Influence of Strengthening Mathematics and Sciences in Secondary Education In-Service Training on students' academic achievement in physics in Merti Sub-county, Kenya

By

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A research project submitted in partial fulfillment of the requirements for the award of the degree of Master of Education in (Physics education) of the Department of Educational Communication, Technology and Pedagogical Studies, University of Nairobi.

DECLARATION

I declare that this research project is my original work and has not been submitted to any university for examination or for any other award.

Kelvin Gwiyanga Misoga

Reg No: E60/37410/2020

This project has been submitted for examination with our approval as university supervisors.

SIGNED  11th NOVEMBER 2023

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DEDICATION

This project is dedicated to my daughter Adriella Tracy and my son Amani Isaac Gwiyanga.

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I wish to pass my sincere gratitude to almighty God for giving me the ability to carry out the research in good health. I acknowledge my supervisor Dr. Evanson Muriithi for guiding me in writing this research project. I appreciate my lovely wife Ridah Ahuga for great encouragement and emotional support during the process of writing this research.

LIST OF ABREVIATIONS

ASEI: Activity, Student, Experiment, Improvisation

CEMASTEA: Centre for Mathematics, Science and Technology Education in Africa

IBL: Inquiry Based Learning

ICT: Information Communication Technology

INSET: In-service Education Training

JICA: Japan International Corporation Agency

KCSE: Kenya Certificate of Secondary Education

MOEST: Ministry of Education Science and Technology

PCK: Pedagogical Content Knowledge

PhET: Physics education technology

PTQ: Physics Teachers Questionnaire

SMASSE: Strengthening of Mathematics and Sciences in Secondary Education

SQ: Students Questionnaire

TPD: Teacher Professional Development

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ABSTRACT

This study sought to determine how SMASSE INSET influenced students academic achievement in Physics in Merti subcounty, Kenya. The objectives included : to determine the influence of the useIBL approach taught in SMASSE on students academic achievement in physics, to determine the influence of the use of ICT integration as taught by SMASSE on students academic achievement in physics, to determine the influence of the use of peer support on on students academic achievement in physics and to determine the influence of the use of subject content taught in SMASSE on students academic achievement in physics.The study employed descriptive survey research design and targeted two(2) SMASSE trainers, 8 physics teachers and 170 physics students. The research used simple random sampling in selecting the 170 students from the sampled schools. The data was analysed using descriptive and inferential statistics which included frequencies, correlation and regression analysis. The findings of the study indicated IBL approach positively influenced academic performance. The study found out that learner centered activities contributes to effective teaching. Learner critical thinking skills, activeness in class, retention and understanding of science concepts can be achieved using the IBL approach. Students group activities enhance learner participation in class. The study further established that the use of ICT tools like PowerPoint presentation makes learners attentive in class, performing of experiments using virtual laboratories is time saving and PhET Colorado virtual laboratory helps in explaining complex concepts in physics. The study further found out that schools in Merti sub-county have inadequate laboratory equipment hence the integration of ICT in teaching positively influences academic performance in physics. The study found out that physics teachers in Merti sub-county collaborates with each other and always allow learners to collaborate with each other Furthermore, the study established that teacher's quality of teaching in Merti subcounty improves termly, they have new pedagogies of handling challenging physics concepts and good mastery of subject content improves teacher's confidence in teaching which enhances syllabus coverage without any challenges. The study also found out that physics teachers in Merti sub-county have innovative ways of doing practical work in physics. The study recommended tha the ministry of education and the school board of management should provide adequate ICT infrastructure to enhance learner's digital literacy skills. The CEMASTEA taskforce should monitor teachers trained in the SMASSE INSET at school level in order to assess the effectiveness of the Programme. The ministry of education and CEMASTEA should increase the frequency of physics teachers SMASSE INSET to enhance positive results of the schools. The researcher recommended a similar study in other areas to establish the case in the regions.

CHAPTER ONE

1.0 Introduction

This section contains the background of the study, the purpose of the study, objectives of the study, research questions and significance of the study. It later focuses on limitation and delimitation of the study, assumptions of the study and operational definition of terms used in study. It concludes by the organization of the study.

1.1 Background of the study

In-service training, also known as professional development, can have a positive impact on teachers by providing them with the knowledge, skills, and support they need to improve their teaching practices and better support their students. Bayrakcı (2009) highlights that teacher in-service training can help teachers stay up-to-date with the latest teaching methods and curriculum developments, and can also provide them with the opportunity to collaborate with their colleagues and share best practices. According to Harris & Sass (2011) teacher's in-service training plays a very significant role in both teachers' professional development and learners' academic achievement. Most educational institutions both Public and private focus on teacher's professional gaps. They address the gaps through teacher in-service training from specified professional bodies. These trainings have a direct impact on teacher's pedagogical abilities and learner's academic achievement especially in secondary schools. Various studies show a strong relationship between teacher in-service training and leaner academic improvement (Junejo, Sarwar, & Ahmed, 2018)

Poor academic achievement is contributed by various factors which mostly are teacher or learner related. According to a Strengthening Mathematics and Science in Secondary education

(SMASSE) piloting Programme study of 1998 on causes of poor performance in mathematics and sciences in Kenya, the study reveals that poor teachers, learners and stakeholders' attitude, inappropriate teaching approaches and poor teachers' mastery of content are the major causes (MoEST, 1998). A report by Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) on teacher professional development highlights various remedies that could improve learners' academic performance in sciences and mathematics. Some of the remedies include; using new teaching approaches like Inquiry based approach, using Information Communication Technology tools in teaching like virtual laboratories, enhancement of teacher mastery of content, peer teaching, among others (CEMASTEA, 2021).

The Inquiry Based Learning approach (IBL) is a very significant approach in teaching and learning of Mathematics and science subjects. This approach offers the learners an opportunity to own the learning process by adopting the 5E instructional model which incorporates engagement, exploration, explanation, elaboration and evaluation activities. A study done by Aparicio-Ting, Slater, & Kurz (2019) on IBL as a key element of curriculum implementation proves that the approach develops learners' high order thinking skills which are essential in learner's innovation, critical thinking, research skills and creativity. Another research conducted by Romero-Ariza, Quesada, Abril, Sorensen, & Oliver (2020) on teachers' view on IBL found out that teachers who use IBL approach in the classroom develop learners' scientific literacy skills which contributes to learner academic achievement in sciences. However, most teachers avoid full implementation of the approach because of various reasons like lack of adequate knowledge on the approach.

Another contributor to learner academic achievement is the Information Communication Technology (ICT) integration in teaching and learning of physics. Aslan & Zhu (2018) carried

out a research on integration of ICT in lower secondary; the study reveals that ICT integration in teaching is very significant to teachers' effectiveness and learner's level of understanding. The study also recommends that the teachers should be given an opportunity to access variety of ICT resources to enhance their effectiveness in teaching abstract concepts.

Peer support is also another strategy of teaching which contributes significantly to the academic achievement of learners. Ukhra et al., (2020) defines peer support as a teaching strategy where instructors or students collaborate with each other in teaching and learning process by sharing new knowledge according to their area of expertise. This strategy involves cooperative teaching and learning through facilitation, instruction and leadership which forms a community of practice. The collaboration of teachers and learners enhances the acquisition of 21st century skills in the learning process impacting the learner's academic achievement and attitude towards sciences (CEMASTEA, 2021).

Lastly, teachers' mastery of content is also among the factors that influence academic achievement in physics. Various studies show that teachers' mastery of content strongly affects learners' academic performance. Langat (2018) in his research on teacher's factors that influence academic achievement of students in physics highlights teachers' mastery of content as a factor. Teachers who have better mastery of content have confidence in teaching; they are likely to produce better results than those with less mastery of content (Langat, 2018). This calls for more in-service trainings which addresses the gap of teacher's mastery of content.

1.2 Statement of the problem

The economic, political and social development of a nation depends on the quality of the education system (Krueger & Lindahl, 2001). Many researches reveal that the quality of education significantly impacts economic growth than quantity of schooling. In 1998, SMASSE

project was established by the government with the aim of improving the performance of mathematics and science subjects through teacher in-service training (Miyoshi, 2006). Their main goal was to capacity build the science and mathematics teachers with better classroom practices which could enhance learner academic achievement. The project also aims to improve teaching methodologies among the science and mathematics teachers across the country. Currently, the Ministry of education through CEMASTEA has established SMASSE INSET centers in every county to provide training for all the teachers including those from Arid and Semi-Arid Lands (ASAL). In Kenya, the ministry of education also allocates SMASSE project funds from the government capitation programme of free secondary school to cover for training costs at county level. This has enhanced the sustainability and implementation of the project across the country.

Despite the efforts put in place by the SMASSE taskforce to improve academic achievement in mathematics and science subjects, there has been very little impact on the students' performance over the years. According to Merti sub-County DQASO report of (2022), the performance of physics which is low as compared to the other two sub counties.

Table 1.0 Isiolo county physics performance

Sub-county/ Year	**2020**	**2021**	**2022**
Isiolo central	4.54	4.78	5.34
Garbatulla	4.24	4.38	4.79
Merti	3.98	4.20	4.51

Source: Isiolo County Director, Ministry of Education

The teachers from Merti Sub County are trained at Isiolo boys which is the only Isiolo county INSET centre. The attendance of teachers from Merti Sub County has been increasing

every year and yet there is very little significant improvement in physics (Merti sub-County DQASO report of 2022). Other researchers have been done in the sub county on students' academic performance but no research has been done to ascertain the influence of the SMASSE in-service training on students' academic achievement. There was therefore need to determine the influence of SMASSE INSET on students' academic achievement in physics in Merti sub county, Kenya. This study therefore sought to assess the influence of SMASSE in-service training on the academic achievement in Physics.

1.3 Purpose of the Study

The purpose of the study was to assess the influence of Strengthening Mathematics and Sciences in Secondary Education In-Service Training on students' academic achievement in physics in Merti Sub-county, Kenya.

1.4 Research Objectives

The study was guided by the following objectives:

1. Determine the influence of the use of the Inquiry Based Learning approach covered in SMASSE INSET on students' achievement in Physics.
2. Determine the influence of the use of ICT integration taught in SMASSE INSET on students' academic achievement in physics.
3. Determine how the use of peer support covered in SMASSE INSET affects students' academic achievement in physics.
4. To determine the influence of the use of subject content covered in SMASSE INSET on students' academic achievement in physics.

1.5 Research Questions

The research questions for the study were:

1. How does IBL approach covered in SMASSE INSET affect students' academic achievement in physics?
2. To what extent do ICT integration taught in SMASSE INSET affect students' academic achievement in physics?
3. How does peer support covered in SMASSE INSET influence students' academic achievement in physics?
4. How does subject content covered in SMASSE INSET affect students' academic achievement in physics?

1.6 Significance of the study

The findings of this study are expected to be used by the TSC Teacher Professional Development and CEMASTEA task-force in finding out better approaches to be used in in-service training, developing new mechanisms of assessing the influence of the INSET on teachers and also promoting accountability among the teachers. The study will also impact policy and decision makers on improving the competency of secondary school physics teachers in the teaching fraternity. Lastly, this study will help provide room for other researchers to conduct further research on how to make secondary school physics teachers to continually update knowledge and skills in this changing world.

1.7 Limitations of the study

The study was limited by factors such as teacher's workload. Most of the teachers in Merti sub-county have high number of lessons per week due to shortage of physics teachers in the sub-

county. Due to this high workload, some teachers were in a hurry to fill the questionnaire within their limited time.

1.8 Delimitations of the Study

The study only focused on influence of SMASSE INSET on students' academic achievement in Physics in secondary schools in Merti Sub County alone. Only two SMASSE trainers, physics teachers and physics students from Merti subcounty schools were involved in data collection. However, the study did not focus on other sub counties in the country due to limited time and resources.

1.9 Assumptions of the study

The study was guided by the following assumptions

i. The sampled schools had adequate teaching and learning materials.
ii. Schools in Merti Sub-county had adequate number of physics teachers under investigation.
iii. SMASSE INSET in the target schools influence student's academic achievement in physics
iv. That the school principals would allow the study to be conducted in their schools.
v. That the respondents would cooperate to give factual information on the influence of SMASSE INSET on academic achievement in physics.

1.10 Operation Definition of Terms

Influence: the impact exerted on an object which leads to a change in its properties.

Learning: Is a process of acquiring knowledge, skills and attitudes that are useful in life.

Peer support: Is a way teachers or learners collaborate with each other inside or outside the school environment with the aim of helping each other in specific content areas

Secondary school: An institution of learning that offers four years of formal schooling preceding university education. The education offered at this level is based on the four-year curriculum which is broad based and builds on concepts, principles, skills and attitudes established at the primary level.

1.11 Organization of the Study

This study was organized into five chapters. The first chapter covers background to the study, statement of the problem, purpose of the study, limitations of the study, delimitation of the study, assumptions of the study and operational definitions of significant terms. The second section is the literature review with the following sub-themes drawn from the objectives: IBL approach, ICT integration, peer support and subject content as covered by SMASSE INSET.

This is followed by summary and research gap of the literature review, theoretical framework and conceptual framework. The third section is the research methodology which covers research design, target population, sampling size and sampling procedures, research instruments for data collection, validity and reliability of the instruments, data collection procedures, data analysis and ethical consideration.

CHAPTER TWO

2.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

In this section, there was a general literature review of different studies relating to SMASSE in-service training. The review encompasses both international and local research studies which contribute to my research topic. However, the main objective of literature review was to identify various gaps and propose further studies which aim in improving physics academic achievement. Consequently, the study sought to assess the influence of SMASSE in-service training on students' academic achievement in physics.

