INFLUENCE OF SCHOOL SYSTEMIC MANAGEMENT DYNAMICS ON STEM SUBJECTS LEARNING OUTCOMES IN SECONDARY SCHOOLS, IN KAJIADO NORTH SUB-COUNTY

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A PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF EDUCATION DEGREE IN EDUCATIONAL MANAGEMENT, LEADERSHIP AND ADMINISTRATION OF MOUNT KENYA UNIVERSITY

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DECLARATION AND APROVAL

Declaration

This project is my original work and has never been presented for any academic award in any institution.

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MED/2015/25794

Signature……  ……Date 17/10/2024

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Approval

This thesis/project is being submitted for examination with our approval as University supervisors.

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Signature  Date 16/10/2024

DEDICATION

I am dedicating this project to my dear wife Joy, my son Prince Ian Kisali and daughters Princess Myrna Kisali and Arriela Azaria.

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ABSTRACT

STEM subjects learning outcomes in Kenya secondary schools have not been impressive. The situation is similar in schools in Kajiado North Sub-County. Students in secondary schools have continued to perform below the mean score in science-related subjects in national examinations over the years. The purpose of the study was to investigate the influence of school systemic management dynamics on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. Specific objectives were to determine the influence of teachers' competence, students' attitude, syllabus coverage, school infrastructure and school management support on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. This study was guided by the systems theory and education function theory of learning. This study used concurrent triangulation with the descriptive survey research designs in determining the influence of school systemic management dynamics on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub County. The study targeted 16 schools, 2 sub-county directors, 16 principals and 80 teachers and 544 students in secondary schools in Kajiado North sub County. The simple random sampling was used to select the schools and principals. The sub county director of education was selected using the census method since the population is only one. The teachers and students were selected using the purposive sampling method. The sample size was 5 schools, 2 sub-county directors, 5 principals and 34 teachers and 163 students in secondary schools in Kajiado North sub County. The study collected primary data using the questionnaires. The questionnaires were semi-structured. The interview schedule and checklists was also used in data collection. Piloting was done for the research instruments. The study used the SPSS version 23.0. The quantitative data was analyzed using the descriptive and inferential statistics. Descriptive statistics comprised mean, standard deviation and percentages. The information was displayed in form of tables and 3-D figures. Data collected from open ended was analyses using the thematic analysis method were presented in a prose form. The inferential statistics comprised the regression analysis. Correlational analysis was used to determine the strength of the relationship between variables. The linear regression analysis was conducted to determine the relationship between variables. The study found that teachers' competence had a significant influence on STEM subjects learning outcomes. It was established that students' attitude had a significant influence on STEM subjects learning outcomes. The study revealed that syllabus coverage had a significant influence on STEM subjects learning outcomes. The study found that school infrastructure had a significant influence on STEM subjects learning outcomes. The study found that school management support had a significant influence on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. The study recommends that there is need to implement regular and structured professional development programs for STEM teachers. These should focus on contemporary teaching methods, advancements in STEM fields, and innovative instructional practices. There is need to integrate real-world applications of STEM concepts into the curriculum to demonstrate the relevance of STEM subjects to everyday life and future careers.

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LIST OF ABBREVIATIONS AND ACRONYMS

APET	African Union High Level Panel on Innovation and Emerging Technologies
AU	African Union
CEMASTEA	Centre for Mathematics, Science and Technology Education in Africa
KNEC	Kenya National Examination Council
MIT	Massachusetts Institute of Technology
MOEST	Ministry of Education Science and Technology
STEM	Science, Technology, Engineering, and Mathematics
USA	Untied States of America

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter discussed the study background, problem statement, study purpose, statement of the study, research objectives, and research questions, study significance, limitations and delimitations, assumption of the study, theoretical framework and scope of the study.

