

**THE IMPORTANCE OF STEM EDUCATION IN KISII SCHOOL AND  
SIRONGA GIRLS IN KISII COUNTY**

**BY**

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
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**A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF EDUCATION  
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
**NOVEMBER, 2023**

**DECLARATION**

We hereby declare that this research project is our original work and has not been submitted for the award of a bachelor's degree or any similar purpose in any other institution.


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This project has been submitted with my approval as a University supervisor

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## **ACKNOWLEDGMENT**

We would like to express our sincere gratitude to our supervisor, Mr. Edwin Muna for his invaluable guidance and unwavering support throughout the course of this research project.

## **DEDICATION**

We dedicated this project to our loving parents, Mr. and Mrs. Nyabuari, Mr. and Mrs. Nyabuto, whose unwavering support and encouragement fueled our academic journey. To our cherished friend, Adriellah Kerubo whose belief in us was a constant source of inspiration. Gratitude to all supporters who stood by us, your collective influence shaped this research endeavor.

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## **ACRONYMS AND ABBREVIATIONS**

**K.C.S.E** - Kenya Certificate of Secondary Education

**M.O.E** - Ministry Of Education

**STEM** – Science, Technology, Engineering and Mathematics

## **OPERATIONAL DEFINITION OF TERMS**

**Innovation** Introduction of something new.

**Resources** Materials needed to effectively teach and learn STEM.

**STEM Disciplines** Subjects that are related to STEM example; gaming

**Student Attitude** The way students look at STEM.

## **Abstract**

The level of creativity, innovation and problem solving is measured by the number of creative young professionals who are produced from school each year. The Ministry of education works towards the development a curriculum that is not only academic based but also creative based and gives training to teachers in order to address its need in the country in problem solving. However, the efforts made have not yielded the desired goals as the number of jobless graduates is still high throughout the country especially in Kisii County. The purpose of this study is to investigate the impact of STEM education and its related disciplines in Kisii County. The study is guided by the following objectives; to determine the extent to which STEM education contributes to creativity, to analyze how STEM education contributes to innovation and to determine the extent to which lack of STEM teaching and learning resources contribute to the problems faced in Kisii County. The study findings will be significant to various educational stakeholders such as the ministry of education, teachers, parents and students in determining different ways of developing students' creativity and problem-solving techniques. The study should establish that, STEM education and its disciplines are important towards the development of creativity and problem solving and that students with no access to STEM education face difficulties in the outside world example given; unemployment. Further the study should reveal that STEM education is not wholly taught by secondary schools in Kisii County. The study therefore should conclude that STEM education is a core discipline that unlocks the infinite potentials of the learners hence must be taught well and encouraged. Furthermore, the study should recommend that the school management including the board of governors and the principals should ensure that they put in place the strategies required in ensuring that STEM education is well taught are well developed in schools good. This is achieved when they introduce incentives to teachers and organize science fairs in the schools and also provide required resources needed in teaching and learning STEM education.

## **CHAPTER ONE: INTRODUCTION**

This chapter comprises the background of the study, it contains the statement of the problem, the purpose of the study, the conceptual framework, the research question, the objectives of the study which outlines both the general objective and the specific objectives, the hypothesis of the study, significance of the study, delimitation of the study, limitation of study and the assumption of the study.

### **1.1 Background to the Study**

Our educational system is tasked with preparing the next generation to succeed in life. That's a tall order and will substantially fail if it doesn't teach students how to be more creative and solve problems. The ultimate goal of STEM as a concept and a method of developing knowledge is to develop creativity, problem solving and innovation skills in students which will make them more capable and competitive in the workforce. In STEM, the four disciplines are integrated and this integration approach results in a cohesive curriculum and holistic teaching and learning approaches.

STEM puts emphasis on preparing future generations to be successful in their careers. The skills gained from STEM education extend beyond those needed to be successful in STEM fields, preparing students with varied interests who move into any industry to have valuable skill set that allow them to be successful.

STEM based education teaches students more than science and mathematics concepts. The focus on hands-on learning with real world application helps develop a variety of skill set including creativity and 21<sup>st</sup>- century skills.

21<sup>st</sup> century skills include media and technology literacy productivity, social skills, communication, flexibility and initiative. Other skills attained through STEM education include problem solving, creative thinking, curiosity, decision-making, leadership, entrepreneurship, acceptance of failure and more.

Most of the literature on STEM education mentions training teachers which helps improve their teaching with ICT, or to enhance their teaching capacity in STEM subjects. This helps teachers to explore the abilities of the students not just school wise but also explore their creativity in STEM related disciplines.

STEM discipline like the educational gaming, is interactive and often collaborative nature of education that enables learning by doing complex topic by allowing students

to (repeatedly) make mistakes and learn from them. Real-life based gaming allows experimentation that would otherwise be too costly and dangerous. Gaming can be particularly useful when educating students who would later take careers like architects, engineers, nurses, chemists, doctors or physicists which need the capacity to think and work simultaneously. (Raju, Ahmed and Anumba,2011; Lin, Son and Rojas,2011; Shaffer, forthcoming).

Educational gaming covers specific topics or subject areas and take place within a set of rules can increase students' achievements and subject-specific knowledge (Akisola and Animasahun, 2007; Papastergiou, 2009; Yien et al. 2011; Bai et al, 2012; Shaffer, forthcoming). Constructive education games seem to increase deep learning more than just using existing games (Vos, Meijden and Denessen, 2011).

Such games help students develop a real-life picture of problems they are going to face in the outside world. This will also help students to solve problems around them. In Kisii County, only two schools teach STEM education, this are the schools that this study will mainly focus on and compare to other schools in the county that don't teach STEM education. This study will focus on Kisii School and Sironga Girls Secondary School as they are the only schools that teach STEM education in the county in comparison to Kereri Girls and Nyambaria High School.

## **1.2 Statement of the Research Problem**

This study is set to help get project-based, problem-solving approach into more schools in Kisii County. Kisii as a county is faced with a lot of challenges. Being one of the country's most productive county, it is faced with problems like environmental problems, unemployment, lack of clean drinking water, traffic among many.

This project aims to use STEM disciplines to help students to come up with solutions to solve such problems. Students are allowed to be creative and help in giving solutions to such issues. Out of classroom monotony and the academic based curriculum, here students are supposed to use their own creativity and STEM gained knowledge.

### 1.3 Purpose of the Study

The findings of the study may be helpful to various educational stakeholders such as The Ministry of Education, teachers and even students to be able to understand the contribution of STEM in education.

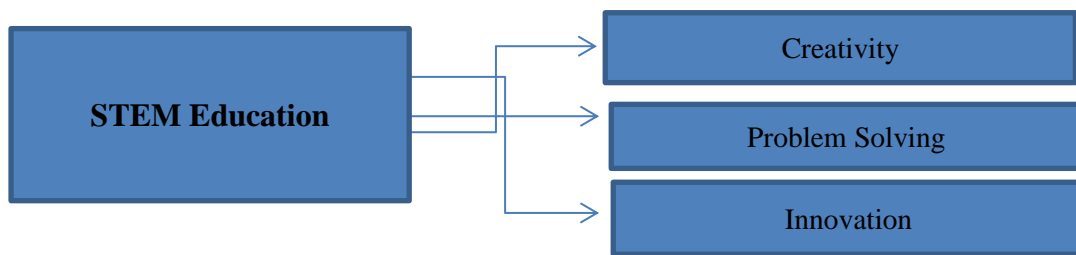
The findings may also help the government of the county of Kisii to be able to encourage the study to help grow a society that is concerned about how to solve the problems being faced in the county.