2.2 Inquiry Based Learning Approach and Student Academic Achievement in Physics

The Inquiry-Based Learning (IBL) approach, which is a student-centered, investigative approach to learning, can have a positive impact on academic achievement in physics. IBL is based on the idea that students learn best when they are actively engaged in the learning process, and when they are given the opportunity to explore and discover concepts on their own. CEMASTEA (2021) elaborates that in IBL physics classroom, students are typically presented with an open-ended problem or question, and are then encouraged to work collaboratively to design and conduct experiments, collect and analyze data, and develop their own explanations and solutions. This approach helps students develop important skills, such as critical thinking, problem-solving, and communication, which are essential for success in physics and other STEM fields. Additionally, IBL provides students with a deeper understanding of physics concepts leading to improvement in learner academic achievement.

Various studies have been carried out on the influence of Inquiry based learning approach both nationally and internationally with most findings showing its influence on the learning. A study carried out in Turkey on 90 6th grade learners by Duran & Dökme (2016) on the effect of IBL approach on learners critical thinking skills found out that development of learner's activities using the IBL approach significantly affects learners critical thinking skills in learning of Science and technology. This finding agrees with another study carried out in University of Hawaii School of Nursing, United States of America by Magnussen, Ishida & Itano (2000). The study aimed in determining if IBL approach enhances critical thinking of the students by using patient problems. By grouping 228 and 257 first and final semester students respectively into stratified groups, the learners in the lower group had a significant increase in mean score as compared to those in the higher group which had a significant drop in mean score. The study therefore concludes that exposing learners to IBL approach develops learner critical thinking skills which increase their ability to solve complex problems (Magnussen, Ishida & Itano, 2000). Wale & Bishaw (2020) suggests that IBL model should be highly embraced by instructors due to its ability to increase learner's critical thinking skills. Their study which implored a quasi-experimental design concludes that IBL approach enhances learner's interpretation, analysis, evaluation, inferences, explanations, which are core critical thinking skills (Wale & Bishaw, 2020)

IBL approach promotes student's activeness in the classroom during learning. A study carried out in Indonesia by Husni (2020) on the effect of IBL approach on learning activities in religious subjects concludes that IBL approach increases learner's activeness during the teaching and learning process. The study used an experimental research design with pretest and posttest

control groups. The groups which were exposed to IBL approach became very responsive, enthusiastic, inquisitive, and discovered new knowledge (Husni, 2020)

In Nigeria, a research carried out by Enebechi (2021) highlights the significance of the IBL approach over other conventional approaches. The findings of the study show that the IBL approach increases students' retention and understanding of science concepts. These studies summarize that the IBL approach is effective in teaching science and mathematics subjects. Effective implementation of this approach has a significant impact on the academic performance of learners especially in physics subjects. However, this approach needs to be infused with other teaching approaches for effectiveness.

In Kenya, a study carried out by Nzomo, Rugano, Njoroge, & Gitonga (2023) shows a strong positive correlation ($r = 0.903$) between IBL and learner academic achievement in Chemistry. The findings of this study agree with Kunga (2021) which found out that inquiry-based learning approach is effective in improving leaners academic achievement in physics. Another study done on Nyeri by Njoroge, Changeiywo & Ndirangu (2014) found out that IBL teaching improves motivation and academic achievement of physics students.

2.3 ICT Integration and student academic achievement in physics

The use of information and communication technology (ICT) tools, such as computers, tablets, and interactive whiteboards, in physics education can have a positive impact on academic achievement. ICT tools can provide a variety of benefits to students, such as increased engagement and motivation, improved collaboration and communication skills, and enhanced problem-solving and critical thinking skills (Huang, Silitonga & Wu, 2022). ICT tools can also provide students with access to a wide range of learning resources and virtual simulations, which

can help them better, understand complex concepts in physics. The use of ICT tools can help teachers effectively integrate technology into their teaching practices, and can provide them with new ways to assess student learning and progress.

ICT is the greatest contributor to the 21st century skill of digital literacy. In the field of education, ICT skills are important for the teachers and if well utilized it can lead to improve learners' performance in teaching. In Nepal, the government is putting a lot of efforts in developing teacher's ICT competences so as to curb the traditional teacher centered approaches to learner centered approaches using various ICT related infrastructures. A study done by in Nepal by Rana & Rana (2020) show that the evolution of ICT tools has significantly impacted the traditional teacher centered approaches with a large percentage of teachers embracing the use of ICT tools in content delivery. However, a study done in Malaysia by Kamaruddin, Abdullah, Idris, & Nawi (2017) reveals that ICT integration in teaching by teachers is below average where very few teachers have the necessary ICT skills which are significant in teaching. The study also reveals that most old teachers have difficulties adapting to this change as compared to the young teachers. According to Kamaruddin, Abdullah, Idris, & Nawi (2017) over 30% of teachers in Malaysia are aware of the ICT integration in teaching with only about 10% implementing ICT integration in schools. A study carried out in by Bariu (2020) reveals that the Kenyan government under the ministry of education emphasizes the use of ICT infrastructure by teachers in teaching. However access to the ICT infrastructure is still a challenge in many schools in Kenyan schools. A research carried out in Isiolo Merti Sub- County, Kenya by Muchui, Ngaruiya, Ganira, & Kinyua (2022) reveals that only 8.9 % of teachers actively participate in the digital literacy programme by the government. The study recommends the Kenyan ministry of

education to build more functional ICT infrastructure which should be equipped with skilled taskforce to enhance its effectiveness in every school.

Physics is a science subject whose concepts require experimental treatment for easier understanding. However, the introduction of some ICT infrastructure like computers, screens, projector, and audio devices, among others is essential in teaching physics. For instance, software like virtual laboratories is overcoming the challenges of inadequate school physical laboratories (Ugwuanyi, Ezenwa-Nebife, Gana, Ene, Oguguo, & Agah, 2019). The virtual software is able to perform an experiment virtually with very accurate results. Virtual laboratories software like Physics educational technology (PhET) interactive simulation that contributes to learners' performance in physics especially in schools which have inadequate laboratory apparatus. According to Batuyong & Antonio (2018) PhET simulations are very effective in teaching complex concepts in physics like production of X-rays, waves, among others. The simulations have high validity and accuracy in teaching hence improving learners' understanding of concepts (Batuyong & Antonio, 2018). A study done in Morocco which involved 114 physics and chemistry teachers, conclude that the use of interactive simulations like PhET Colorado simulator enhances learner understanding of scientific concepts and learning activities (Ben Ouahi, Lamri, Hassouni, Ibrahmi, & Mehdi, 2022). Najib, Md-Ali, & Yaacob (2022) supports the idea of virtual laboratories and its impact on academic achievement of learners in science subjects. The study by Najib, Md-Ali, & Yaacob (2022) involved a quasi-experimental design where the group which used PhET simulation in learning had improved academic scores as compared to the groups taught without the PhET simulation. However, the study recommends that teachers should not over rely on the use of virtual laboratories and forget to perform real physical experiments in the laboratories.

A number of studies have found out that Power point presentation as an ICT tool has a significant impact on academic performance by improving learner concentration and participation in the learning process. This is because the Power point presentations are easy to read and break down complex concepts to simple concepts. A study by Ugwuanyi, et al (2019) reveals that power point presentations are very vital in drawing learner concentration especially if designed with attractive features. Power point presentation is very effective when the teacher prepares them prior to the lesson (León & García-Martínez, 2021). However, a study by León & García-Martínez (2021) which employed a quasi-experiment design finds out that learner's access to the PowerPoint slides before the lesson negatively influenced their academic performance, lesson attendance and concentration.

In Tanzania, a study carried out by Manyilizu (2023) on the influence of using virtual laboratories vs hands on experiements in the physical laboratory in Tanzanian schools when performing chemistry practical found out that virtual laboratories are time saving. Another study carried out in Daadab Sub-county Garissa County, Kenya on influence of ICT on learner academic achievement shows a strong positive correlation between instructional methods and academic achievement (Muema, 2018). The study which was carried out in mathematics subject also showed that use of ICT tools like PowerPoint is a determinant to good students' academic achievement. The studies above therefore reveal the great influence that PowerPoint presentations have on learner academic achievement.

2.4 Peer Support and Students' Academic Achievement in Physics

Peer support involves students providing support and guidance to their peers in order to help them learn and succeed. This can have a positive impact on academic achievement in physics (Cowie & Wallace, 2000). According to Fortuna, Solomon & Rivera (2022) Peer support

programmes provides a range of benefits to students, such as increased motivation and engagement, improved social skills and self-esteem, and enhanced learning and retention of information. In a physics classroom, peer support can take many forms, such as peer tutoring, peer mentoring and collaborative learning groups. These activities can help students develop important skills, such as critical thinking, problem-solving, and communication, which are essential for success in physics and other STEM fields. Peer support also provides students with a sense of belonging and community, and can foster a positive learning environment. Ultimately, the use of peer support can lead to improved academic achievement in physics.

According to Carter, Cushing & Kennedy (2009), peer support strategies have a lot of significance on students' academic achievement. The strategies aid students learning, improves students' socialization skills and prepares learners future professional careers. A book entitled "effective peer learning" by Topping, Buchs, Duran & Keer (2017) supports the findings that peer support fosters students' collaboration which results to improvement in their performance. Further study on the importance of peer learning shows that peer support improves learner attitude towards learning through engagement (Mahbuba, 2022). These improved learner attitude towards learning leads to improved academic performance (Ozan & Kıncal, 2018).

Teachers professional peer support is also very vital in learners' academic achievement. A research conducted by Nel (2018) finds out that many teachers are not involved in the peer support programs; these programs are beneficial in updating the teacher's pedagogical content knowledge. The teachers are able to share knowledge though various channels and platforms hence improving their lesson delivery. Good lesson delivery increases learners understanding of concepts taught hence improved academic performance (Awodun, 2020).

Finally, teacher professional peer support groups can be organized in various clusters where the teachers share teaching and learning resources, discuss challenging concepts and come up with better approaches of teaching those concepts. According to CEMASTEA (2021) teachers need to work collaboratively by enhancing learner centered approaches especially in Mathematics and Sciences. Since most of the concepts in physics are abstract, the teachers need to embrace new methods of teaching which incorporates more learner activities than teacher activities (CEMASTEA, 2021). These learner activities should incorporate peer support groups among the learners where one learner helps the other learners in challenging areas.

2.5 Subject Content and Students' Academic Achievement

According to Cheng, Buntting & Jones (2022) subject content of a physics course refers to the specific topics and concepts covered in the physics curriculum; it has a significant impact on academic achievement in physics. Awuor & Okono (2022) postulates that students who are exposed to a high-quality, comprehensive physics curriculum, which covers a wide range of topics and builds upon foundational concepts, are more likely to develop a deep understanding of physics and perform well in their coursework and assessments. On the other hand, students who are not provided with a well-structured, coherent physics curriculum may struggle to grasp the key ideas and principles of the subject, and may have lower academic achievement in physics.

Olasehinde-Williams, Yahaya & Owolabi (2018) defines content knowledge as teachers' knowledge and information in a subject which learner learn. The content knowledge comprises; theories, laws and principles especially in science subjects, concepts and facts which teachers teach in their respective content areas in schools. A study carried out in Canada in mathematics education by Dyment, Chick, Walker, & Macqueen (2018) show that good pedagogical content knowledge contributes to quality teaching and learning in education. A study by Csíkos &

Szitányi (2020) show that teacher's pedagogical content knowledge is significant in learners understanding of concepts. The study further reveals that teachers' who have good mastery of content have extremely high confidence in teaching complex concepts. They easily break complex concepts into simple tasks that learners are able to work on and understand.

According to Abdurrahman, Nurulsari, Maulina, Rahman, Umam, & Jermsittiparsert (2019) physics teachers who undergo teacher development programs which promote mastery of content knowledge produce improved learners scores. This study reveals that many physics teachers avoid teaching some concepts due to lack mastery of content. This adversely affects the academic performance of learners. A study in Zambia show that curriculum development and teachers PCK significantly contributes to the comprehension of physics concepts by the learners (Zulu & Mulenga, 2019). The study recommends the curriculum developers under the ministry of education to come up with TPD program to equip the physics teachers with theoretical and practical skills on how to handle complex concepts (Zulu & Mulenga, 2019). Finally, a study carried out in Kitui County, Kenya by Kunga, Embeywa & Koech (2022) supports the findings that poor mastery of content among teachers is a major contributor to learners' academic achievement.

2.6 Theoretical framework

The theoretical framework will focus on introduction and description of the theory that explains the reason for the existence of the research problem under study. This study will be guided by cognitive constructivist theory by Piaget. The SMASSE in-service training focuses much on student centered approaches that require students to carry out activities like experiments, make observations and explain the observation. This links the SMASSE INSET with the

cognitive constructivist theory which advocates that learners should be allowed to freely interact with surrounding objects for acquisition of knowledge (Fernando & Marikar, 2017)

Cognitive Constructivism or constructivist learning theory supports the idea that learners are able to construct knowledge for themselves (Hein, 1991). Constructivists strongly believe that learners are able to construct their own knowledge from their experiences within their environment. Zahorik (1995) asserts that constructivist theory supports the teaching process by equipping the teachers with strategies that enhance learner development of knowledge based on their personal life experiences.

IBL approach also encourages students to contribute to the learning process by contributing to the knowledge being taught. Hifarianti (2019) finds that the IBL approach becomes more effective when blended with constructivism. This means that, for teaching to become learner centered the learners need to construct their own knowledge relevant to what is being taught.

Peer support programs among learners bases its operation on the constructivist theory as most of the activities require learners to construct their own knowledge. Thomaz & Gilbert (1989) also support the impact of constructivism on physics teacher education. Physics teachers who apply this theory in teaching enhance learners' understanding of concepts which contribute to good performance in physics.