1.1 Background to the Study

The acronym (STEM) was coined in the 1990s by the National Science Foundation in the United States. It is a field and curriculum that focuses on science, technology, engineering, and mathematics (STEM) education (Gülen & Yaman, 2019). The discipline combinations were viewed as strategic decisions made by scientists, technicians, engineers, and mathematicians to join forces and generate a stronger political voice (STEM Task Force Report, 2020). STEM education is an interdisciplinary technique to learning in which students apply challenging academic ideas to real-world situations (Akkaya, 2019).

Globally, in USA STEM focused schools date back as in the early twentieth century (English, 2020). The development of STEM led to a significant increase in funding for STEM research and programs (White, 2021). This precipitated the need for the same in other regions of the world. Countries like China, Korea, Taiwan, Australia and England have specialized programmes and schools that teach STEM (Taşdemir, 2022). K-12 STEM curriculum that incorporates a multi-disciplinary with a project based pedagogical approach is a good example of the specialized programme introduced by the said countries (Aslan & Bektaş, 2019).

In Asia Wahono, Lin and Chang (2020) looked at if enactment of STEM effectively improves learning outcomes of students. Learner academic accomplishment, motivation and higher-order thinking skills (HOTS) were used as learning outcome factors. It was noted that the STEM enactments were moderately effective in enhancing learners' learning outcomes. In the United States, Ellis (2022) evaluated STEM learning outcomes and noted that numerous relevant, experiences can enhance a learner's ability to make use of science, math and engineering principle, solve problem and locate, arrange and analyze data from several sources. Karaşah-Çakıcı, Kol and Yaman, (2021) evaluated whether active learning improves a student's performance in science, engineering, and mathematics. Results showed that active learning sessions improved average test results, and that traditional classroom instruction greatly increased the likelihood of failure for pupils.

In Africa, nations are revitalizing and growing accessibility to quality education, utilizing the capability systems of training, education management integration and harmonization and consolidation of STEM curriculum. This comprises distributing scientific knowledge and promotion of science culture in the African setting (Coleman, 2020). Countries like Rwanda have boosted their efforts to revise their nation's educational curriculum as a result of realizing the value of STEM education (Almeda & Baker, 2020). STEM education is regarded as a crucial foundation of their educational system by the redesigned curriculum. Such initiatives have significantly enhanced investment in infrastructure, like fully-stocked STEM labs, make STEM highly practical (Hacioglu & Gulhan, 2021). In Nigeria, Adeyemi (2018) determines the association of the teacher's experience and performance of student's in STEM subjects noted that the experience and capability of teachers' were the main determinants of learner's performance in each subject in secondary schools in Ondo state.

In Kenya, the Ministry of Education announced the establishment of STEM model secondary schools in each county in 2016. The Centre for Mathematics, Science, and Technology Education in Africa (CEMASTEA) is the primary agency in STEM education, with a focus on continuing capacity development in STEM activities through a variety of programs, methods, and collaborations (Ministry of Education, 2020). CEMASTEA launched the STEM education model school's initiative to foster a culture that encourages learners to thrive and seek careers in science and mathematics, as well as to boost their creativity and innovativeness (MoE, 2020). In a review by Chebotib and Kering (2021) students' attitudes toward computer-based learning in the Biology course at a chosen secondary school in Uasin Gishu County, were examined. It was found that the computer-assisted learning module influences students' attitudes and can be viewed as an effective teaching tool for coordinating students' attitudes in Kenyan secondary schools.

Systemic dynamic is a potent methodology and computerized simulation and a platform for modeling used in developing, understanding and examining into challenging issues (Atta & Bonyah, 2023). In education, systemic dynamics application has been in physics, literature, mathematics, biology, social study, economics and history (Tomljenović, Zovko & Holenko Dlab, 2021). In the whole development, system dynamics is an area covering education, medicine, science, law or engineering (Yang & Baldwin, 2020). In the successful schools, systemic dynamic management is integrated in the classroom reform referred as learner-centric learning. The focus of learner-centric education is solving complex problems (Mendes & Aleluia, 2019). Teachers are not seen as lecturers, nor a source of all knowledge, or even leadership figures. The teachers are now coaches and advisors to learners undertaking projects that could be beyond the experience of teacher. Indeed, the change of

education to learner-centric may be disturbing to some teachers who have a feeling that they ought to be command of what is done by students as well as teaching (Al Hallak, Ayoubi, Moscardini & Loutfi, 2019). This shows the importance of school systemic management dynamics on STEM subjects' learning outcomes instructional management in secondary schools.