Furthermore, this research may form the basis for further research and these findings will add to the body of knowledge as STEM education should be embraced fully and this will increase problem solving opportunities not just in Kisii County but also in the country as well.

Finally, this research may be used as a reference point for future researchers.

### 1.4. Conceptual Framework

#### Independent Variable



*Figure 1 conceptual framework*

The conceptual diagram, Figure 1 above shows the interdependence of the study variable. The conceptual framework shows the systematically organized variables interrelations. In the framework, creativity, problem solving, and innovation depend on STEM education.

### 1.5 Research Questions

1. What are the contributions of STEM knowledge in developing the student ability to solve problems?
2. Which are the benefits of STEM knowledge in the development and exploration of students' creativity?

3. In what manner has schools without STEM syllabus contributed to development of innovation in Kisii County?

## **1.6 Objectives of the Study**

### **1.6.1 General Objectives**

To determine the contribution of STEM education in the development of students' creativity, problem solving skills and innovation in schools Nairobi County.

### **1.6.2 Specific Objectives**

1. To determine the extent to which STEM education contributes to creativity in Nairobi County.
2. To analyze how problems faced in Kisii County can be solved by use of STEM syllabus and disciplines.
3. To determine the extent to which lack of proper STEM education leads to more problems faced in Nairobi County.

## **1.7 Hypothesis of the Study**

**H<sub>01</sub>:** There is no significant relationship between STEM education, its disciplines and the problems faced in Kisii County.

**H<sub>02</sub>:** There is no significant relationship between STEM education and creativity of graduates from schools with no STEM syllabus.

**H<sub>03</sub>:** There is no significant relationship between STEM teaching resources and lack of innovation.

## **1.8 Significance of the Study**

The findings of the study may be helpful to various educational stakeholders such The Ministry of Education, teachers and even students to be able to understand the contribution of STEM in education.

The findings may also help the national government to be able to encourage the study to help grow a society that is concerned about how to solve the problems being faced in the county.

Furthermore, this research may form the basis for further research and these findings will add to the body of knowledge as STEM education should be embraced fully and this will increase problem solving opportunities not just in Kisii County but also in the country as well.

Finally, this research may be used as a reference point for future researchers.

### **1.9 Delimitation of the Study**

Even though there are many schools in Kisii County, the study will mainly focus on 4 schools.

Even though STEM education may affect students in different areas, this study will only focus on the students' innovation, creativity and problem-solving abilities.

Furthermore, this research may form the basis for further research and these findings will add to the body of knowledge as STEM education should be embraced fully and this will increase problem solving opportunities not just in the county of Nairobi but also in the country as well.

### **1.10 Limitation of the Study**

In data collection, the study will rely mostly on questionnaires which will include self-assessment measures of teachers and students. As pointed out by Sharma (2018), research has shown that individuals tend to overrate themselves on desirable traits and underrate themselves on undesirable. This means that some teachers could overrate their competency in some areas of management which may lead to the wrong conclusion that there is no effect of the identified factors on underperformance. This will necessitate the use of other data samples collection methods such as use of interviews to help get more accurate answers.

### **1.11 Assumption of the Study**

This study will be based on the following assumptions; the respondents would give honest, reliable, and accurate responses, understands the state of facilities in the school and the instruments to be used would give reliable and valid feedback.



## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

This chapter reviews literature related to the importance of increasing more STEM teaching schools to increase the level of creativity, innovation and problem skills in students. A theoretical review of research work done by other scholars shall be shown.

### **2.2 Creativity and Innovation in Academics**

Creativity and innovation provide a deeper understanding of concepts. Teachers and schools, employing a creative, experimental form of teaching, develop thinkers who are capable to explore their varied interests utilizing their own strengths. These creative methods are essential and helpful in developing young learners into creative, knowledgeable, and independent thinkers who are not shy to express themselves.

It's essential to develop an educational system that nurtures and cultivates creativity among students. Students need to be creative and adaptable to prepare themselves for life beyond the classroom.

#### **The Benefits of in Creativity and Innovation in Academics**

**Helps in Expressing Opinions:** Creativity and innovation help kids in expressing their opinions and emotions through new and expressive ways of music, dance, theatre, art projects, etc. This enhances and enables the emotional development of students and helps them in realizing their hidden potential.

**Builds a Successful Career:** By making the course curriculum creative enhances the understanding of subjects beyond books. Students learn to know the real-life application and implementation of various subjects and understand their significance. It also adds a spark to the classroom.

**Creative Students are Happy:** Creativity gives the freedom and exposure to students to express themselves, and thus they are found to be happier. They are able to find multiple solutions to a problem and invent strategies to deal with unexpected and complex situations.

**Provides a Deeper Understanding of Concepts:** Making any lecture or assignment creative brings out the fun part, and when students enjoy their work, they understand in

a better way. With being creative, one can think of multiple solutions to solve a problem.

Easy Communication: Creative students find it easy to communicate with others and share his/her experiences freely that might seem difficult otherwise. A creative classroom is helpful in providing endless opportunities for innovative thinking, group problem solving, and shared learning experiences.

According to Kajal Sharna, Innovating and being creative allows us to better understand concepts. By utilizing a creative, experimental method of teaching, schools develop thinkers who are able to use their own strengths to explore their varied interests. It is essential and helpful for young learners to learn these creative methods in order to become able to think independently, independently, and creatively in the future. If you are interested in knowing what is the importance of creativity and innovation in academics, here we provide you with a complete guide.

Developing a system of education that fosters and cultivates creativity among students is essential. In order to achieve success outside the classroom, students must be creative and adaptable.

The best classroom environment is one that has some elements of creativity that make lessons more engaging and interactive. Students who are given the right mix of creativity and curriculum are more likely to learn new things and be innovative. Through communication skills and social skills development, students can become good communicators. Learning can be transformed in creative classrooms by giving students the opportunity to apply what they've learned in their real lives. The development of a student's emotions depends in part on their ability to express themselves creatively.

There are several theories, which the scholars have used to explain the concepts of creativity, innovation and change include, including the Jenga theory of creativity, which this research will mainly focus on (Noe, 2009).

### **The Jenga Theory of Creativity**

The theory suggests that creativity and innovation involve the addition and subtraction of issues and objects to make a completely new, and complex one that overcomes the limitations of the previous aspects (Almekinders, Beukema & Tromp, 2008). Besides the subtraction of elements is more pronounced than the ones added. The theory is most concerned with the outcome other than the input because some of the contributions

could be removed for a better product. Indeed, while constructing a new idea or product, one needs to include numerous opinions and elements respectively as possible, provided that the focus remains on the intended outcome that the innovator is working on.

Each person has a way of creating unique objects using, with some applying the experimental means of overcoming the failures during the process. Through creativity, the person can learn the simpler ways of doing things. The intended results are achievable after persistence trials and mistakes, which make the inventor learn the most appropriate ways of nurturing the elements to achieve desirable and great objects.

## **2.2 Problem Solving in Students**

Students develop problem-solving skills at different rates; nevertheless, it is imperative that students learn to tackle problems with grit and creativity, especially as they learn to cope with setbacks or resolve conflict. Moreover, problem solving is one of the most important skills students can develop, because it prepares them to face increasingly complex academic and interpersonal issues as they mature.

Experts agree that the ability to meet challenges confidently is “a critical skill for school readiness.” In many cases, students learn by watching parents or caregivers solve problems.

This study will explore three benefits of learning problem-solving skills at school:

Improved Academic Performance

Increased Confidence

Career Readiness

Why is Problem Solving Important in Child Development?