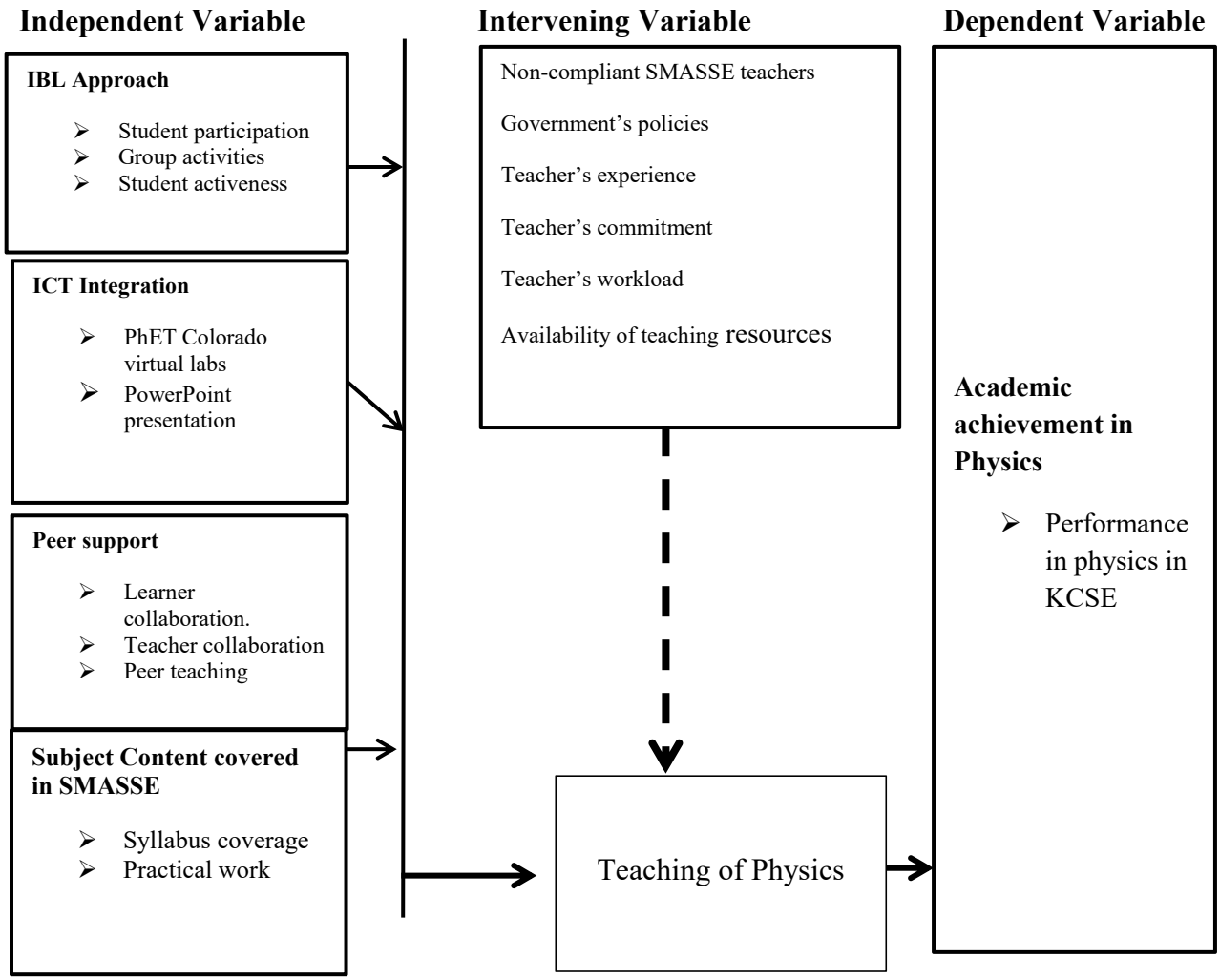
The theory also applies to ICT integration in learning, especially using virtual platforms like using virtual labs in performing experiments. Koç (2005) asserts that ICT enhances learner participation and activeness in the classroom. Use of virtual laboratories in performing physics experiments enhances learners' internal cognitive skills as they interact with the new

technologies which enable them to construct knowledge from past experiences with digital devices.

Lastly, the SMASSE in-service-training focuses much on teachers' mastery of content where the teacher is equipped with better approaches for teaching difficult concepts. According to CEMASTEA (2021), teachers need to help physics learners in developing curiosity towards the concepts in the syllabus. The learners should be guided on how to develop and contribute to the learning process.

2.7 Conceptual Framework

The theoretical framework shows the relationship between independent, dependent and intervening variables. Dependent variables are variables which are affected by other variables e.g. good academic performance, students' positive attitude in physics and learner involvement in Physics. However, independent variables aren't influenced by other variables. Examples are ICT tools, IBL approaches, subject content, and peer support among others. On the other hand, the intervening variables are those which interfere with other variables. They include; Non-compliant SMASSE teachers, Government's policies, Teacher's experience, Teacher's commitment, Teacher's workload, Availability of teaching resources. The variable was controlled to avoid them affecting the dependent variable. For government policies, the study considered teachers who had attended the SMASSE INSET at least 2 years. Those who didn't attend were not considered in the study. Considering teachers experience, the study considered different teaching experience and workload. To control the influence of teaching resources on the dependent variable, schools of different resources ability were selected.



SMASSE INSET is among the best TPD Programme for Mathematics and science teachers in Africa and Japan with most countries implementing it. The spreading of the project has led to establishment of CEMASTEA which coordinates the program in Africa. The main focus of SMASSE is to shift approaches of teaching from teacher centered to learner centered with the aim of improving learner academic achievement. Teachers are the main target of these training hence needs to implement approaches which facilitate learners' involvement.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter consists of appropriate research design for the study, target population, sample size and sampling techniques which represent the population. It highlights the research instruments of the study, their validity, reliability and data analysis techniques. The section ends by highlighting the ethical considerations of the study.

3.2 Research Design

The study used descriptive survey design where questions in a questionnaire were presented to a target population in person. Descriptive survey design was suitable for the study because it provides detailed data from the target population and involves a large population of students and teachers. Sahin & Mete (2021) asserts that descriptive research design involves use of questionnaires and personal interviewing. According to Orodho, (2009) the descriptive design is effective in gathering data on individual's attitudes, opinions and habits on various educational issues. Descriptive design is appropriate for this study because the study aims to describe the subjects under study without altering or affecting them. The design is simple and widely used research design in education. It enables one to gather information on opinions, attitudes and beliefs of the sampled population. It also enables one to employ research instruments such as questionnaires, interview schedule and document analysis for effective data collection and analysis.

3.3. Target population

According to Mugenda & Mugenda (2008) a population is defined as group, objects or individual specifications which have common characteristics. The target population comprises of Principals, SMASSE county Trainers, and SMASSE trained Physics teachers and secondary

school physics students in Merti Sub-County. The Sub-county comprises of 8 (eight) secondary schools; 2(two) of them double streamed and 6(six) single streamed. According to Isiolo County CEMASTEA training programme, the total number of SMASSE trained Physics teachers in Merti Sub-county was 10(ten) by October, 2022. The total population of the students in the Sub-county is 1500.

3.4 Sampling procedure and Sample Size

3.4.1 Sampling procedure

The study used simple random sampling in selection of samples to avoid biasness and provide equality in representation of subgroups in the sample (Olken & Rotem, 1986). 170 students were sampled from the secondary schools in Merti sub-county where 62 students came from two streamed schools and 18 from each of the remaining 6 schools. One physics teacher was sampled from each of the 8 schools. Systematic random sampling was used in obtaining students to participate in the study where learners were chosen from the physics class register. This is because systematic random sampling is very ideal in collection of data where there is very little chance of data manipulation (Etikan & Bala, 2017). In every class under the study, the total number of students will be divided by 10 so that every subject is included in the study. For example, a class of 50 students the 5th, 10th, 15th, 20th, 25th, 30th, 35th, 40th, 45th and 50th subject was included in the study. This sampling procedure ensured that all the students with different intellectual abilities were included in the study.

3.4.2 Sample Size

Sample is a small part of a population which represents a large population (Orodho, 2010). A sample can be used to know a population without studying the whole population. Merti Sub-county has 8 schools, 8 out of 8 schools actively participate in SMASSE INSET programmes. 2 schools are private schools which actively participates in SMASSE programmes. The study

sampled 2 physics county trainers found in the subcounty. The study sampled 8 secondary schools, 2 SMASSE county trainers, 8 physics teachers and 170 form 2, 3 & 4 students.

Category	Target population	Sample Size	Percentage %
SMASSE Trainers	2	2	100
Physics teachers	8	8	100.00
Form 2, 3 & 4	187	170	90.90
Total	**197**	**180**	**91.37**

Table 3.0 Sample size

3.5 Research Instruments

The study adopted one research instrument for collecting data from the SMASSE Trainers, physics teachers and students. The data obtained was significant in achieving the objectives of the study. The instruments included SMASSE County Trainer's Questionnaire (SCT), Physics teachers' questionnaire (PTQ) and students' questionnaire (SQ)

3.5.1 Physics Teachers' Questionnaire

The PTQ were used to collect data from the sampled teachers who attended SMASSE training. The questionnaire collected data on influence of IBL approach as taught by SMASSE on students' academic achievement in physics. The questionnaire gathered information on the variety of ICT tools and their influence on academic performance. It also collected information on influence of SMASSE INSET and peer support on academic performance in physics. Most of the questions in the questionnaire were based on a Likert scale where One (1) was the minimum score for 'Strongly Disagree' and five (5) for the maximum score for 'Strongly Agree'. The PTQ adopted both close ended questions and open-ended questions. Mugenda & Mugenda (2003) asserts that closed ended questions are objective and enhances clarity of response from the teachers while open ended ones allow for independent opinion.

3.5.2 SMASSE County trainer questionnaire

The SMASSE county trainer questionnaire was used to collect data influence of IBL approach as taught by SMASSE on students' academic achievement in physics. The questionnaire gathered information on the variety of ICT tools and their influence on academic performance. It also collected information on influence of SMASSE INSET and peer support on academic performance in physics. Most of the questions in the questionnaire were based on a Likert scale where One (1) was the minimum score for 'Strongly Disagree' and five (5) for the maximum score for 'Strongly Agree'. The SCTQ adopted both close ended questions and open-ended questions. Mugenda & Mugenda (2003) asserts that closed ended questions are objective and enhances clarity of response from the teachers while open ended ones allow for independent opinion.

3.5.3 Students' Questionnaire

The SQ was be used to collect data on influence of IBL approach as taught by SMASSE on students' academic achievement in physics. The questionnaire gathered information on the variety of ICT tools and their influence on academic performance. It also collected information on influence of SMASSE INSET and peer support on academic performance in physics. Most of the questions in the questionnaire were based on a Likert scale where One (1) was the minimum score for 'Strongly Disagree' and five (5) for the maximum score for 'Strongly Agree'. The SQ adopted both close ended questions and open-ended questions. Mugenda & Mugenda (2003) asserts that closed ended questions are objective and enhances clarity of response from the teachers while open ended ones allow for independent opinion.

3.6 Validity and Reliability of Research Instruments

3.6.1 Validity of research instruments

Mugenda & Mugenda (2003) defines validity as the extent to which the data obtained for analysis represents the phenomenon under study. Validity is the accuracy of the collected information which promotes accuracy in making meaningful inferences. One research specialist from the Department of Educational Communication Technology and Pedagogical Studies of University of Nairobi validated the instruments used in data collection. Three secondary school physics teachers and one county physics SMASSE trainer assisted in content validation of the instruments.

3.6.2 Reliability of Research Instruments

Faenkel & Wallen (2000) defines reliability of an instrument as how suitable an instrument is over time (its level of consistency). Piloting of the research instruments was done in the neighboring sub counties of Merti sub-county to estimate their reliability. The main aims of piloting were to identify any challenges that may occur when administering the research instruments and for checking the clarity of items in the instrument. Mugenda & Mugenda (2003) proposes the pilot sample size to be 1% to 10% of the sample size. Therefore, two teachers, one trainer and 10 students were used for piloting. A reliability coefficient was computed using Pearson –product moment correlation coefficient. The following alpha coefficients were obtained. For trainer' questionnaire, the Cronbach alpha was 0.79, for students 0.82 while that for the physics teachers was 0.87. Since these coefficients were above the required threshold of 0.7 according to (Mugenda and Mugenda, 2003), it indicated that the instrument was reliable.

3.7 Data Collection Procedures

The researcher sought research authorization from the National Commission for Science and Technology (NACOSTI), Isiolo County commissioner, Isiolo county Director of Education and Merti sub county director's office to be allowed to visit schools. The questionnaires were self-administered by the researcher to improve the return rate and interview performed with the sampled teachers.

3.8 Data Analysis Techniques

Descriptive and inferential statistics were used in this study. The resultant data was presented in frequencies and percentages, means and standard deviation so as to answer the research questions. SPSS version 20.0 for windows package was utilized in the analysis of the information gathered from the respondents. The data collected was summarized, organized and presented in form of tables.

3.9 Ethical Considerations

During the process of collecting data from the respondents, the researcher ensured privacy and confidentiality of the respondents. The research instruments did not capture the name of the respondents and information provided by the respondents did not reveal the true identity of the person. The researcher ensured the respondents are protected from any form of harm during data collection. The process of data collection was a voluntary process from the respondents and no one was coerced into filling the questionnaires and could opt out without explanation or punishment.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.0 Introduction

This chapter gives a detailed analysis of findings on the influence of Strengthening Mathematics and Sciences in Secondary Education In-Service Training on students' academic achievement in physics in Merti Sub-county, Kenya. This chapter gives empirical evidence with regard to student's academic achievement in Physics with respect to: effect of inquiry-based learning approach, influence of ICT tools, peer support and subject content covered in SMASSE on student's academic achievement in physics in secondary schools in Merti Sub-county, Kenya.

