. **[For students in the traditional classroom]** What kind of homework is usually assigned in your class?
    Class exercises □ No homework is assigned □ Out-of-class text reading □

20. How does the organisation of this term's classroom help you in learning the science content?
    Promotes Communication and Collaboration □ Promotes Critical Thinking and Problem Solving □ Enhances Imagination and Creativity □ Promotes Self Efficacy □

21. Which among the following would be your preferred mode of learning that helps grasp most of the science concepts?
    Educational videos □ blended learning □ traditional learning □ out-of-class text reading □

Appendix VI: Standard Achievement Test

Topic: Properties of Matter

PART A: Dissolving solids in water

1. Which **ONE** of the following is a solute in water?
   A. Sand
   B. Salt
   C. Chalk
   D. Ashes

2. When a substance dissolves in a solvent, it forms a:
   A. Residue
   B. Filtrate
   C. Solution
   D. Solute

3. Water is a:
   A. Solution
   B. Solute
   C. Solvent
   D. Residue

4. Matter is any substance that has:
   A. Weight and occupies space
   B. Weight and has no space
   C. Air and water
   D. Weight and solid

5. Which of the following statements is **INCORRECT**?
   A. All solids dissolve in water
   B. The ability of a substance to dissolve in water is called solubility
   C. Sand is insoluble in water
   D. The tape in record cassette is magnetic

PART B: Mixing liquids

1. Which **ONE** of the following pairs of substances **CANNOT** make a uniform mixture?
   A. Paraffin and water
   B. Water and milk
   C. Sand and salt
   D. Beans and maize

2. Which **ONE** of the following pairs of liquids are miscible?
   A. Milk and cooking oil
   B. Milk and water
   C. Paraffin and water
   D. Paraffin and ink

3. Liquids that do not mix are called:
   A. Miscible liquids
   B. Immiscible liquids
   C. Solutions
   D. Filtrate

4. We say liquids are miscible when they:
   A. Mix completely
   B. Mix partially
   C. Do not mix
   D. Mix for some time

5. Which one of the following pairs consist of immiscible liquids?
   A. Water and methylated spirit C. Water and Kerosene
   B. Cooking oil and turpentine D. Petrol and kerosene

PARTC: Magnetic and Non-Magnetic Materials

1. Which **ONE** of the following materials is magnetic?
   A. Copper wire
   B. Aluminium *sufuria*
   C. Iron nail
   D. Zinc metal

2. In which of the following mixtures can the solids be separated by use of a magnet?
   A. Rice and husks
   B. Iron filings and flour
   C. Flour and copper turnings
   D. Zinc and copper turnings

3. Magnetic materials are those that:
   A. Have magnets
   B. Attract things
   C. Are attracted by a magnet
   D. Are not attracted by a magnet

4. Which **ONE** of the following materials is **NOT** magnetic?
   A. Aluminium
   B. Cobalt
   C. Iron
   D. Nickel

5. Which of the following list consists of non-magnetic materials only?
   A. Iron, aluminium, carbon C. Aluminium, copper, glass
   B. Iron, cobalt, nickel D. Zinc, nickel, copper

PART D: Separating Mixtures

1. As Brian was cooking *ugali*, he accidentally mixed salt, water and maize flour. Which of the following methods could he use to recover the salt only?
   A. Evaporating and then filtering
   B. Filtering and the evaporating
   C. Sieving and the decanting
   D. Decanting and then evaporating

2. Which **ONE** of the following is the best method of separating a mixture of water and soil?
   A. Sieving using a piece of cloth
   B. Decanting and filtering
   C. Filtering and evaporation
   D. Sieving and decanting

3. Which ONE of the following mixtures can be separated using a magnet?
   A. Flour and copper
   B. Flour and iron fillings
   C. Flour and salt
   D. Flour and husks

4. Which **ONE** of the following represents the correct order of processes to separate a mixture of salt and sand?
   A. Add water to the mixture, decant, stir, filter
   B. Add water to the mixture, stir, filter, decant
   C. Filter, evaporate, decant
   D. Add water, stir, filter, evaporate

5 Rice and wheat flour can be separated by:
   A. Winnowing
   B. Sieving
   C. Using magnets
   D. Picking

Appendix V: Observation Schedule

	Items	Inadequate	Adequate	Satisfactory
1	**Instructional Materials/Equipment** - Apparatus - Textbooks - Chalkboards - Chalk/Dusters/Pens/Exercise Books - Desks - Library - Computer lab - Science kit			
2	**Physical Facilities** - Compound - Fencing - Building and rooms - Boys Latrines/Toilets - Girls Latrines/Toilets - Administrative offices - Lockable doors/windows			
3	**Staff Furniture** - Chairs - Lockers/Cabinets			
4	**Learning Areas** - Nature/science corner - Farms model - Shop model - Wall displays			
5	**Professional documents** Schemes of work Progressive record Record of work Lesson plan Pupils Register			
6	**Lesson in progress** Video integrated lesson enthusiasm Blended lesson resourcefulness Out-of-class-text reading class effort Collaboration Class discussion Question and answer			

Appendix VII: Research Permit

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

RESEARCH LICENSE

This is to Certify that Mr.. Alfred Kithinji of University of Nairobi, has been licensed to conduct research in Meru on the topic: EFFECT OF FLIPPED LEARNING ON PRIMARY SCHOOL PUPILS' ACADEMIC ACHIEVEMENT IN SCIENCE IN ABOTHUGUCHI CENTRAL DIVISION, MERU COUNTY for the period ending : 20/August/2020.

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