The earlier a student begins solving problems, the more ready they are to deal with bigger challenges as they mature.

By introducing problem solving skills in the classroom, students learn to think in terms of manageable steps as they:

1. Identify Problems
2. Brainstorm Possible Solutions

3. Test Appropriate Solutions
4. Analyze Results

By viewing problems as opportunities to grow, students broaden their understanding while building confidence. The classroom is a safe, controlled environment, with experienced teachers who direct students as they hone problem-solving skills.

A good curriculum knows that problem solving is important in student's development. Therefore, we incorporate problem-solving exercises into a wide range of classes. STEM's goal is to ignite intellectual inquiry by combining problem solving with creativity, collaboration, and communication, thereby empowering our students to become actively engaged global citizens.

#### Problem-Solving Skills Improve Academic Performance

One reason that problem solving is important in child development is that it teaches discernment, helping young people distinguish what is a solvable problem.

Problem solving also develops grit, a trait that successful students routinely display. Often, it takes an entire team to solve a problem. Since it can feel intimidating to collaborate or ask for help, the classroom is a perfect space to take risks. Together, students learn how to ask determining questions, such as:

Why is this situation so challenging?

Do I know how to address the problem?

Who can help me find a workable solution?

Students who learn how to solve problems have a deeper understanding of cause and effect. Teachers often urge students to look for patterns or make predictions. Problem-solving skills, then, boost reflective, critical thinking.

#### Problem-solving Skills Build Confidence

Solving problems means making choices. Typically, effective problem-solving skills result in "happier, more confident, and more independent" individuals. When students tackle problems on their own, or in a group, they become resilient. They learn to look at challenges from a fresh perspective. Therefore, they take more calculated risks.

Problem solving is important in student's development because confident, capable students usually grow into confident, capable adults. If students practice problem solving consistently, they can develop greater situational and social awareness. Additionally, they learn to manage time and develop patience.

As students mature, problems they face become more complex:

How do I make lasting friendships?

How can I bring justice to my community?

Which career suits my abilities and interests best?

STEM recognizes the need for practice; no one masters problem solving overnight. Consequently, it teaches secondary school students how to solve problems in the real world.

Here are a few middle school electives that focus on critical thinking, thus enhancing students' confidence:

As students develop their problem-solving skills, they learn to rely on independent, creative thinking, which enhances their sense of independence; these skills, then, prepare students for life and future careers.

#### Problem-Solving Skills Prepare Students For Future Careers

Students who learn how to solve problems when they are young tend to appreciate lifelong learning. They are curious, motivated, and innovative. Employers want new hires to think imaginatively, especially since many problems that society faces today are new.

The push for STEM programs in schools reflects this trend. For instance, coding requires students to envision a goal, then identify logical steps, and plan ahead. Coding also requires persistence, which means that students must be able to power through failure.

Notwithstanding the need for personal excellence, employers also really want team members. Taking classes that encourage group problem solving can be invaluable as

students look ahead to college and careers. As a result, students participate in academic teams that build leadership through problem-solving activities.

STEM prepares students to enter the workforce. Problem solving is important in child development because it trains young people to think independently and to collaborate. STEM graduates are ready to enter adulthood because they know how to solve problems.

### **2.3 Teaching and Learning Resources and the Performance of Mathematics.**

A school must have to fulfill certain minimum and core resources. Absence of them affects the quality of education and consequently the effectiveness of the teacher and the students. Teaching and learning resources can be defined as the spectral of education resources used by the teacher in teaching and learning to achieve a certain objective during the lesson planning stage. It can be considered as vessels used by the teacher to facilitate learning effectively. They include maps, charts, diagrams, books, overhead projectors, slides, blackboard, chalkboard, chalk and felt pens.

Classroom as a teaching and learning resource is like a workshop for students' future as the destiny of the mathematics teachers are often required to combine their expertise in mathematics subject knowledge with pedagogy and more recently with integration of digital resources and technology in a productive manner. In these, lots of mathematical thinking is required. The availability of digital resources and technology impact on teachers' practices (Clark-Wilson et al., 2015) and creative mathematics thinking is vital in adapting to the evolution of teachers' practices occasioned by the presence of these technologies nation is shaped in the classroom (Kothari commission, 2014). It acts as an experimental laboratory for classroom learning and teaching. So, the importance of the classroom for the efficiency of education is understood. Classrooms should be equipped well in order to serve the growing need of education. It should be furnished in a manner that creates a genuine curiosity, interest and motive of the learner. The current individual learning and teaching replaces the collective teaching.

As such traditional classrooms have been transformed into laboratory environments where teachers and students can actively participate. There should be provision of good light and ventilation in the classroom and ensure that light does not make a reflection on the background to cause inconveniences. Moreover, we must ensure that rooms are

free from noise and sounds that come from neighboring classes to reduce disturbances. Developing the classroom as a teaching resource is upon the teacher's competency, knowledge or expertise. Richardson, (2006) asserted that the role of a teacher is a key determinant in the implementation of any classroom innovation. The teacher makes the learner oriented.

A blackboard also acts as a teaching resource. If a teacher is capable of using a blackboard, the other resources become secondary. The use of blackboard enhances the teaching expertise of the teacher though some ignore its importance. It can be used in different contexts; important points of the content can be written; teachers can draw diagrams and solve mathematical problems.

Library is another teaching and learning resource. It can be described as the silent teacher for students. Modern education has not only become student-centered but also library-centered too. In the method of self-learning, it plays a significant role to the learners. Learners may go to the library to collect necessary information, make analysis and verify the knowledge acquired in learning mathematics. A resourceful library acts as a powerful motivating force for studies and research. It creates a tendency to know and develop reading habits in students. Further, it is of great help to achieve the roles of a teacher in renewal of his or her knowledge to make it useful for the students. To create interest to the students, the librarian should organize book exhibitions in school premises from time to time.

Teaching and learning aids serve to clear the difficult concepts of mathematics in the minds of the learners. They facilitate learning by doing or self-learning through self-activity. There should be an arrangement of education technology like projectors, screens, films and slides with electrical outfits to ensure the visual effects of education. Students get first-hand experience by using real objects, persons and events around them. Teachers should try to show the real objects to students while teaching so that they get direct experience while teaching for the students to get the concepts they are expected to learn. For instance, while teaching the concept of angles, the teacher ought to show it by asking each student to have a complete geometrical set. There is a saying; I hear I forget, I see I remember, I do I understand. We remember 20% of what we hear, 30% of what we see, 50% of what we see and hear but we remember 90% of what we do They also serve to make the lesson interesting. For communication to be effective, the lesson should be as per the interest of the learner and stimulate the learner. They

also help the facilitator to deliver the lesson successfully and effectively as the facilitator is able to express the intended concept effectively.

Learning materials are used to achieve certain objectives. Full use of the learning and teaching material should be used so as to achieve the stated objective. The materials should be adapted to suit the knowledge and ability of learners, what background the learners come from and what learning and teaching resources they are used to.

To identify the teaching and learning materials to use, the teacher needs to choose a topic, make a plan and identify the resources available. The teaching and learning aids should be found locally, easy to carry, simple and adaptable to local conditions, enable everyone to participate actively in the classroom and allow learners to relate what is being taught to real life situations. When a concept is abstract, a child may not be able to understand. The locally made teaching and learning material can easily substitute expensive ones which are not available. In case we buy expensive teaching and learning materials, maintenance can be difficult for a teacher. So, we use the locally available teaching and learning materials for class.