4.2 Response Rate

The researcher administered two (2) questionnaires to SMASSE physics trainers, eight (8) physics teachers and 170 to physics students as show in table 4.1. Out of these, two (2) questionnaires to SMASSE physics trainers, eight (8) physics teachers and 1 to physics students' questionnaires were returned by teachers.

Table 2 Response rate

Respondents	Administered	Returned	% Return rate
Smasse Trainers	2	2	100
Physics teachers	8	8	100
Physics students	170	157	92.35

The return rates were 100% for SMASE physics trainers and physics teachers. The return rate for the physics students in the selected schools was 92.35%. According to Babbie (2010) and Best and Khan (2011), a response rate of 50% was considered adequate, 60% good and above 70% very good. Therefore, the response rate from these respondents was considered to be very good and as such the researcher proceeded to analyze the data as planned.

4.3 Demographic information

The study sought to find out SMASSE Trainers and teachers' gender, age, professional qualification, teaching experience and SMASSE INSET training experience. Teachers load per week, frequency of CAT assessments and SMASSE attendance cycles was also investigated. For the students the study only sought out to find the students class and gender. The information about these parameters is presented in sections 4.3.1 through 4.3.5

4.3.1 Gender of teachers and head teachers

The study sought to find out the SMASSE Trainers and teachers' bio-data by way of gender. Tables 4.2 shows the distribution in terms of gender of SMASSE Trainers, teachers' and students as shown below

Table 4.2 Gender

Category	Gender	Frequency	Percentage (%)
SMASSE Trainers	Male	2	100
	Female	0	0
	Total	**2**	**100**
Physics teachers	Male	6	75
	Female	2	25
	Total		**100**
Students	Male	101	64.3
	Female	56	35.7
	Total	**157**	**100**

According to table 4.2, 100% of the SMASSE county trainers from Merti sub-county are men with no female represented. Majority of physics teachers are men at 75% and only 25% being female. This is contributed to the low number of female physics teachers enrolling for physics subject and hardship challenges experienced in the ASAL subcounty. 64.3% of the student respondents were male while 35.7% being female. The constitution of the republic of Kenya (2010) requires 30% gender rule in all the public representations, this has not been achieved by the SMASSE trainers and physics teachers in the subcounty. However, the student's respondents achieved this 30% gender rule by 35.7% female respondents participating.

4.3.2 Age of the respondents

This study further sought to establish the age distribution of SMASSE Trainers and physics teachers. Analysis of this parameter is as shown in Tables 4.3

Table 4.3: Age of respondents

Table 4.3 Age of the respondents

Years	Trainers Frequency	Percent %	Physics teacher's frequency	Percent %
25-29	0	0	2	25
30-39	1	50	4	50
40-49	1	50	2	25
Above 50	0	0	0	0
Total	**2**	**100**	**8**	**100**

Table 4.3 shows that 50% of the SMASSE Trainers are between 30-39 years of age, the other 50% are between 40-49 age bracket with none being above 50 years. However, 25% of the physics teachers are between 25-29 years of age, 50% between 30-39 years while 25% between 40-49 years of age.

4.3.3 Teaching experience

The study also sought to determine the teaching experience for both the SMASSE trainers and the physics teachers under Teachers Service Commission and in the same institution. The analysis is shown in the table 4.4 below

Table 4.4 Teaching experience

Years	Trainers Frequency	Percent %	Physics teacher's frequency	Percent %
1-5	0	0	3	37.5
6-10	0	0	3	37.5
11-20	2	100	2	25.0
Above 20	0	0	0	0
Total	**2**	**100**	**8**	**100**

According to table 4.4 100% of the SMASSE trainers have a teaching experience of between 11 to 20 years. This shows that they have adequate experience, knowledge and skills to train other physics under SMASSE. It also shows promotion to be a SMASSE County trainer is based on your teaching experience. A majority of the physics teachers (37.5%) have a teaching experience between 1-5 and 6-10 years, only 25% of the teachers have taught between 11-20 years in the same institution under TSC. This shows that the teachers under investigation have adequate experience and understand the challenges facing physics in their institution.

4.3.4 Professional Qualification

The study also found out the professional qualification of the SMASSE Trainers and the physics teachers in Merti sub-county. The results are as shown in the table 4.5 below

Table 4.5: Professional Qualification

Professional Qualification		SMASSE Trainers Frequency	Percentage (%)	Physics Teachers Frequency	Percent (%)
Valid	Dip Ed	0	0.0	2	25.0
	BEd	1	50.0	4	50.0
	MEd/MSC/MA	1	50.0	2	25.0
	PHD	0	0.0	0	0.0
	Total	**2**	**100.0**	**8**	**100.0**

The analysis in table 4.5 clearly indicated that 50% of the trainers have a bachelor's degree in education while 50% a master's degree. Majority of the physics teachers (50%) have bachelor's degree, 25% a diploma in education while 25% with a master's degree. This clearly shows that majority of the teachers and the trainers have adequate professional knowledge about physics.\

4.3.5: SMASSE INSET Cycles

The study sought to find out how many SMASSE INSET cycles the teachers had attended and how many SMASSE trainers had trained. The results are as shown in the table 4.6

Table 4.6: SMASSE INSET Cycles

Cycles attended/ trained		SMASSE Trainers Frequency	Percent %	Physics Teachers Frequency	Percent %
Valid	1	0	0.0	0	0.0
	2	0	0.0	0	0.0
	3	0	0.0	2	25.0
	4	1	50.0	3	37.5
	5	0	0.0	1	12.5
	above 5	1	50.0	2	25.0
	Total	**2**	**100.0**	**8**	**100.0**

According to the descriptive analysis in table 4.6, 50% of the SMASSE trainers have trained above 5 years while the remaining 50% for 4 years. This shows that the trainers have adequate training experience of above 3 times. A significant number of physics teachers (37.5%) have attended SMASSE INSET four (4) times, 25% attended twice, 12.5% only 5 times and finally 25% have attended more than 5 times. The analysis clearly shows that all the physics teacher under investigation have attended a SMASSE cycle more than three (3) times hence they have adequate knowledge about SMASSE INSET activities.

4.3.6 CAT Frequency

The study sought to gather data on the teacher's frequency in administering CAT. Table 4.7 shows the analysis on the frequency Merti sub-county teachers administer their CATs.

Table 4.7: CAT Frequency

CAT		Frequency	Percent
Valid	Monthly	3	37.5
	2 weeks	3	37.5
	1 week	1	12.5
	after topic	1	12.5
	Total	**8**	**100.0**

According to table 4.7, a majority of the teachers (37.5%) administer CATs on monthly basis, 37.5% after two weeks, 12.5% after 1 week while 12.5% after the topic. This CAT frequency was relevant in determining the deviations in the academic achievement in physics at a school level.

4.3.7 Class enrolment

The study administered questionnaires to students in form two, three and four. Form one students were not involved because they haven't covered much physics content which is of interest for the study. The table 4.8 shows the analysis for the class enrolment.

Table 4.8: class enrolment

CLASS		Frequency	Percent
Valid	Form 2	100	63.7
	Form 3	32	20.4
	Form 4	25	15.9
	Total	**157**	**100.0**

According to the table 4.8 a larger percentage of the respondents (63.7%) were from form two (2). 20.4% were form threes and 15.9% were form fours. The low percentage of respondents from form three and four was contributed to by subject selection which is done at form two. Most of the learners in form two drop physics subject when proceeding to form three.

4.4 Descriptive statistics

In the study the researcher sought the respondent's views on impact of SMASSE INSET on student's academic achievement in physics. The study used a Likert scale that indicated the level of agreement, frequency of use and the extent of influence. The findings were presented and discussed thereafter.

4.4.1 Academic Achievement in Physics

The researcher sought to find out the performance of physics in the sampled schools. The results are shown in table 4.9

Table 4.9: students' performance in physics

KCSE Year	Mean
2020	3.98

2021	4.20
2022	4.51

From the table above, the performance of physics is low but has been recording a positive deviation since 2020. The table 4.10 show SMASSE trainers, teachers and students' views on academic achievement of physics in their schools. The level of agreement was assessed by a Likert scale with a rating 5– Strongly agree 4-Agree 3-Neutral 2-Disagree 1 Strongly Disagree

Table 4.10: agreement Statements on academic achievement in physics

Statements	**TRAINERS (N=2)**		**TEACHERS (N=8)**		**STUDENTS (N=157)**	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
The school has high performance in physics	2.00	.000	2.00	.756	2.10	1.334
Students perform highly in physics compared to other subjects	1.50	.707	2.38	.518	2.24	1.046
Most students perform well in physics	2.00	.000	2.13	1.126	2.54	1.380
Physics records a positive deviation in every exam	4.00	.000	3.63	1.408	3.52	.984
Using learner centered approaches improves academic performance of physics	4.50	.707	3.50	1.604	3.85	1.205
Use of Virtual laboratories, simulations, video clips and PowerPoint presentations encourage better performance in physics	5.00	.000	3.50	1.069	4.09	1.313
Peer support affects performance of physics positively	4.00	.000	4.12	1.126	3.92	1.377
A teacher with good mastery of physics content produces high academic performance among students	5.00	.000	3.63	.744	4.18	1.222

According to the descriptive statistics in the table majority of the trainers, teachers and students disagree with a mean of 2.00, 2.00 and 2.10 respectively that their schools have high performance in physics. They also disagree with the statement that students perform highly in physics compared to other subjects offered in their schools (mean of 1.50, 2.38 and 2.24 respectively). The trainers and teachers disagree with a mean of 2.00 and 2.13 respectively that most of the students perform well in physics. However, the students are neutral (mean = 2.54) on whether they perform well in physics.

All the respondents having a mean of 4.00, 3.63 and 3.52 respectively agree that physics subject records positive deviation in every exam. When the respondents were asked if learner centered approaches improve academic performance of physics in their schools, the trainers strongly agreed with a mean of 4.50 while majority of the teachers and students agreed with a mean of 3.50 and 3.85 respectively. The physics county trainers in Merti subcounty strongly supports (mean=5.00) the use of virtual laboratories, simulations, video clips and PowerPoint presentation in improving the academic achievement in physics. The teachers and students' respondents agreed with the opinion with a mean of 3.50 and 4.09 respectively

According to the descriptive statistics in the table, all the respondents agree that peer support positively affects academic performance in physics with a mean of 4.00, 4.12 and 3.92 respectively. The county SMASSE INSET trainers strongly agree (mean = 5.00) that a teacher with good mastery of physics content produces high academic performance among the students. However, the teacher and students' respondents agreed with the opinion with a mean of 3.63 and 4.18 respectively

4.4.2 Inquiry Based Learning approach and Students Academic Achievement in Physics

The first objective of the study was to determine influence of the Inquiry Based Learning approach covered in SMASSE INSET on students' achievement in Physics in Merti sub-county. The opinions of the trainers, teachers and students regarding this variable was obtained depending on the agreement with various statements on IBL approach. The findings were recorded in table 4.11. The level of agreement of the statements was measured using a Likert scale with Strongly agree having the highest rating (5) and strongly disagree with the lowest rating (1)

Table 4.11: agreement statements on IBL approach

TRAINERS (N=2)	Mean	Std. Dev
SMASSE trains teachers on effective teaching through leaner centered activities	4.50	.707
IBL approach taught in SMASSE focuses on enhancing learner critical thinking skills	5.00	.000
IBL approach taught in SMASSE aims at improving learner activeness in class	4.00	.000
SMASSE trains teachers on IBL activities which enhance student's retention and understanding of science concepts	5.00	.000
SMASSE INSET encourages group activities which enhance learner participation in class	5.00	.000
SMASSE INSET emphasizes on effectiveness of IBL approach over other traditional approaches	5.00	.000
The use of IBL approach increases students' academic achievement in physics	4.00	.000
TEACHERS VIEW (N=8)	**Mean**	**Std. Dev**
Effective teaching can be achieved through leaner centered activities	4.38	1.061
IBL approach enhances learner critical thinking skills	3.63	.916
IBL approach makes make my learners to be active in class	4.25	1.165
IBL activities enhance student's retention and understanding of science concepts	4.75	.463
Group activities enhance learner participation in class	3.50	1.414
IBL approach is effective than other traditional teacher centered approaches.	4.50	.535
The use of IBL approach increases students' academic achievement in physics	4.00	1.069
STUDENTS VIEW (N=157)	**Mean**	**Std. Dev**
Effective teaching can be achieved through leaner centered activities	3.87	1.372
My teacher gives me activities which enhances my critical thinking skills	4.18	1.367
Teachers method of teaching makes me active in class	4.11	1.286
My teacher gives activities which enhances retention and understanding of science concepts	4.09	1.190
My teacher gives group activities that enhance learner participation in class	4.13	1.296
My teachers' approach is effective than other traditional teacher centered approaches.	3.80	1.185
The use of IBL approach increases my academic achievement in physics	4.27	1.004

According to the descriptive statistics, it was established from the table 4.11 that majority of the trainers strongly agreed that they train teachers on effective teaching through learner centred activities as shown by a mean of 4.50, that IBL approach taught in SMASSE focuses on enhancing learner critical thinking skills as shown by a mean of 5.00. According to Monari (2018), in-service trainings equips teachers with methods that increase learner activeness through interactive activities. The finding by Monari (2018) supports the finding of this study

that IBL approach taught in SMASSE aims at improving learner activeness in class as shown by a mean of 4.00. The study also found out that SMASSE trains teachers on IBL activities which enhance student's retention and understanding of science concepts as shown by a mean of 5.00. This is supported by a research carried out by Hamdan, Salleh, Shahrill & Asamoah (2022) which found out that IBL activities significantly influences retention and understanding of concepts in a flipped classroom. Finally, the study also found out that SMASSE INSET encourages group activities which enhance learner participation in class as shown by a mean of 5.00, that SMASSE INSET emphasizes on effectiveness of IBL approach over other traditional approaches as shown by a mean of 5.00 and The use of IBL approach increases students' academic achievement in physics by a mean of 4.00

It was established from Merti sub-county physics teacher respondents that effective teaching can be achieved through leaner centered activities as shown by a mean of 4.38, Majority of the respondents agree that IBL approach enhances learner critical thinking skills as shown by a mean of 3.63. These findings agree with a research done by Duran & Dökme (2016) which found out that learner centered activities improve critical thinking skills. This clearly implies that when learners are exposed to activities frequently, they are likely to improve their critical thinking skills. The teacher respondents also agree that IBL approach makes learners to be active in class as shown by a mean of 4.25. This implies that learner activeness in class depends on the teacher's strategies. However, when trying to establish a relationship between IBL approach and student's retention, majority of the respondents strongly agree that IBL activities enhance student's retention and understanding of science concepts as shown by a mean of 4.75 indicating that a large number of physics teachers in Merti Sub-county support the effectiveness of IBL approach on students retention and understanding of physics concepts. The study also established that the respondents agree that group activities enhance learner participation in class as shown by

a mean of 3.50. A mean of 3.5 isn't very large implying that even though majority agree, there is still a significant number of teachers who are neutral or disagree with this item. However, a study carried out by Ismail, Bungsu & Shahrill (2023) agree that group activities enhances learner participation as they freely interact with each other when performing the activities. Lastly, the teacher respondents strongly agree that IBL approach is effective than other traditional teacher centered approaches as shown by a mean of 4.50 and the use of IBL approach increases students' academic achievement in physics as shown by a mean of 4.0. Napitupulu (2023) cites that there is a strong positive relation between inquiry-based learning approach and learner academic achievement. This implies that effective use of IBL approach over other traditional approaches can positively influence the performance of physics in Merti subcounty.