Developing skills for making teaching and learning materials reduces dependence on other people's skills. When we are able to do a certain task by ourselves, we are not depending on anybody, hence carrying the task easily. Ability to identify various types of teaching and learning materials make the facilitators and learners adapt to any classroom situation. The teaching and learning materials are mostly used by learners though both learners and teachers use them. Teaching becomes interesting when the learners use reasonable teaching aid which can be seen easily by the learner. The size of the material should be big enough so that the learner can read what is written and see what is shown. No student should strain to see what is written, since when we see we can understand. Learners should be able to handle the material themselves. For by experimenting, they are able to learn a lot and concepts can stick for the long time.

#### **2.4 Teaching and Learning Resources and the Importance of STEM**

A school must have to fulfill certain minimum and core resources. Absence of them affects the quality of education and consequently the effectiveness of the teacher and the students. Teaching and learning resources can be defined as the spectral of education resources used by the teacher in teaching and learning to achieve a certain objective during the lesson planning stage. It can be considered as vessels used by the teacher to



facilitate learning effectively. They include maps, charts, diagrams, books, overhead projectors, slides, blackboard, chalkboard, chalk, felt pens and other STEM related resources such as LEGO toys.

Classroom as a teaching and learning resource is like a workshop for students' future as the destiny of the STEM teachers are often required to combine their expertise in STEM disciplines and more recently with integration of digital resources and technology in a productive manner. In these, lots of critical thinking is required. The availability of digital resources and technology impact on teachers' practices (Clark-Wilson et al., 2015) and problem solving is vital in adapting to the evolution of teachers' practices occasioned by the presence of these technologies nation is shaped in the classroom (Kothari commission, 2014). It acts as an experimental laboratory for classroom learning and teaching. So, the importance of the classroom for the efficiency of education is understood. Classrooms should be equipped well in order to serve the growing need of education. It should be furnished in a manner that creates a genuine curiosity, interest and motive of the learner. The current individual learning and teaching replaces the collective teaching.

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Library is another teaching and learning resource. It can be described as the silent teacher for students. Modern education has not only become student-centered but also library-centered too. In the method of self-learning, it plays a significant role to the learners. Learners may go to the library to collect necessary information, make analysis

and verify the knowledge acquired in learning mathematics. A resourceful library acts as a powerful motivating force for studies and research. It creates a tendency to know and develop reading habits in students. Further, it is of great help to achieve the roles of a teacher in renewal of his or her knowledge to make it useful for the students. To create interest to the students, the librarian should organize book exhibitions in school premises from time to time.

Teaching and learning aids serve to clear the difficult concepts of STEM in the minds of the learners. They facilitate learning by doing or self-learning through self-activity. There should be an arrangement of education technology like projectors, screens, films and slides with electrical outfits to ensure the visual effects of education.

Students get first-hand experience by using real objects, persons and events around them. Teachers should try to show the real objects to students while teaching so that they get direct experience while teaching for the students to get the concepts they are expected to learn. For instance, while teaching the concept of angles, the teacher ought to show it by asking each student to have a complete geometrical set. There is a saying; I hear I forget, I see I remember, I do I understand. We remember 20% of what we hear, 30% of what we see, 50% of what we see and hear but we remember 90% of what we do. They also serve to make the lesson interesting. For communication to be effective, the lesson should be as per the interest of the learner and stimulate the learner. They also help the facilitator to deliver the lesson successfully and effectively as the facilitator is able to express the intended concept effectively.

Learning materials are used to achieve certain objectives. Full use of the learning and teaching material should be used so as to achieve the stated objective. The materials should be adapted to suit the knowledge and ability of learners, what background the learners come from and what learning and teaching resources they are used to.

To identify the teaching and learning materials to use, the teacher needs to choose a topic, make a plan and identify the resources available. The teaching and learning aids should be found locally, easy to carry, simple and adaptable to local conditions, enable everyone to participate actively in the classroom and allow learners to relate what is being taught to real life situations. When a concept is abstract, a child may not be able to understand. The locally made teaching and learning material can easily substitute expensive ones which are not available. In case we buy expensive teaching and learning materials, maintenance can be difficult for a teacher. So, we use the locally available teaching and learning materials for class.

Developing skills for making teaching and learning materials reduces dependence on other people's skills. When we are able to do a certain task by ourselves, we are not depending on anybody, hence carrying the task easily. Ability to identify various types of teaching and learning materials make the facilitators and learners adapt to any classroom situation. The teaching and learning materials are mostly used by learners though both learners and teachers use them. Teaching becomes interesting when the learners use reasonable teaching aid which can be seen easily by the learner. The size of the material should be big enough so that the learner can read what is written and see what is shown. No student should strain to see what is written, since when we see we can understand. Learners should be able to handle the material themselves. For by experimenting, they are able to learn a lot and concepts can stick for the long time.

## **2.5 Summary and Research Gaps**

This chapter looked at the importance of STEM. It focuses mainly on the three major importance of studying STEM education which are creativity, problem solving and innovation.

The literature review shows that there is a lot that STEM education contributes in the development of students. It shows the need for research on the three major contributions of STEM in education which are developed by the two schools teaching STEM education to their students. The available literature had looked at (creativity, problem solving and innovation) contributing to the development of students in Kisii County.

Researchers are therefore interested in finding out the contribution of STEM education (creativity, problem solving, and innovation) contributing to the proper development of students in Kisii School and Sironga Girls Secondary School in Kisii County in Kenya.

## **CHAPTER THREE**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.0 Introduction**

This section outlines research method and design to be applied. The chapter describes the study design applied and the target population. In addition, the chapter gives the sampling design the instruments used and the reliability and validity of instruments, data collection procedures to be used and data analysis methods to be used.

#### **3.1 Research Design**

The study will employ a descriptive survey research design. Descriptive survey design is a method of collecting information by interviewing or administering questionnaires to a sample of individuals hence suitable for extensive research. It is an excellent vehicle for the measurement of characteristics of a large population (Orodho, 2005). It maintains a high level of confidentiality, is convenient and enables data to be collected faster, enables questions to be asked personally in an interview, or impersonal through a questionnaire about things that cannot be observed easily. It also allows the study to get an accurate view of response to issues as well as test theories on the social relationship at both the individual and group level (Kothari, 2018).

#### **3.2 Study Area**

This study will be carried out in Kisii School and Sironga Secondary School, Kisii County, Kenya.

Singleton (2019), advises that the ideal setting for any study should be easily accessible to the researcher and should be that which permits instant rapport with the informants. Kisii School and Sironga Girls Secondary School have been chosen by the researcher because they are easily accessible and are the only STEM offering schools in the county.

### 3.3 Target Population

The target population is defined as all the members of a real or hypothetical set of people, events, or objects to which a researcher wishes to generalize the results of the research study as indicated by Borg and Gall (2007).

The target population for this study consists of a principal, teachers and support staff and students.

### 3.4 Sampling Techniques

According to Salome (2019), a sample is a small group of accessible population. Sampling refers to a process of selecting a sample from a finite population with the intent that the sample accurately represents that population, Borg and Gall (2019).

Sampling techniques are important to establish the representativeness of the sample for generalization.

The researcher will use random sampling as the best form of sampling as it allowed all members of the population to have an equal and unbiased chance of appearing in the sample.

### 3.5 Sample Size.

The sample consists of 331 respondents (10 Principals, 30 Teachers, 10 Support staff (librarian and secretaries), and 612 Students).

Description	Target Population	Sample size
(50% of the target population)		
Principals	10	5
Teachers	30	15
Support staff (librarians and secretaries)	10	5
Students	612	306
<b>TOTAL</b>	<b>662</b>	<b>331</b>

*Table 1 sample size*

### 3.7 Research Instruments

The data will be collected using questionnaires for teachers and students, and interviews for principal and support staffs (librarian and secretaries).

### **3.7.1 Questionnaires**

The questionnaires will be used for collecting data because it offers considerable advantages in the administration. It also presents an even stimulus potentially to large numbers of people simultaneously and provides the investigation with an easy accumulation of data.

The researchers believe that questionnaires will give respondents the freedom to express their views or opinion and also to make suggestions. It is also anonymous. Anonymity helps to produce more candid answers than is not possible in an interview.

### **3.7.2 Interview Schedule**

The researchers will interview the principal and support staffs (librarian and secretaries) using interview guide.

### **3.8 Validity of Measurement**

Validity is the appropriateness, meaningfulness, and usefulness of the inferences a researcher makes (Orodho, 2005). This will be established to ensure the clarity and suitability of language to be used in the pilot study by the researchers.

Validity refers to the extent to which a test measures what the researchers' wishes to measure (Kothari, 2018). To ensure that the instruments were valid that is, whether they measured what they ought to measure, the researchers will refer to the work done by several scholars in the literature review and sought assistance from the university research supervisors and other research experts.

### **3.9 Reliability of Measurement**

Reliability is the degree to which a research instrument yields consistent results after repeated tests (Salome, 2019). Test-retest is a technique of applying the same test twice to the same group. Use of graphs and charts will be employed which will establish the extent to which the contents of the questionnaires will be consistent in eliciting the same responses, every time the instrument will be administered.

### **3.10 Data Collection**

The researchers will submit a letter of permission to the institution which will allow them to conduct their research study. The researchers will personally administer the questionnaires to teachers and students and also interview principal and support staffs in Kisii School and Sironga Girls Secondary School. The respondents will be assured that strict confidentiality will be maintained in dealing with the responses.

### **3.11 Data Analysis**

Data analysis is the process of bringing meaning to raw data collected (Salome, 2019). After collecting data, there was cross-examination to ascertain their accuracy, competencies and identify those items that were wrongly responded to, spelling mistakes, and blank spaces.

Qualitative data will be analyzed qualitatively using content analysis based on analysis of meanings and implications emanating from respondent's information. On the other hand, quantitative data will be analyzed using various statistics including measures of central tendency and dispersion.

Descriptive (frequency distribution table, graphs and charts) will be used to analyze the data that will be collected during the study. The research questions will seek to establish the importance of STEM education in the development of students.

### **3.12 Ethical and Logistical Considerations**

Some of the various ethical and logistical considerations will be adhered to are as follows: The questions that are both in the research questionnaire and that of the research interview guide will not infringe on the respondent's privacy, the researchers will ensure high level of data privacy and confidentiality will be maintained and the findings will only to be used for academic purposes, the researchers will ensure the consent of respondents, and the respondents will be permitted to answer the questions they will be willing to answer.

## **CHAPTER FOUR: FINDINGS AND DISCUSSIONS**

### **4.0 Introduction**

This chapter outlines the research findings of the survey and presents them in frequency tables and charts. It also contains the analysis and interpretation of the descriptive research findings. The general objective of the study was to determine the importance of STEM education in Kisii school and Sironga Girls secondary Kisii county, Kenya.

The findings of the research are presented based on the following specific objectives;

1. To determine the extent to which STEM education contributes to creativity in Kisii school and Sironga girls high school Kisii county.
2. To analyze how problems faced in Kisii county can be solved by use of STEM syllabus and disciplines.
3. To determine the extent to which lack of proper STEM education leads to more problems faced in Kisii County.

Data analysis was done through Statistical Package of Social Science (SPSS). Frequencies and percentages were used to display the results which were then presented in tables and charts.

### **4.1 Response Rate**

Completion rate is the proportion of the sample that participated as intended in all the research procedures. From the sample size of two hundred and seventy three respondents which included the principal, thirteen teachers, 3 support staff (librarian and 2 secretaries) and two hundred and fifty six students, a total of two hundred and thirteen respondents responded forming a response rate of 78.02%. The information is shown in table 4.1 below.



## 4.2 Descriptive Statistics

Research data was collected and analyzed according to the variables used in the research study which are, motivation, attitude and teaching and learning materials.

### 4.2.1 Determine the Extent to which STEM Contributes to Creativity.

The first research hypothesis sought to determine whether there was any significant relationship between creativity and problems faced in Kisii County, Kenya. In establishing this hypothesis, the teachers and students were given a list of items in a table regarding the contribution of creativity in the problems faced. They were required to rate their agreement levels with the items on a five-point like scale ranging from strongly disagree to strongly agree. The mean and standard deviation of their responses are recorded in Table 4.2 below.

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Standard deviation</b>
Volunteer					
To					
creativity	70	1	5	2.74	1.3594
Seeking					
feedbacks		1	5	2.57	1.4015
Being					
creative	70	1	5	2.64	1.3631
valid N					
	70				

*Table 2 Descriptive statistic*

The findings of this research show that the overall mean obtained from creativity is 2.65 and  $SD=1.375$ . This means that creativity is a very strong factor contributing to problems faced in Kisii County. Students volunteer to creativity scored the highest mean of 2.74 with a standard deviation of 1.3594 and students seeking feedback had the lowest mean of 2.57