According to the student's perception on inquiry-based learning approach in table 4.11, most students agreed that effective teaching can be achieved through leaner centered activities with a mean of 3.87, this is a clear indication that learners in Merti sub-county prefer teachers using learner centered approaches. The learners agree that their teachers give out activities that enhances their critical thinking skills as shown by a mean of 4.18. On the other hand, the student respondents also agree that the teacher's methods of teaching make them active in class as shown with a mean of 4.11. This finding implies that the physics teachers in Merti sub-county apply the new approaches they learn in the SMASSE INSET. Majority of the respondents also agreed that their teachers gives them activities which enhances retention and understanding of science concepts as shown by a mean of 4.09. Furthermore, when the respondents were asked on their participation in learning, a high number of students agreed that their teacher gives them group activities which enhances their participation in class as shown by a mean of 4.13. According to Brown (2023), learner centered approaches are more effective than traditional teacher centered approaches. This supports the finding of this study where majority of the respondents agree that

the teachers' approach is effective than other traditional teacher centered approaches as shown by a mean of 3.80. Finally, the student respondents agreed that the use of IBL approach increases their academic achievement in physics as shown by a mean of 4.12. In conclusion, the findings agree with Duran & Dökme (2016) which postulates that using the IBL approach significantly affects learners critical thinking skills in learning of Science and technology. Husni (2020) also agrees with the findings that IBL approach increases learner's activeness. The findings of this study also agreed with Kunga (2021) which found out that inquiry-based learning approach is effective in improving leaners academic achievement in physics.

4.4.3 ICT Integration and Academic Achievement in Physics

The second objective of the study was to determine influence of ICT integration covered in SMASSE INSET on students' achievement in Physics in Merti sub-county. The opinions of the trainers, teachers and students regarding this variable was obtained depending on the agreement with various statements on ICT integration. The findings were recorded in table 4.12. The level of agreement of the statements was measured using a Likert scale with Strongly agree having the highest rating (5) and strongly disagree with the lowest rating (1)

Table 4.12 ICT Integration and academic performance in Physics

TRAINERS VIEWS (N=2)	**Mean**	**Std. Dev**
SMASSE trainings encourages the use ICT tools (computer, phones, tablet, projectors, etc.) in teaching	5.00	.000
SMASSE trains teachers to cultivate digital literacy skills in learners especially in manipulating ICT tools	4.00	.000
SMASSE INSET trains teachers on using PowerPoint presentation in teaching	3.50	.707
SMASSE trains teachers on how to perform experiments using virtual laboratories	5.00	.000
SMASSE uses PhET Colorado virtual laboratory in explaining complex concepts in physics	5.00	.000
SMASSE provides alternative methods of improvisation other than using laboratory equipment	4.50	.707
Integration of ICT in teaching positively influences academic performance in physics	4.00	.000
TEACHERSS (N=8)	**Mean**	**Std. Dev**
I normally use ICT tools (computer, phones, tablet, projectors, etc.) in teaching	3.50	1.414

My learners have difficulty in manipulating ICT tools	3.38	.744
PowerPoint presentation makes learners attentive in class	3.75	1.488
Performing experiments using virtual laboratories is time saving	4.00	1.069
PhET Colorado virtual laboratory helps explain complex concepts in physics	4.38	.744
My school has adequate laboratory equipment	1.75	.886
Integration of ICT in teaching positively influences academic performance in physics	3.50	1.414
STUDENTS VIEWS (N=157)	**Mean**	**Std. Dev**
My teacher uses ICT tools (computer, phones, tablet, projectors, etc.) in teaching	4.14	.957
I have difficulty in manipulating ICT tools	3.22	1.243
PowerPoint presentation makes me attentive in class	3.69	1.036
Performing experiments using virtual laboratories is time saving	3.86	.851
PhET Colorado virtual laboratory helps explain complex concepts in physics	3.86	.738
My school has adequate laboratory equipment	2.24	1.237
Integration of ICT in teaching positively influences academic performance in physics	3.82	1.538

The table 4.12 shows that all the SMASSE trainers' respondents strongly agree (mean = 5.00) that SMASSE trainings encourage the use ICT tools (computer, phones, tablet, projectors, etc.) in teaching. This indicates that teachers from Merti sub-county who attend the SMASSE INSET have adequate knowledge on the use of ICT tools. They also agree that SMASSE trains teachers to cultivate digital literacy skills in learners especially by manipulating ICT tools as shown by the mean of 4.00. When investigating if SMASSE INSET trains teachers on using PowerPoint presentation in teaching, majority of the respondents agreed by a mean of 3.50. This shows that teachers attending the SMASSE INSET are able to use power point in teaching physics. The study further sought to determine if SMASSE trains teachers on how to perform experiments using virtual laboratories, the findings show that they do so as shown by a mean of 5.00 meaning all the trainers strongly agree. When it comes to the use of virtual laboratories, all the SMASSE trainers' respondents strongly agree (mean of 5.00) that SMASSE uses PhET Colorado virtual laboratory in explaining complex concepts in physics during the INSET. The study also found out that SMASSE provides alternative methods of improvisation other than

using laboratory equipment as shown by a mean of 4.50. Lastly, on the influence of ICT integration on academic achievement, the SMASSE trainers agreed that integration of ICT in teaching positively influences academic performance in physics as shown by a mean of 4.00

Table 4.12 shows that majority of the teachers in Merti sub-county normally use ICT tools (computer, phones, tablet, projectors, etc.) in teaching as shown by a mean of 3.50. This mean of 3.50 implies that majority of the physics teachers in Merti Subcounty use ICT tools in teaching while minority of the teachers rarely or do not use the ICT tools at all. However, the teachers were neutral (mean=3.38) on the opinion of their learners having difficulty in manipulating ICT tools. Neutrality means that fewer number the learners know how to manipulate ICT tools and fewer don't know how to manipulate them., a higher percentage of teachers aren't sure of their learner's ability to manipulate ICT tools. On the subject of power point presentation, the teachers in Merti subcounty agree that PowerPoint presentations makes their learners attentive, this finding agree with the findings of Awasthi (2023) which show that PowerPoint presentation positively influences learner attentiveness in class. The teachers also agree that performing experiments using virtual laboratories is time saving as shown by a mean of 4.00. This finding agrees with a research done in Tanzania on public secondary schools on chemistry students which found out that performing of experiments using virtual laboratories is more time saving than doing it physically in a Laboratory (Manyilizu, 2023). This implies that teachers who use virtual laboratories are able to save time hence cover the physics syllabus in time.

Furthermore, majority of the teachers in Merti sub-county agree that PhET Colorado virtual laboratory helps explain complex concepts in physics as shown by a mean of 4.38. However, the teachers disagreed (mean = 1.75) that their schools have adequate laboratory equipment. This clearly shows why teachers in Merti sub-county resolve to use virtual

laboratories like PheT Colorado to overcome the challenge of inadequate laboratory equipment. When trying to establish the influence of ICT on academic performance, the teachers in Merti sub-county agree that integration of ICT in teaching positively influences academic performance in physics as shown by a mean of 3.50. The mean of 3.50 indicates that majority agree but a significantly low number of teachers in Merti sub-county disagree or are neutral on whether ICT integration in teaching affects academic performance in physics. However, this finding is supported by Banda & Nzabahimana (2023) that ICT influences learners' academic performance positively.

According to the descriptive statistics in the table, Majority of the learners agree that their teachers use ICT tools (computer, phones, tablet, projectors, etc.) in teaching as shown by a mean of 4.14. However, these findings disagree with a study done in Malaysia by Kamaruddin, Abdullah, Idris, & Nawi (2017) which reveals that ICT integration in teaching by teachers is below average where very few teachers have the necessary ICT skills which are significant in teaching. Most of the learners were neutral (mean of 3.22) on having difficulty in manipulating ICT tools. A mean of 3.22 shows that a slightly lower number of students are able to manipulate ICT tools and slightly high number having difficulty. However, this finding doesn't agree with Amrullah, Lail & Sumayani (2023) which asserts that learners in rural area have difficulty in handling ICT tools. However, a majority of the respondents agreed that PowerPoint presentation makes them attentive in class as shown by a mean of 3.69. The respondents also agreed (mean of 3.86) that performing experiments using virtual laboratories is time saving. On the subject of Virtual laboratories, the respondents agreed that PhET Colorado virtual laboratory helps explain complex concepts in physics as shown by a mean of 3.86.Batuyong & Antonio (2018) agrees with this finding that PhET simulations are very effective in teaching complex concepts in physics like production of X-rays, waves, among others the study also found out from the

respondents that schools in Merti subcounty have inadequate laboratory equipment as shown by a mean of 2.24 which disagreed with the statement my school has adequate laboratory equipment. In conclusion, the study found out that integration of ICT in teaching positively influences academic performance in physics as shown by majority of learners agreeing with a mean of 3.82. The findings agree with another study carried out in Daadab Sub-county Garissa County, Kenya on influence of ICT on learner academic achievement shows a strong positive correlation between instructional methods and academic achievement (Muema, 2018).

4.4.4 Peer Support and Academic Achievement in Physics

The third objective of the study was to determine influence of peer support covered in SMASSE INSET on students' achievement in Physics in Merti sub-county. The opinions of the trainers, teachers and students regarding this variable was obtained depending on the agreement with various statements on peer support. The findings were recorded in table 4.13. The level of agreement of the statements was measured using a Likert scale with Strongly agree having the highest rating (5) and strongly disagree with the lowest rating (1)

Table 4.13: Peer support and academic performance in physics

TRAINERS VIEW (*N=2*)	**Mean**	**Std. Dev**
SMASSE enhances collaboration between physics teachers	3.50	.707
SMASSE INSET encourages teachers to allow learners work collaboratively on physics tasks	4.00	.000
Formation of peer groups by teachers improves my learner socialization skills	5.00	.000
SMASSE encourages teachers to allow learners work with their peers in order to improve their attitude towards physics	5.00	.000
SMASSE trains teachers to peer teach challenging concepts	4.00	.000
Peer support positively influence learner's academic performance in physics	4.50	.707
TEACHERS VIEW (N=8)	**Mean**	**Std. Dev**
I Collaborate with other physics teachers to improve my mastery of content	3.75	1.581
I allow my learners to collaborate when working on physics tasks	3.25	1.282
Peer groups improves my learner socialization skills	4.00	.756
Allowing learners to work with their peers improves their attitude towards physics	3.00	1.512

I usually invite my college physics teachers to help me teach challenging concepts	2.00	1.069
Peer teaching improves my learner's academic performance in physics	3.13	1.126
STUDENTS VIEW (N=157)	**Mean**	**Std. Dev**
My teacher collaborates with other physics teachers	3.03	1.430
My teacher allows me to collaborate with other learners when working on physics tasks	3.66	1.426
Peer groups improves my socialization skills	3.70	1.546
Working with my peers improves my attitude towards physics	4.42	1.032
My teacher always invites other physics teachers to help teach challenging concepts	3.33	1.151
Peer support groups improves my academic performance in physics	4.11	1.219

According to the descriptive statistics on trainers view in the table, Majority of the trainers agree that SMASSE enhances collaboration between physics teachers as shown by a mean of 3.50. All the trainers also agreed (mean=4.00) that SMASSE INSET encourages teachers to allow learners work collaboratively on physics tasks. They also strongly agreed that formation of peer groups by teachers improves my learner socialization skills as shown by a mean of 5.00. when investigating if SMASSE encourages teachers to allow learners work with their peers in order to improve their attitude towards physics, the SMASSE trainers' respondents strongly agreed as shown by a mean of 5.00. The study also found out that SMASSE trains teachers to peer teach challenging concepts in physics as shown by a mean of 4.00. Lastly, the study found out from the respondents that peer support positively influences learner's academic performance in physics with majority of the respondents strongly agreeing with a mean of 4.50.