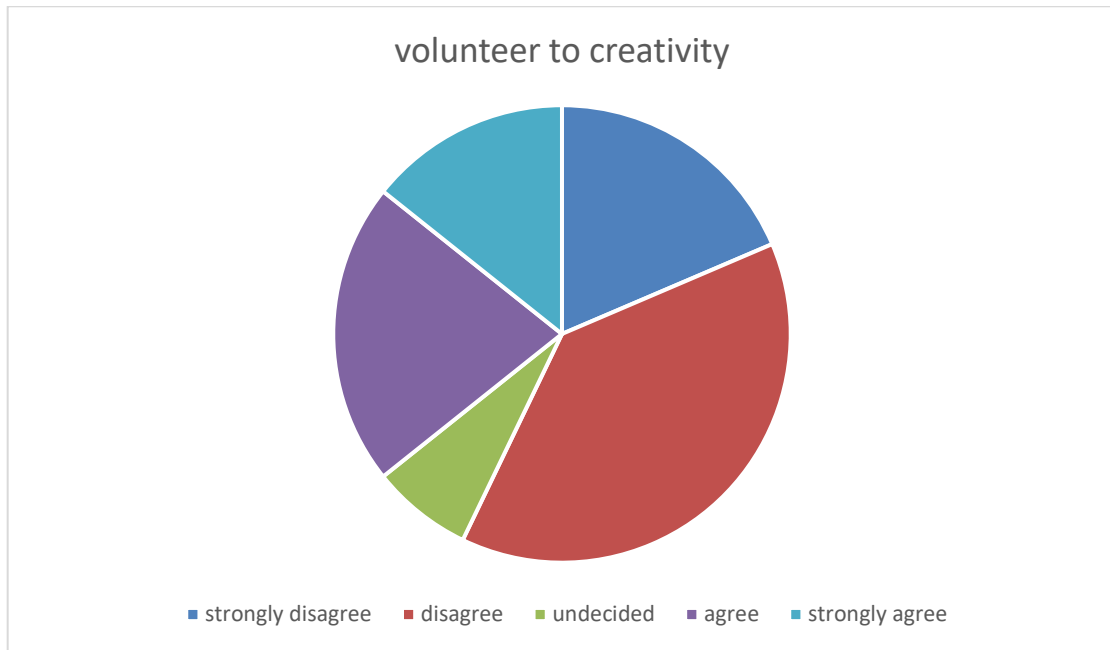
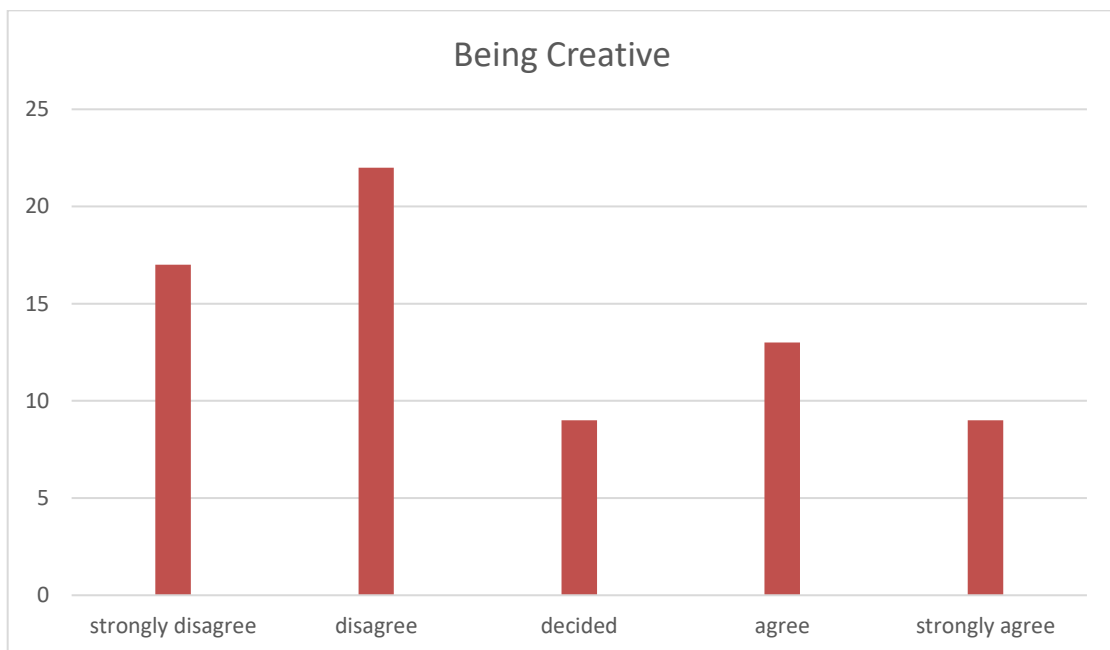


Figure 2 volunteer to creativity



### *Figure 3 being creative*

From the interviews, the principal and support staff (librarian and secretaries) confirmed that volunteer to creativity, seeking feedback and being creative contributes to problems faced since teachers together with students lack the drive to be creative thus leading to problems faced in Kisii county. The researchers therefore agreed with Margues, 2010 who defines motivation as what causes people to be active and execute their roles or duties effectively and better in any task or activity given.

According to the findings, researchers agreed with Gallup, (2013) who summarizes that without motivation, only 13% of the workers engage at work, 63% are not engaged at work and are less likely to put their efforts at work and 24% are likely to spread negativity to others. For example, lack of creativity may be the cause of more problems faced in Kisii county. In all areas, creativity is the pillar in realizing the best performance of the workers and in this context the students. It is seen that without creativity in a school, performance of students, teachers and even subordinate staff will go down. Since creativity is a main item in realizing the better performance, the school principal, the board of governors and the board of management must be able to analyze what is connected to creativity and what is dependent on the whole process. The distribution of relationship between problems faced and creativity among the respondents in Kisii School and Sironga high school was significant depending on the motivation factor. Therefore, the hypothesis that there is no significant relationship between motivation and students' underperformance in mathematics was therefore rejected.

#### **4.2.2 Innovation**

The second research hypothesis sought to find out whether there is any relationship between innovation and the problems faced in Kisii county, Kenya. In establishing this

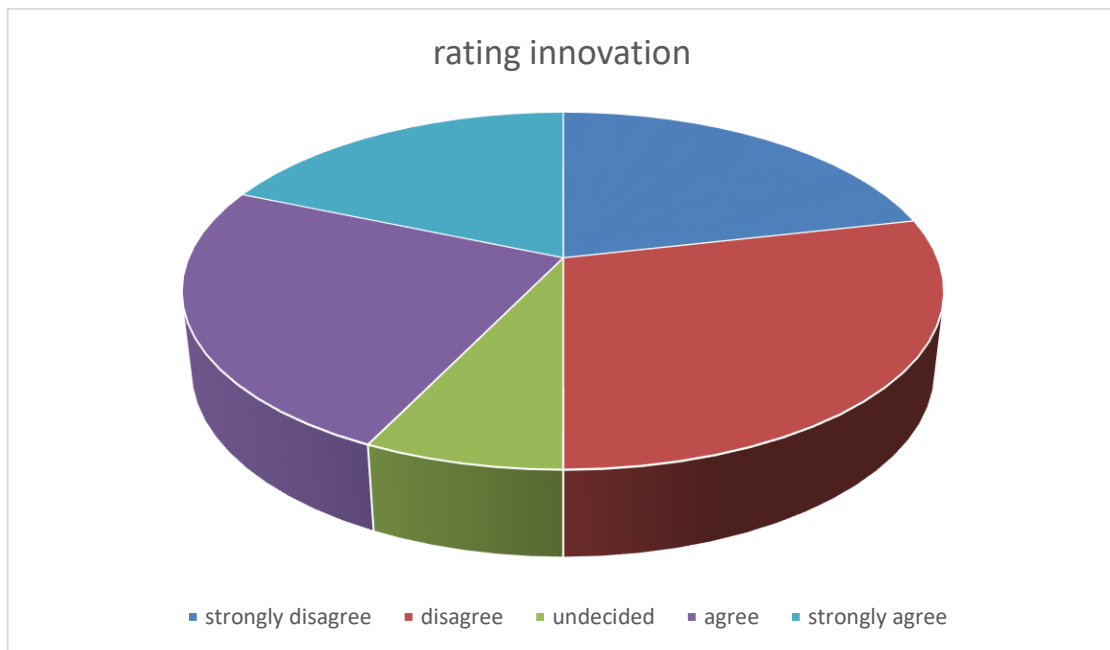
hypothesis, the researchers gave a list of items to students and teachers regarding the contribution of attitude to the performance of mathematics. They were required to rate their agreement levels on a five-point like scale ranging from strongly disagree to strongly agree. Their response mean and standard deviations are rated in the table 4 below.

Descriptive Statistics

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Standard Deviation</b>
Rating					
innovation	70	1	5	2.90	1.466
Ability to be innovative	70	1	5	2.66	1.538
Valid N (listwise)	70				

*Table 3 Innovation*

The findings of this research shows that the overall mean obtained for innovation was 2.78 and the standard deviation of 1.502. This means that innovation is a key factor in the problems faced in Kisii county. The item rating innovation score highest with the mean of 2.90 and standard deviation of 1.466 while the item ability to be innovative scored lowest with a mean of 2.66 and standard deviation of 1.538.



*Figure 4 rating innovation*

Researchers agreed with Mohammed and Waheed (2011), that understanding innovation and its contribution to problem solving, there are three factors to be considered since they play a vital role in influencing the students. These factors are; factors associated with students themselves including self-support, factors that are associated with the school including teacher and teaching materials, classroom, teacher knowledge towards innovation and finally the factors from home such as parental expectations and occupations.