According to the teachers view on peer support in the table, majority of the respondents agreed that they collaborate with other physics teachers to improve my mastery of content as shown by a mean of 3.75. According to Jones (2023) teacher collaboration helps improve their mastery of content. This clearly indicates that majority of teachers in Merti sub-county benefit from SMASSE INSET cycles that trains them to collaborate for effective pedagogical content knowledge delivery. Most respondents were neutral on allowing their learners to collaborate when working on physics tasks as shown by a mean of 3.25. The study also found out that peer

groups improves my learner socialization skills as shown by a mean of 4.00. majority of the respondents were neutral (mean = 3.00) on the opinion that allowing learners to work with their peers improves their attitude towards physics. However, majority of the teachers in Merti subcounty disagree that they usually invite my college physics teachers to help me teach challenging concepts as shown by a mean of 2.00. Lastly, teachers were neutral on the opinion that Peer teaching improves their learner's academic performance in physics as shown by a mean of 3.13. This finding contradicts with the findings of Banza & Kasongo (2023) which agree that learners involved in peer tutoring record high academic achievement

According to descriptive statistics on the students view in the table, majority of the students are neutral on whether their teacher collaborates with other physics teacher as shown by a mean of 3.03. However, the respondents agree that their teacher allows them to collaborate with other learners when working on physics tasks as indicated by a mean of 3.66. The respondents also agree (mean=3.70) that peer groups improve their socialization skills. This finding is in agreement with a study by Sørlie, Hagen & Nordahl (2021) on peer interaction improving socialization skills. The study also found out that working with peers improves learners' attitude towards physics as shown by a mean of 4.42. This finding agreed with a study by Ozan & Kıncal (2018) which found out that peer support improves learner attitude towards learning which leads to improved academic performance According to the table, the respondents were neutral on the opinion that their teacher always invites other physics teachers to help teach challenging concepts as shown by a mean of 3.33. Lastly, the respondents agreed (mean of 4.11) that learner Peer support groups improves their academic performance in physics. These findings agree with a study carried out by Carter, Cushing & Kennedy (2009) and found out that peer support strategies have a lot of significance on students' academic achievement. The strategies

aid students learning, improves students' socialization skills and prepares learners future professional careers.

4.4.4 Subject Content and Academic Achievement in Physics

The last objective of the study was to determine influence of subject content covered in SMASSE INSET on students' achievement in Physics in Merti sub-county. The opinions of the trainers, teachers and students regarding th**is** variable was obtained depending on the agreement with various statements on subject content. The findings were recorded in table 4.14. The level of agreement of the statements was measured using a Likert scale with Strongly agree having the highest rating (5) and strongly disagree with the lowest rating (1)

Table 4.14 Subject content and academic achievement in Physics

TRAINERS VIEW (N=2)	**Mean**	**Std. Dev**
SMASSE INSET improves teacher's quality of teaching	5.00	.000
Teachers gain new pedagogies of handling challenging physics concepts from SMASSE INSET	4.50	.707
SMASSE equips teachers with good mastery of content which improves teacher's confidence when teaching	5.00	.000
The physics content covered in SMASSE INSET teachers with strategies that helps them cover entire syllabus comfortably	4.00	.000
SMASSE INSET equips teachers with innovative ways of doing practical work in physics	4.50	.707
A teacher with good mastery of content produces learners with high scores in physics	4.00	1.414
TEACHERS VIEW (N=8)	**Mean**	**Std. Dev**
SMASSE INSET has improved my quality of teaching	4.13	.835
I have gained new pedagogies of handling challenging physics concepts from SMASSE INSET	3.50	.756
Good mastery of content improves teacher's confidence in teaching	4.38	.744
The physics content covered in SMASSE INSET equips me with strategies that helps me cover the entire syllabus comfortably	3.75	1.488
SMASSE INSET equipped me with innovative ways of doing practical work in physics	3.63	1.685
A teacher with good mastery of content produces learners with high scores in physics	3.75	1.488
STUDENTS VIEW (N=157)	**Mean**	**Std. Dev**
My teacher's quality of teaching improves termly	3.69	.867
My teacher has new pedagogies of handling challenging physics concepts	3.68	1.369
Good mastery of content improves teacher's confidence in teaching	3.94	1.442

My teacher covers the syllabus completely without any challenges	3.82	1.439
My teacher has innovative ways of doing practical work in physics	3.72	1.418
A teacher with good mastery of content produces learners with high scores in physics	4.01	1.439

According to the descriptive statistics on SMASSE trainers view in the table, all the respondents strongly agreed that SMASSE INSET improves teacher's quality of teaching with a mean of 5.00. This implies that the content being taught by SMASSE during in-service training offers quality to the teachers. The respondents also strongly agreed that teachers gain new pedagogies of handling challenging physics concepts from SMASSE INSET as shown by a mean of 4.50. When establishing the influence of subject content on teacher's confidence in teaching, the respondents strongly agreed (mean of 5.00) that SMASSE equips teachers with good mastery of content which improves teacher's confidence when teaching. Accordingly, the study found out majority of the respondents agree that the physics content covered in SMASSE INSET equips teachers with strategies that helps them cover entire syllabus comfortably. This is shown by the mean of 4.00. The respondents also strongly agree that SMASSE INSET equips teachers with innovative ways of doing practical work in physics as shown by a mean of 4.50. The SMASSE trainer's perception on subject content and academic performance shows that teacher with good mastery of content produces learners with high scores in physics as shown by a mean of 4.00

According to the descriptive statistics on teachers view on subject content in the table, the respondents agree that SMASSE INSET has improved their quality of teaching as shown by a mean of 4.13, that they have gained new pedagogies of handling challenging physics concepts from SMASSE INSET as shown by a mean of 3.50. These findings agree with a study carried out by Mahmoudi Rashtchi & Abbasian (2021)which concluded that teachers attending in-service training acquire new teaching strategies after the training. However, the study found out that fewer number of teachers (below 20%) apply the newly acquired approaches in teaching.

The study found out that good mastery of content improves teacher's confidence in teaching as shown by a mean of 4.38 which means a higher percentage of teachers agree and strongly agree that there is a strong relationship between teachers' mastery of content and teacher's confidence in teaching. The physics teachers in Merti subcounty also agree that the physics content covered in SMASSE INSET equips them with strategies that helps cover the entire syllabus comfortably as shown by a mean of 3.75. This was in agreement with Oluoch-Suleh & Ombara (2023) study which found out that teachers who attend in-service training are more equipped and are able to cover a subject curriculum comfortably. The teachers also agreed that SMASSE INSET equips teachers with innovative ways of doing practical work in physics as shown by a mean of 3.63 and that a teacher with good mastery of content produces learners with high scores in physics as shown by a mean of 3.75.

According to the descriptive statistics on students view on SMASSE subject content in the table, Most of the respondents agree that their teacher's quality of teaching improves termly as shown by a mean of 3.69, that their teacher has new pedagogies of handling challenging physics concepts as shown by a mean of 3.68, that good mastery of content improves teacher's confidence in teaching as shown by a mean of 3.94, that their teacher covers the syllabus completely without any challenges as shown by a mean of 3.82, that their teacher has innovative ways of doing practical work in physics as shown by a mean of 3.72 and finally a teacher with good mastery of content produces learners with high scores in physics as shown by a mean of 4.01. These findings agree with a study by Csíkos & Szitányi (2020) which shows that teacher's pedagogical content knowledge is significant in learners understanding of concepts and that teachers' who have good mastery of content have extremely high confidence in teaching complex concepts.

4.5 Correlation analysis

The study used inferential statistics to establish a relationship between the variables. The questionnaires obtained responses based on a Likert scale with 5-point rating for all the items. All the means of academic performance, IBL approach, ICT integration, peer support and subject content covered in SMASSE INSET were converted to composite scores of their means which enabled analysis of the inferential statistics. The average mean of 2 trainers, 8 physics teachers and 157 students' questionnaires were obtained. The table below shows the composite scores of the study variable means.

Table 4.15: composite scores of study variables means

Variable	N	Mean	Std. Deviation
Student's academic achievement	167	3.32	1.506
IBL approach covered in SMASSE INSET	167	4.26	1.270
ICT Integration taught in SMASSE	167	3.80	1.225
Peer support taught in SMASSE	167	3.74	1.247
Subject content covered in SMASSE INSET	167	4.05	1.236
Valid N (listwise)	167		

The study used Pearson product moment correlation coefficient determine the relationships

Between the study variables. In order to answer the research questions Pearson Correlation analysis was conducted using SPSS software to determine the nature of the relationship between the dependent variable 'students' academic achievement in Physics' and independent variables (IBL approach, ICT integration, Peer support and subject content covered in SMASSE INSET). The correlation analysis was conducted at 95% confidence level and was two-tailed as the independent variables could influence students' academic achievement negatively or positively

Table 4.16: Correlation between SMASE INSET and students' academic achievement in physics

Variables		Students' academic achievement in physics
IBL approach	Pearson Correlation	.718**
	Sig. (2-tailed)	.000
	N	167
ICT Integration	Pearson Correlation	.937**
	Sig. (2-tailed)	.000
	N	167
Peer support	Pearson Correlation	.943**
	Sig. (2-tailed)	.000
	N	167
Subject content	Pearson Correlation	.862**
	Sig. (2-tailed)	.000
	N	167

Table 4.16 shows that there was a strong positive relationship between IBL approach taught in SMASSE INSET and student's academic achievement in Physics with R-value of 0.718 significant at 95% confidence level (P=0.000). ICT Integration had a correlation value of 0.937 which is significant at P=0.000 at 95% confidence level. This shows a very strong positive relationship between ICT integration and students' academic achievement in physics. Peer support had a correlation value of 0.943 (p=0.000) at 95% confidence level which signified a very strong positive relationship between peer support taught in SMASSE INSET and student's academic achievement in physics. Subject content covered in SMASSE INSET had a positive R-value of 0.862 at 95% confidence level with a significant value of (p=0.000). This clearly indicated that Subject Content covered in SMASSE INSET has a strong positive relationship between SMASSE INSET and student's academic achievement in physics.

4.6 Regression analysis

The influence of IBL approach, ICT integration, Peer support and subject content covered in SMASSE INSET on academic achievement in physics was determined using multiple linear regression model. Table 4.17 shows the summary of the regression analysis from SPSS.

Table 4.17 Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.969[a]	.938	.937	.379

a. Predictors: (Constant), Subject content, IBL approach, Peer support, ICT Integration

From table 4.17, a correlation value of R=0.969 showed a good linear dependence between the study variables. The study established an R square value of 0.938 which was adjusted to 0.937 with a standard error of estimate being 0.379. The coefficient of determination shows that IBL approach, ICT integration, peer support and ICT integration affect students' academic achievement by 93.8% while 6.3% of other variables not included the study affects academic achievement.

CHAPTER FIVE

STUDY SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the analysis of the major findings of this study, conclusions and recommendations arising from the discussion.

5.2 Summary of the findings

The study aimed at determining the influence of Strengthening Mathematics and Sciences in Secondary Education In-Service Training on students' academic achievement in physics in Merti Sub-county, Kenya. The study was guided by four key objectives: determine the influence of the Inquiry Based Learning approach covered in SMASSE INSET on students' achievement in Physics, determine the influence of ICT tools taught in SMASSE INSET on students' academic achievement in physics, determine how peer support covered in SMASSE INSET affects students' academic achievement in physics and to determine the influence of subject content covered in SMASSE INSET on students' academic achievement in physics. The study used descriptive survey research design where there was collection of information from respondents without compromising their privacy. The target population of the study consisted of SMASSE County Trainers, physics teachers employed by Teachers Service Commission who have attended SMASSE INSET cycle and public secondary school students in Merti sub-county. The total number of SMASSE Physics country Trainers was 2, 8 physics teachers and 170 form 2, 3 and 4 physics students.

The study used simple random sampling in selection of samples to avoid biasness and provide equality in representation of subgroups in the sample (Olken & Rotem, 1986). 170 students were sampled from the secondary schools in Merti sub-county where 31 students were sampled from two-streamed schools and 18 students from the remaining 6 schools in the

subcounty. 8 out of 10 physics teachers were selected and 2 physics county trainers. Systematic random sampling was used in obtaining students to participate in the study where learners were chosen from the physics class register. This is because systematic random sampling is very ideal in collection of data where there is very little chance of data manipulation (Etikan & Bala, 2017). In every class under the study, the total number of students were divided by 10 so that every subject is included in the study.

The research instrument was piloted using the test retest technique and a Pearson correlation coefficient computed. The refined instruments were administered, filled and responses analyzed. The study applied the use of primary data collection technique. This was achieved through the use of questionnaires. Data from questionnaires were analyzed quantitatively using descriptive and inferential statistics. The Descriptive analysis generated data which were presented in tables, percentages and figures. Statistical Package for Social Sciences (SPSS) version 21.0 was used to aid in data analysis. After a comprehensive data analysis, the findings of the study are as summarized below:

5.3 Influence of IBL approach taught in SMASSE INSET on academic performance in physics

The first objective of the study was to determine the influence of the Inquiry Based Learning approach covered in SMASSE INSET on students' achievement in Physics in physics. The quantitative descriptive results from the questionnaires showed that many items under this variable significantly relates to academic achievement in Merti sub-county. The results showed that effective teaching can be achieved through leaner centered activities. The results established that IBL approach enhances learner critical thinking skills, activeness in class, retention and understanding of science concepts. The results further showed that students group activities enhance learner participation in class. The results also showed that IBL approach is effective

than other traditional teacher centered approaches and the use of IBL approach increases students' academic achievement in physics

Inferential statistical results from Pearson's Product-Moment Correlation also show that IBL approach taught in SMASSE INSET and student's academic achievement in physics in Merti sub-county have a strong and significant positive correlation. Regression analysis shows that student's academic achievement in physics has a linear dependence on IBL approach taught in SMASSE INSET

5.4 ICT Integration taught in SMASSE INSET and academic achievement in physics

The second objective of the study was to determine the influence of ICT tools on academic achievement in physics in Merti sub-county. The quantitative descriptive results showed that many teachers use ICT tools (computer, phones, tablet, projectors, etc.) in teaching, some learners have difficulty in manipulating ICT tools, PowerPoint presentation makes learners attentive in class and performing experiments using virtual laboratories is time saving. The results also showed that PhET Colorado virtual laboratory helps in explaining complex concepts in physics. On the other hand, the descriptive results established that schools in Merti sub-county have inadequate laboratory equipment. The results further established that integration of ICT in teaching positively influences academic performance in physics in Merti sub-county.

Inferential statistical results from Pearson's Product-Moment Correlation show that ICT Integration and students' academic achievement in physics in Merti sub-county have a strong positive correlation meaning that the use of ICT tools in teaching leads to improved performance in physics. Linear Regression model analysis showed that student's academic achievement in physics had a linear dependence on ICT integration.

5.5 Peer Support taught in SMASSE INSET and academic achievement in physics

The third objective was to determine the influence of peer support on academic achievement in physics in Merti subcounty. The descriptive quantitative results indicated that physics teachers in Merti sub-county collaborates with each other frequently, teachers also allow learners collaborate with other learners when working on physics tasks. The results also established that Peer groups improves learner socialization skills and attitude towards physics. Furthermore, the descriptive results show that teachers in Merti subcounty rarely invite other physics teachers to help teach challenging concepts. The results further indicated that Peer support groups improves learner academic performance in physics. Inferential statistics using the Pearson's Product-Moment Correlation also show that peer support and student's academic achievement in physics in Merti sub-county have a strong and significant positive correlation meaning that increased teacher-teacher and learner-learner collaboration leads to improved academic achievement in physics and vice versa. Regression analysis shows that student's academic achievement in physics had a linear dependence on the spatial factors

5.6 Subject Content covered in SMASSE INSET and academic achievement in physics

The last objective was to determine the influence of the use of subject content covered in SMASSE INSET on academic achievement in physics in Merti sub-county. The descriptive results established that teacher's quality of teaching improves termly, teachers in Merti sub-county have new pedagogies of handling challenging physics concepts. The results also established that good mastery of subject content improves teacher's confidence in teaching which enhances syllabus coverage without any challenges. Furthermore, the results established that physics teachers have innovative ways of doing practical work in physics. Lastly, the descriptive results established that a teacher with good mastery of content produces learners with high scores in physics. Results from Inferential statistics using the Pearson's Product-Moment

Correlation also show that subject content covered in SMASSE INSET and students' academic achievement in physics in Merti subcounty have a very strong and significant positive correlation meaning innovative teaching strategies, new ways of doing practical work and god mastery of content leads to improved academic achievement in physics and vice versa. Regression analysis shows that student's academic achievement in physics had a linear dependence on subject content covered in SMASSE INSET.

5.7 Conclusions of the study

The following conclusions can be made from this study. Firstly, the first objective of the study was to determine the influence of the use of IBL approach on academic achievement of physics in Merti subcounty. The study concluded that learner centered activities contributes to effective teaching. Learner critical thinking skills, activeness in class, retention and understanding of science concepts can be achieved using the IBL approach. Furthermore, it can be concluded that students group activities enhance learner participation in class. Moreover, it can also be concluded that IBL approach is more effective than other traditional teacher centered approaches and the use of IBL approach can increase students' academic achievement in physics.

Secondly the study concluded that the use of ICT tools like PowerPoint presentation makes learners attentive in class, performing of experiments using virtual laboratories is time saving and PhET Colorado virtual laboratory helps in explaining complex concepts in physics. The study further concludes that schools in Merti sub-county have inadequate laboratory equipment hence the integration of ICT in teaching positively influences academic performance in physics.

Thirdly, the study concludes that physics teachers in Merti sub-county collaborates with each other frequently, allow learners collaborate with each other when working on physics tasks which improves their socialization skills and attitude towards physics. Furthermore, the study

concludes that teachers in Merti sub-county rarely invite other physics teachers to help teach challenging concepts. Lastly, the study concludes that Peer support groups improves learner academic performance in physics in Merti subcounty.

Furthermore, the study concludes that teacher's quality of teaching in Merti subcounty improves termly. It further concludes that the teachers in Merti sub-county have new pedagogies of handling challenging physics concepts. Furthermore, it concluded that good mastery of subject content improves teacher's confidence in teaching which enhances syllabus coverage without any challenges. Moreover, physics teachers in Merti sub-county have innovative ways of doing practical work in physics. Lastly, the study concludes that a teacher with good mastery of content produces learners with high scores in physics.

Lastly the study had an overall conclusion that IBL approach taught in SMASSE, ICT tools, peer support and subject content covered in SMASSE INSET significantly affects academic achievement in physics. Thus, performance of physics in Merti subcounty would increase if the four variables are well implemented in the classroom.

5.8 Recommendations

1. The ministry of education and the school board of management should provide adequate ICT infrastructure to enhance learner's digital literacy skills. Teachers should ensure they teach their learners on how to manipulate ICT tools especially using virtual laboratories.
2. The CEMASTEA taskforce should monitor teachers trained in the SMASSE INSET at school level in order to assess the effectiveness of the Programme. Physics Teachers should implement fully what they have learnt in the SMASSE INSET training.
3. The Teachers service commission should deploy more physics teachers in the subcounty since most of the schools have one physics teacher hence challenges with peer teaching.

4. The ministry of education and CEMASTEA should increase the frequency of physics teachers SMASSE INSET to enhance positive results of the schools.

5.9 Suggestions for further research

i. The study has only focused on SMASSE INSET which includes, IBL approach, ICT integration, peer support, subject content covered in SMASSE INSET and how they influence academic achievement in physics. The study however did not consider other factors which may influence academic achievement in physics in Merti subcounty. Further research may reveal other factors influencing academic achievement in Physics in Merti subcounty.

ii. The study was done in Merti subcounty which is in ASAL region with lower number of schools, physics teachers and students hence the findings of this study cannot be generalized in other regions. Further research can be done in other regions especially the urban and other rural regions.

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APPENDIXES

Appendix I: SMASSE County Trainers Questionnaire

The purpose of this questionnaire is to collect data used to examine the impact of SMASSE in-service training on academic achievement in Physics in Merti Sub County, Kenya. The information required by this questionnaire will only be used for academic research purposes. Your response is voluntary and shall strictly remain confidential. You are therefore required to be as truthful and objective as possible in your responses. Attempt all the questions by filling in blank spaces or by use of a tick (√) in the boxes and parentheses.

SECTION I: Demographic data

Tick (√) where appropriate

1. Gender Male [ ] Female [ ]

2. Age 25-29 [ ] 30-39 [ ] 40-49 [ ] above 50 [ ]

3. What is your highest professional qualification?

Dip Ed [ ] PGDE [ ] BEd [ ] MEd/MSC/MA [ ] PHD [ ]

5. How long have you been training as a SMASSE County Trainer?

1-2 years [ ] 3-5 [ ] 6-9 [ ] Above 10[ ]

SECTION II: Academic Achievement in Physics

What is your opinion on the following statements? Please tick appropriately

Likert scale: 5– Strongly agree (SA) 4-Agree(A) 3-Neutral (N)2-Disagree(D) 1 Strongly Disagree (SD)

Statement	SA	A	N	D	SD
The school has high performance in physics					
Students perform highly in physics compared to other subjects					
Most students perform well in physics					
Physics records a positive deviation in every exam					
Using learner centered approaches improves academic performance of physics					
Use of Virtual laboratories, simulations, video clips and PowerPoint presentations encourage better performance in physics					
Peer support affects performance of physics positively					
A teacher with good mastery of physics content produces high academic performance among students					

SECTION III: Inquiry Based Learning approach and performance in physics

Read the following statements and give your honest opinion by ticking the box

Likert scale: Strongly agree (SA) Agree(A) Neutral (N) Disagree(D) Strongly Disagree (SD)

Statement	SA	A	N	D	SD
SMASSE trains teachers on effective teaching through leaner centered activities					
IBL approach taught in SMASSE focuses on enhancing learner critical thinking skills					
IBL approach taught in SMASSE aims at improving learner activeness in class					
SMASSE trains teachers on IBL activities which enhance student's retention and understanding of science concepts					
SMASSE INSET encourages group activities which enhance learner participation in class					
SMASSE INSET emphasizes on effectiveness of IBL approach over other traditional approaches					
The use of IBL approach increases students' academic achievement in physics					

SECTION IV: ICT Tools and performance in physics

The following statements refer to your use of ICT tools in a physics lesson. Read each statement and evaluate your level of using ICT tools by placing a tick in the box.

Statement	SA	A	N	D	SD
SMASSE trainings encourages the use ICT tools (computer, phones, tablet, projectors, etc.) in teaching					
SMASSE trains teachers to cultivate digital literacy skills in learners especially in manipulating ICT tools					
SMASSE INSET trains teachers on using PowerPoint presentation in teaching					
SMASSE trains teachers on how to perform experiments using virtual laboratories					
SMASSE uses PhET Colorado virtual laboratory in explaining complex concepts in physics					
SMASSE provides alternative methods of improvisation other than using laboratory equipment					
Integration of ICT in teaching positively influences academic performance in physics					

SECTION IV: Peer Support and academic performance in physics

The following statements refer to your peer support programmes in teaching of physics. Read each statement and evaluate your level of engagement in peer support programmes by placing a tick in the box.

Statement	SA	A	N	D	SD
SMASSE enhances collaboration between physics teachers					
SMASSE INSET encourages teachers to allow learners work collaboratively on physics tasks					
Formation of peer groups by teachers improves my learner socialization skills					
SMASSE encourages teachers to allow learners work with their peers in order to improve their attitude towards physics					
SMASSE trains teachers to peer teach challenging concepts					
Peer support positively influence learner's academic performance in physics					

SECTION V: Subject Content covered in SMASSE Inset and academic achievement in physics

The following statements refer to the relevance of subject content covered in SMASSE INSET training in teaching of physics. Read each statement and evaluate by placing a tick in the box.

Statement	SA	A	N	D	SD
SMASSE INSET improves teacher's quality of teaching					
Teachers gain new pedagogies of handling challenging physics concepts from SMASSE INSET					
SMASSE equips teachers with good mastery of content which improves teacher's confidence when teaching					
The physics content covered in SMASSE INSET teachers with strategies that helps them cover entire syllabus comfortably					
SMASSE INSET equips teachers with innovative ways of doing practical work in physics					
A teacher with good mastery of content produces learners with high scores in physics					

Appendix II Physics Teachers' Questionnaire

The purpose of this questionnaire is to collect data used to examine the impact of SMASSE in-service training on academic achievement in Physics in Merti Sub County, Kenya. The information required by this questionnaire will only be used for academic research purposes. Your response is voluntary and shall strictly remain confidential. You are therefore required to be as truthful and objective as possible in your responses. Attempt all the questions by filling in blank spaces or by use of a tick (√) in the boxes and parentheses.

SECTION I: Demographic Data

Tick (√) where appropriate

1. Gender Male [ ] Female [ ]

2. Age 25-29 [ ] 30-39 [ ] 40-49 [ ] above 50 [ ]

3. What is your highest professional qualification?

Dip Ed [ ] PGDE [ ] BEd [ ] MEd/MSC/MA [ ] PHD [ ]

4. How long have you been in the teaching profession?

1-5 years [ ] 6-10 [ ] 11-20 [ ] Above 20 [ ]

5. What is your teaching load per week?

Below 10 lessons [ ] 10-19 [ ] 20-29 [ ] 30-39 [ ] above 40 [ ]

6. Have you attended any Physics SMASSE INSET cycle? Yes/No

If yes, how many?

…….....…….

If no, why?

.....

7. How often do you give CAT? 1 week [ ] 2 weeks [ ] monthly [ ] after a topic [ ]

SECTION II: Performance in Physics

Kindly indicate your student's physics KCSE mean score from 2020 to 2022 in your school

KCSE YEAR	Mean score
2020	
2021	
2022	

What is your opinion on the following statements? Please tick appropriately

Likert scale: 5– Strongly agree (SA) 4-Agree(A) 3-Neutral (N)2-Disagree(D) 1 Strongly Disagree (SD)

Statement	SA	A	N	D	SD
The school has high performance in physics					
Students perform highly in physics compared to other subjects					
Most students perform well in physics					
Physics records a positive deviation in every exam					
Using learner centered approaches improves academic performance of physics					
Use of Virtual laboratories, simulations, video clips and PowerPoint presentations encourage better performance in					
Peer support affects performance of physics positively					
A teacher with good mastery of physics content produces high academic performance among students					

SECTION III: Inquiry Based Learning approach and performance in physics

Read the following statements and give your honest opinion by ticking the box

Likert scale: Strongly agree (SA) Agree(A) Disagree(D) Strongly Disagree (SD)

Statement	SA	A	N	D	SD
Effective teaching can be achieved through leaner centered activities					
IBL approach enhances learner critical thinking skills					
IBL approach makes make my learners to be active in class					
IBL activities enhance student's retention and understanding of science concepts					
Group activities enhance learner participation in class					
IBL approach is effective than other traditional teacher centered approaches.					
The use of IBL approach increases students' academic achievement in physics					

SECTION IV: ICT Tools and performance in physics

The following statements refer to your use of ICT tools in a physics lesson. Read each statement and evaluate your level of using ICT tools by placing a tick in the box.

Statement	SA	A	N	D	SD
I normally use ICT tools (computer, phones, tablet, projectors, etc.) in teaching					
My learners have difficulty in manipulating ICT tools					

PowerPoint presentation makes learners attentive in class					
Performing experiments using virtual laboratories is time saving					
PhET Colorado virtual laboratory helps explain complex concepts in physics					
My school has adequate laboratory equipment					
Integration of ICT in teaching positively influences academic performance in physics					

SECTION IV: Peer Support and academic performance in physics

The following statements refer to your peer support programmes in teaching of physics. Read each statement and evaluate your level of engagement in peer support programmes by placing a tick in the box.