From the finding researchers discovered that the conception that students hold about innovation has determined their approach towards problem solving leading them to either being productive or non-productive orientations. Researchers discovered that students approach innovation in a procedural and rule-oriented which prevents them from experiencing the richness of problem-solving approaches that could be used to develop competence in mathematics.

### 4.2.3 Problem Solving

The last research hypothesis sought to find out whether there is any relationship between problem solving and problems faced in Kisii county, Kenya. To establish this hypothesis, the teacher and students were given a list of items in a table regarding the contribution of problem solving. They were required to rate their agreement levels with the items on a five-point like scale ranging from strongly disagree to strongly agree. The mean and standard deviations of their responses are presented in table 3 below.

#### Descriptive Statistics

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Standard Deviation</b>
Coming up with solutions	70	1	5	2.34	1.382
Implementation of solutions	70	1	5	2.39	1.407
Problem solving materials	70	1	5	2.39	1.311
Valid N (list wise)	70				

*Table 4 Problem Solving*

The third most important factor contributing to problems faced is ability to come up with problem solving ideas. The items related to this factor is that has the highest mean are coming up with solutions and implementation which have the mean of 2.39 each

with the standard deviations of 1.407 and 1.311 respectively. The item with the lowest mean is problem solving materials with 2.34, a standard deviation 1.311.

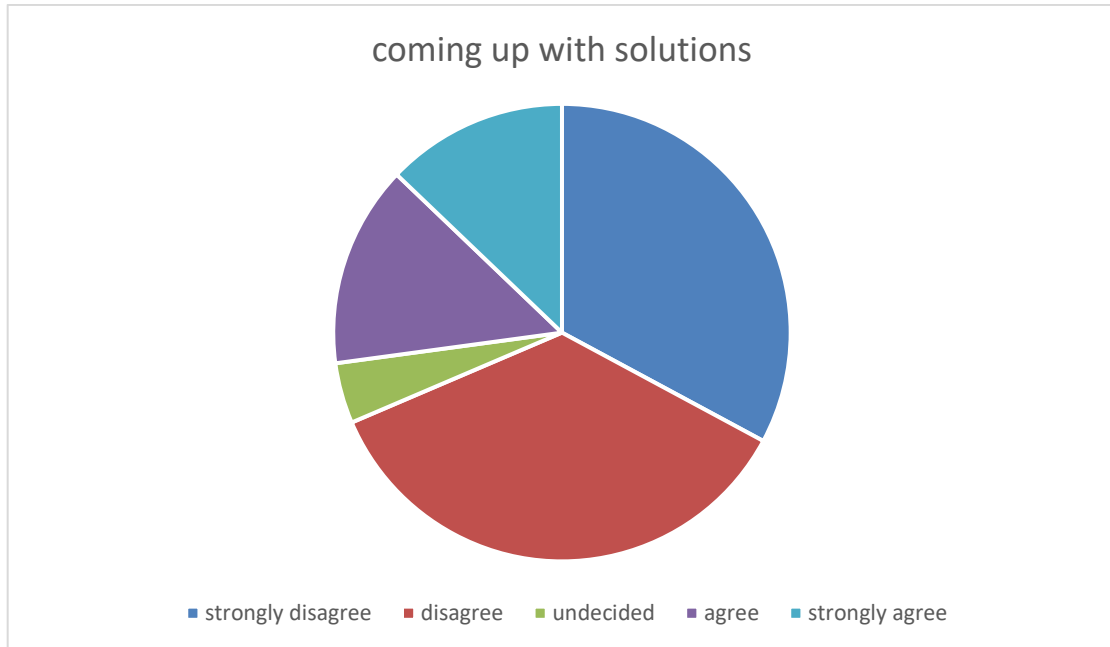
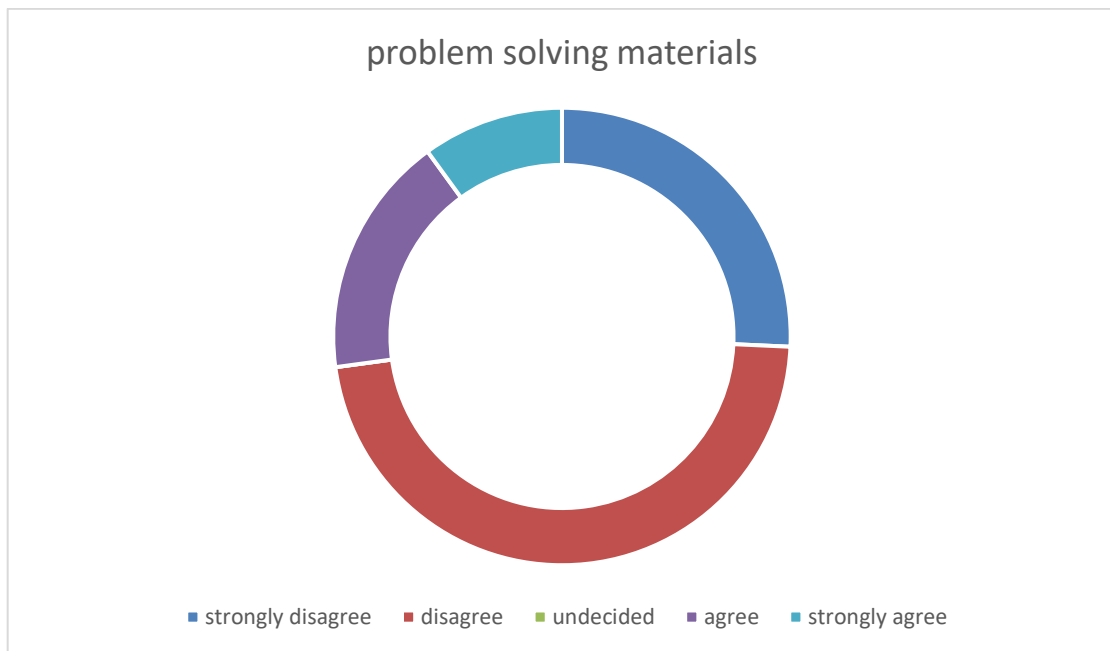


Figure 5 coming up with solution

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	18	25.7	25.7	25.7
Disagree	33	47.1	47.1	72.8
Undecided	0	0.0	0.0	72.8
Agree	12	17.2	17.2	90.0
Strongly agree	7	10.0	10.0	100.0
<b>TOTAL</b>	<b>70</b>	<b>100</b>	<b>100.0</b>	

Table 5 coming up with solution

Table 4.12 shows the frequency table of respondents on implementations. The scale ranged from 1-5, 1=strongly disagree, 2=disagree, 3=undecided,4=agree, 5=strongly agree. Most of the respondents disagreed that there is implementation with a frequency of 52(72.8%). Those that agreed had a frequency of 18(27.2%). There was no respondent who was undecided among those that filled the questionnaires.



*Figure 6 problem solving*

From the interviews, the principal and support staff indicated that lack of problem-solving materials may be a factor that contributes to problems faced.

### 4.3 Test of Hypothesis

The study used descriptive statistics (frequency distribution tables, graphs and charts) to test the importance of the independent variables as follows:

Ho1 There is no significant relationship between STEM education, its disciplines and the problems faced in Kisii county.



Ho2. There is no significant relationship between STEM education and creativity of students from schools with no STEM disciplines.

Ho3. There is no significant relationship between STEM teaching resources and lack of innovation.

## **CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS**

### **Introduction**

This chapter presents the summary the study's findings, conclusion, recommendations and suggestions for further studies.