Statement	**SA**	**A**	**N**	**D**	**SD**
I Collaborate with other physics teachers to improve my mastery of content					
I allow my learners to collaborate when working on physics tasks					
Peer groups improves my learner socialization skills					
Allowing learners to work with their peers improves their attitude towards physics					
I usually invite my college physics teachers to help me teach challenging concepts					
Peer teaching improves my learner's academic performance in physics					

SECTION V: Subject Content covered in SMASSE Inset and academic achievement in physics

The following statements refer to the relevance of subject content covered in SMASSE INSET training in teaching of physics. Read each statement and evaluate by placing a tick in the box.

Statement	**SA**	**A**	**N**	**D**	**SD**
SMASSE INSET has improved my quality of teaching					
I have gained new pedagogies of handling challenging physics concepts from SMASSE INSET					
Good mastery of content improves teacher's confidence in teaching					
The physics content covered in SMASSE INSET equips me with strategies that helps me cover the entire syllabus comfortably					
SMASSE INSET equipped me with innovative ways of doing practical work in physics					
A teacher with good mastery of content produces learners with high scores in physics					

Appendix III Students' Questionnaire

SECTION I: Demographic data

Please do not write your name anywhere in this questionnaire.

1. which class do you belong to?

FORM 2 [ ] FORM 3 [ ] FORM 4 [ ]

2. What is your gender?

MALE [ ] FEMALE [ ]

SECTION II: Academic achievement in physics

What is your opinion on the following statements? Please tick appropriately

Likert scale: 5– Strongly agree (SA) 4-Agree(A) 3-Neutral (N)2-Disagree(D) 1 Strongly Disagree (SD)

Statement	SA	A	N	D	SD
The school has high performance in physics					
Students perform highly in physics compared to other subjects					
Most students perform well in physics					
Physics records a positive deviation in every exam					
Using learner centered approaches improves academic performance of physics					
Use of Virtual laboratories, simulations, video clips and PowerPoint presentations encourage better performance in					
Peer support affects performance of physics positively					
A teacher with good mastery of physics content produces high academic performance among students					

SECTION III: Inquiry Based Learning approach and performance in physics

Read the following statements and give your honest opinion by ticking the box

Likert scale: Strongly agree (SA) Agree(A) Disagree(D) Strongly Disagree (SD)

Statement	SA	A	N	D	SD
Effective teaching can be achieved through leaner centered activities					
My teacher gives me activities which enhances my critical thinking skills					
Teachers method of teaching makes me active in class					
My teacher gives activities which enhances retention and understanding of science concepts					
My teacher gives group activities that enhance learner participation in class					
My teachers' approach is effective than other traditional teacher centered approaches.					
The use of IBL approach increases my academic achievement in physics					

SECTION IV: ICT Tools and performance in physics

The following statements refer to your use of ICT tools in a physics lesson. Read each statement and evaluate your level of using ICT tools by placing a tick in the box.

Statement	SA	A	N	D	SD
My teacher uses ICT tools (computer, phones, tablet, projectors, etc.) in teaching					
I have difficulty in manipulating ICT tools					
PowerPoint presentation makes me attentive in class					
Performing experiments using virtual laboratories is time saving					
PhET Colorado virtual laboratory helps explain complex concepts in physics					
My school has adequate laboratory equipment					
Integration of ICT in teaching positively influences academic performance in physics					

SECTION IV: Peer Support and academic performance in physics

The following statements refer to your peer support programmes in teaching of physics. Read each statement and evaluate your level of engagement in peer support programmes by placing a tick in the box.

Statement	SA	A	N	D	SD
My teacher collaborates with other physics teachers					
My teacher allows me to collaborate with other learners when working on physics tasks					
Peer groups improves my socialization skills					
Working with my peers improves my attitude towards physics					
My teacher always invites other physics teachers to help teach challenging concepts					
Peer support groups improves my academic performance in physics					

SECTION V: Subject Content covered in SMASSE Inset and academic achievement in physics

The following statements refer to the relevance of subject content covered in SMASSE INSET training in teaching of physics. Read each statement and evaluate by placing a tick in the box.

Statement	SA	A	N	D	SD
My teacher's quality of teaching improves termly					
My teacher has new pedagogies of handling challenging physics concepts					
Good mastery of content improves teacher's confidence in teaching					
My teacher covers the syllabus completely without any challenges					
My teacher has innovative ways of doing practical work in physics					
A teacher with good mastery of content produces learners with high scores in physics					

Write down the factors that affect the performance of physics in your school

i) ……

ii) ……

iii) ……

Thank you for your participation

Appendix IV Time Frame

The following table shows the time frame I intend to adhere to during the entire project;

DATE	EVENT
1ST FEBRUARY, 2022 – 1ST JUNE, 2022	Writing the research proposal

25TH OCT, 2022 – 20TH DECEMBER, 2022	Proposal defense
2ND JANUARY, 2023 – 21 AUGUST, 2022	Collecting data, analyzing and writing research report
22ND A UGUST -	Defending the research report

Appendix IV Budget

This is the projected budget for the entire project;

S/N	ITEM	AMOUNT
1	Transport i. Administering piloting pre-test questionnaires ii. To carry out research iii. Supervisors consultation iv. Visiting schools to administer questionnaires	18,000/=
2	Typing secretarial Services i. Typing of proposal ii. Typing of final report iii. Photocopying questionnaires	14,000/=
3	Printing questionnaires, proposal and report Binding Expenses i. Binding proposal ii. Binding final report	17,000/=

4	Stationeries i. Writing materials ii. Copy papers iii. Flash disk iv. Pens	5,000
5	Internet bundles	4,500
6	Airtime	1,000
	TOTAL	**59,500**

Appendix IV Letter of recommendation from University of Nairobi

UNIVERSITY OF NAIROBI

FACULTY OF EDUCATION

DEPARTMENT OF EDUCATIONAL COMMUNICATION, TECHNOLOGY & PEDAGOGICAL STUDIES

Telephone: 020-2500759, 020-2500760
020-2500762, 020-2460056

P.O. BOX 30197, 00100 NAIROBI
P.O. BOX 92, 00902 KIKUYU

16th February 2023

National Commission for Science, Technology and Innovation (NACOSTI)
P. O. Box 30623, 00100
Nairobi, KENYA

Dear Sir/Madam,

RE: APPLICATION FOR AUTHORITY TO CONDUCT RESEARCH IN KENYA: MISOGA KELVIN GWIYANGA -E60/37410/2020

This is to certify that **MISOGA KELVIN GWIYANGA -E60/37410/2020** is a student at the University of Nairobi, Department of Educational Communication and Pedagogical Studies pursuing a Master of Education. He is seeking authorization to conduct research titled **"Influence of Strengthening Mathematics and Science Education on student's academic achievement in Physics in Merti sub-county, Kenya".**

Kindly assist him to acquire a research permit to enable him to continue towards the completion of his work.

Yours faithfully,

DR. BONIFACE N. NGARUIYA
CHAIRMAN, DEPARTMENT OF EDUCATIONAL COMMUNICATION AND PEDAGOGICAL STUDIES

Appendix V: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 974965

Date of Issue: 02/March/2023

RESEARCH LICENSE

This is to Certify that Mr., KELVIN GWIYANGA MISOGA of University of Nairobi, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Isiolo on the topic: Influence of Strengthening Mathematics and Sciences in Secondary Education In-Service Training on students' academic achievement in physics in Meriti Sub-county, Kenya for the period ending : 02/March/2024.

License No: NACOSTI/P/23/23894

974965

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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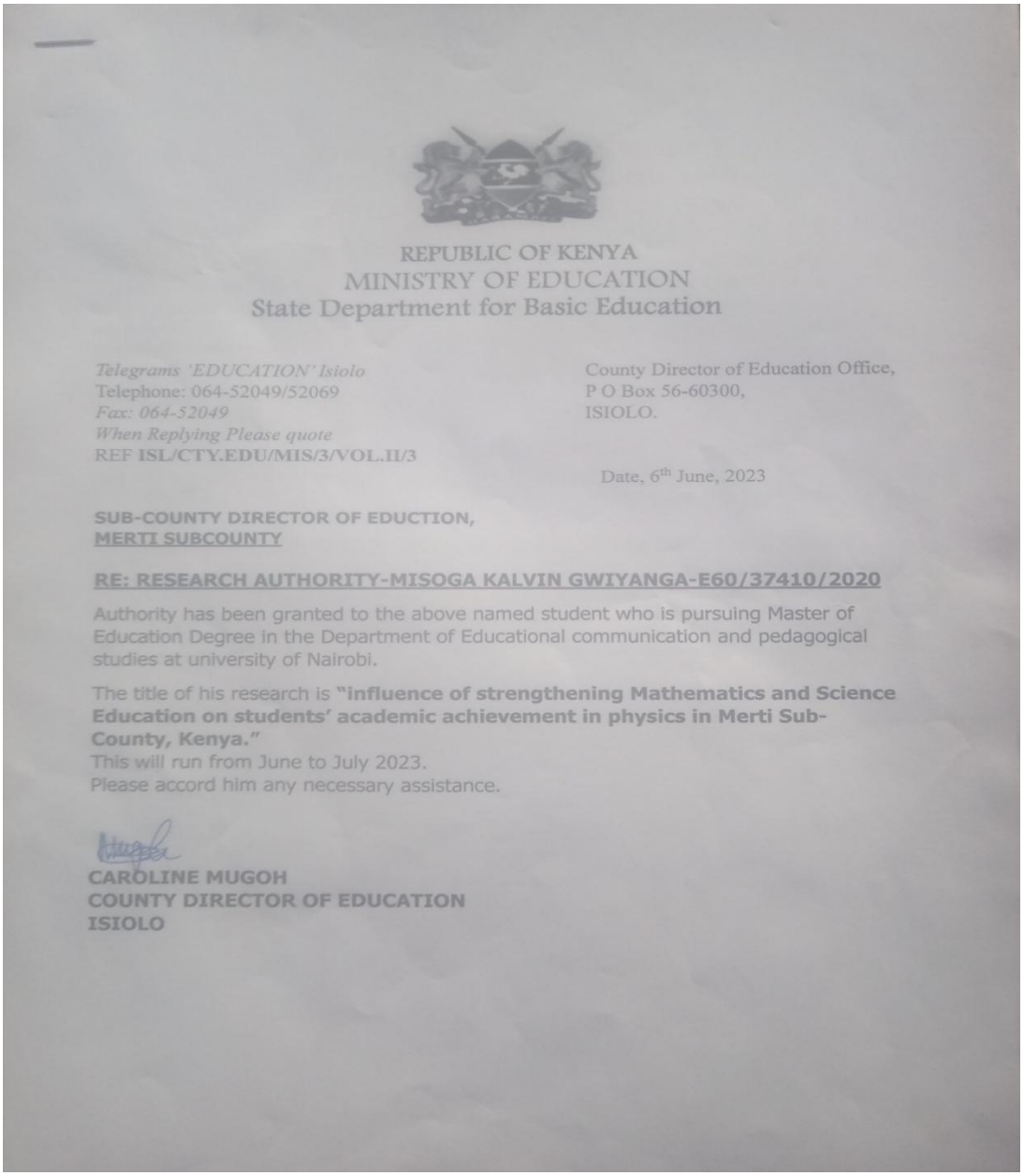
See overleaf for conditions

APPENDIX VI: Letter of Authorization by SCDE



REPUBLIC OF KENYA
MINISTRY OF EDUCATION
State Department for Basic Education

Telegrams 'EDUCATION' Isiolo
Telephone: 064-52049/52069
Fax: 064-52049
When Replying Please quote
REF **ISL/CTY.EDU/MIS/3/VOL.II/3**

County Director of Education Office,
P O Box 56-60300,
ISIOLO.

Date, 6th June, 2023

SUB-COUNTY DIRECTOR OF EDUCTION,
MERTI SUBCOUNTY

RE: RESEARCH AUTHORITY-MISOGA KALVIN GWIYANGA-E60/37410/2020

Authority has been granted to the above named student who is pursuing Master of Education Degree in the Department of Educational communication and pedagogical studies at university of Nairobi.

The title of his research is **"influence of strengthening Mathematics and Science Education on students' academic achievement in physics in Merti Sub-County, Kenya."**
This will run from June to July 2023.
Please accord him any necessary assistance.

CAROLINE MUGOH
COUNTY DIRECTOR OF EDUCATION
ISIOLO

APPENDIX VII: Letter of Authorization by DCC Merti Subcounty

OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR AND
NATIONAL ADMINISTRATION

Telegrams 'DISTRICTER' Isiolo
Telephone: Isiolo 064-52011.
isiolocc@yahoo.com
Fax :064- 52160
When replying please quote

Ref: No: CC/ST. I/7/VOL.I/04

OFFICE OF THE COUNTY
COMMISSIONER
P.O. BOX 3-60300
ISIOLO

5th June, 2023

Deputy County Commissioners
MERTI SUB COUNTY

RE: RESEARCH AUTHORITY – MISOGA KELVIN GWIYANGA – E60/37410/2020

Authority has been granted to the above named student who is pursuing Master of Education Degree in the Department of Educational communication and pedagogical studies at university of Nairobi.

The Title of his research is **"Influence of Strengthening Mathematics and Science Education on student's academic achievement in Physics in Merti Sub County, Kenya".** This will run from June to end of July, 2023.

Please accord him the necessary assistance.

Collins Bett
For: County Commissioner
ISIOLO COUNTY

COUNTY COMMISSIONER
ISIOLO COUNTY
P. O. Box 3 - 60300
ISIOLO