### **5.1 Summary of the Findings**

The general objective of the study was to investigate the importance of STEM education in Kisii County in Kisii School and Sironga girls' secondary school, Kisii County, Kenya. Two hundred and thirteen respondents participated in in the study comprising of principal, ten teachers, two support staff and two hundred students. Given below is the summary of the key study findings.

#### **5.1.1 Creativity**

The study revealed that STEM education has greatly influenced the creativity of students. The mean score ranged from 2.74 to 2.57. From the frequency distribution table, many respondents disagreed about motivation being in school in terms of volunteering to do assignments, seeking feedbacks and taking initiatives.

In addition, the principal and support staff confirmed that STEM education is a key factor contributing to creativity of students in the school. Therefore, the hypothesis that there is no significant relationship between STEM education and creativity was rejected.

#### **5.1.2 Problem-Solving**

The study findings revealed that STEM education contributes to problem-solving in Kisii school and Sironga girls' secondary school Kisii County. The mean score ranged

from 2.90 to 2.66. Respondents agreed that STEM education is rated lowly in the school and also a course related to STEM is not pursued at the higher levels of learning. This was from the questionnaires that were filled by the respondents.

The principal and support staff confirmed that STEM education has improved students' ability to solve problems. The hypothesis that there is no significant relationship between STEM education and problem-solving was therefore rejected.

### **5.1.3 Innovation**

The study findings revealed that STEM education contributes to innovation among students in Kisii School and Sironga girls' secondary school Kisii county. Respondents disagreed that there are many innovative students outside STEM education.

The principal and support staff in addition accepted that the school lack of a proper STEM curriculum has made it hard for students to be innovative. The hypothesis that there is no significant relationship between STEM education and innovation was therefore rejected.

## **5.2 Conclusions of the Study**

From the study findings, all the hypotheses were rejected. The researchers concludes that creativity is the highest importance of STEM education since it had an overall mean of 2.75 with standard deviation of 1.502, followed by problem-solving which had an overall mean of 2.65 with standard deviation of 1.375 and lastly innovation which had an overall mean of 2.37 with a standard deviation of 1.367 in Kisii school and Sironga girls' secondary school Kisii county, Kenya.

STEM education is the basis for the advancement of technology and science. It provides knowledge that helps in enhancing socio-economic developments of the community. It also predicts and explains patterns to clarify the meaning of issues of life. STEM

education helps most importantly in development of creativity, problem-solving abilities and innovation.

For better results in STEM education, performance in, the principal, teachers, students, parents and support staff must work as a team. The principal must first and foremost conceive the idea and relate such idea to his/ her staff and expect response. He or she should not work alone.

### **5.3. Recommendations of the Study**

From the above findings, the researchers therefore recommend that:

The principal and teachers should ensure that STEM education is given first priority during the allocation for remedials in order to realize better performance.

Better performance in STEM education is realized when the attitude of students and teachers is changed. This can be done through the invitation of guest speakers who will discuss about the importance of STEM education to a student's day to day life. It can also be made better through motivation of both teachers and students. This can be achieved through intrinsic form of motivation and the extrinsic form of motivation. Teaching and learning resources should be bought or requested from the government in order to realize better performance in STEM. The school can also hold science and engineering fairs to help students relate more to STEM disciplines.

### **5.4. Recommendations for Further Research**

The study recommends further studies on the importance of STEM education in helping solve problems and create a better environment and country. The contribution of STEM in creativity, problem-solving and motivation should be carried out in different schools, sub-counties and even regions in Kenya. Finally, it is suggested to the future researchers

to conduct a study on contribution of STEM education in other fields and not just on creativity, problem-solving and innovation.

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**APPENDIX I: INTRODUCTORY LETTER**

Dear Sir/Madam,

REF: ASSISTANCE IN CONDUCTING RESEARCH

We, Flight Haggai Nyabwari and Sarah Kerubo Nyabuto, students at Grets University, currently pursuing Bachelor of Education Arts. Our research topic is; THE IMPORTANCE OF STEM EDUCATION IN SECONDARY SCHOOLS IN KISII COUNTY. This is a usually one of partial requirement before a student graduate. Therefore, it is our humble pleasure to welcome you to participate in this study. Your response will be confidential and exclusively used for academic purpose. Kindly respond honestly for your response to be reliable in documenting our final report.

Thanks in advance for taking your time in participating in this study.

Yours Sincerely,

.....

Flight Haggai Nyabwari

.....

Sarah Kerubo Nyabuto



## APPENDIX II: RESEARCH QUESTIONNAIRE

### QUESTIONNAIRE FOR TEACHERS

The main aim of this study is to determine the importance of teaching STEM education in secondary schools in Kisii County, Kenya.

#### INSTRUCTIONS

You are requested to respond to the items in the questionnaire as honestly as possible

Kindly do not write your name anywhere in the questionnaire

Please feel free and responsible for the information provided will be confidential

#### SECTION A: CREATIVITY

Indicate the extent to which STEM Education has been important in the development of creativity in your school on a scale of 1-5

##### Measurement Key

1-Strongly disagree

2-Disagree

3-Undecided

4-Agree

5-Strongly agree

Measures of indicators	1	2	3	4	5
STEM Education has improved creativity in students of your school.					
STEM Education enhanced creativity of students of your school.					

#### SECTION B: INNOVATION

Indicate the extent to which STEM education has influenced Innovation in your school on a scale of 1-5

##### Measurement Key

1-Strongly disagree

2-Disagree

3-Undecided

4-Agree

5-Strongly agree

Measurements of indicators	1	2	3	4	5
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STEM Education is the best in enhancing students innovation					
Students in your school select STEM Education more than any other subject.					

**SECTION C: PROBLEM-SOLVING**

Indicate the extent to which teaching STEM Education has increased students problem solving abilities in your school on a scale of 1-5

Measurement Key

1-Strongly disagree

2-Disagree

3-Undecided

4-Agree

5-Strongly agree

Measure of indicators	1	2	3	4	5
Students have become better problem solvers.					
Students have shown more interest in problems					
There are problems students have helped solve.					

## APPENDIX III: RESEARCH QUESTIONNAIRE

### QUESTIONNAIRE FOR STUDENTS

The main aim of this study is to determine the importance of STEM Education in Kisii County, Kenya.

#### INSTRUCTIONS

You are requested to respond to the items in the questionnaire as honestly as possible

Kindly do not write your name anywhere in the questionnaire

Please feel free and responsible for the information provided will be confidential

#### SECTION A: CREATIVITY

Specify the extent to which creativity has been enhanced in your school in your school on a scale of 1-5

Measurement Key

1-Strongly disagree

2-Disagree

3-Undecided

4-Agree

5-Strongly agree

Measures of indicators	1	2	3	4	5
There are intrinsic forces form of motivation in your school.					
There are extrinsic forces form of motivation in your school.					

#### SECTION B: INNOVATION

Specify the extent to which innovation has been enhanced in your school on a scale of 1-5

Measurement Key

1-Strongly disagree

2-Disagree

3-Undecided

4-Agree

5-Strongly agree

Measurements of indicators	1	2	3	4	5
Students want to learn more of STEM Education					
Students in your school select a course related to STEM.					

### SECTION C: PROBLEM SOLVING

Indicate that STEM Education has increased problem solving skill in your school on a scale of 1-5

Measurement Key

1-Strongly disagree

2-Disagree

3-Undecided

4-Agree

5-Strongly agree

Measure of indicators	1	2	3	4	5
STEM Education has increased problem solving skills.					