1.2 Statement of the Problem

STEM subjects learning outcomes in Kenya secondary schools have not been impressive (KNEC, 2020). The situation is similar in schools in Kajiado North sub County as shown in Table 2.

Table 1: STEM Performance for the Last Five Years in Kajiado Sub-Counties

	2016	2017	2018	2019	2020
Isinya	30.13	29.10	28.61	27.81	26.03
Kajiado central	31.22	30.01	29.42	29.27	27.18
Oloitoktok	27.41	27.75	28.09	27.84	26.72
Kajiado South	29.73	29.13	28.54	28.20	28.33
Kajiado West	29.89	28.06	27.95	27.54	27.70
Kajiado North	32.17	30.19	30.23	29.88	29.41

Teachers have a vital part to play in the encouragement or discouragement of learners from choosing STEM subjects in secondary schools. Moreover, from time-to-time teachers advise the learners they see as weak not to choose the subjects, instead of encouraging them (Ghaicha, 2019). Another challenge in learning STEM subjects is poor school infrastructure. Also, over the years, students in secondary schools have continuously performed below the required mean score in subjects linked to science in the national examination (Gichuru, 2020). This depicts that generally school performance has advanced between 2016 and 2020. Only in 2016 is when the mean score for biology was higher in comparison to other years that are a mean of 2.6. In other subjects in STEM, the score was low in relation to overall

mean, in 2016 the mean for mathematics was 2.7 while in 2020 it was 2.6, and chemistry had a mean of 2.1 in 2016 and 2.4 in 2020, this depicts that in majority of schools, science and mathematics were poorly done (KNEC, 2020).

The government had been in the fore front in encouraging STEM subject learning. However, this can further be enhanced by school systemic management dynamics. School systemic management dynamics would help in ensuring that learning is student centered and hence students can solve complex problems (Ghaicha, 2019). Kenya, like many of African nations, continues to experience many challenges in the incorporation of school systemic management dynamics on STEM subjects learning outcomes at all levels of education (Kiilu, Mwania & Mumo, 2022). These challenges include poor infrastructure, attitude due to culture like early marriages, poor management support, lack of practical's infrastructure, students do not do practical they only see the apparatus during exams, and practical chemicals are unavailable until the time for exams (Langat, Situma & Kapkiai, 2022). Other challenges are poverty, low financing, students lack of interest, teachers that are unqualified or untrained, low learning aids and increase in strikes or industrial actions (Kiilu, Mwania & Mumo, 2022). There has been little focus on the influence of school systemic management dynamics on STEM learning outcomes in secondary schools in Kajiado North Sub-County. This formed the basis of the proposed study.

1.3 Purpose of the Study

The purpose of the study was to investigate the influence of school systemic management dynamics on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

1.4 Research Objectives

The study was guided by the following objectives: To

i. Determine the influence of teachers' competence on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.
ii. Find out the influence of the students' attitude on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.
iii. Establish the influence of syllabus coverage on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.
iv. Examine the influence of school infrastructure on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.
v. Determine the influence of school management support on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

1.5 Research Questions

The study was guided by the following research questions:

i. How does teachers' competence influence the STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County?
ii. What extent does students' attitude influences the STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County?
iii. What is the influence of syllabus coverage on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County?
iv. How does school infrastructure influence the STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County?

v. What extent does school management support influence the STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County?

1.6 Rationale of the Study

The performance of STEMs subjects in Kenya and Kajiado North Sub-County has not been impressive over the years. This has created a great concern to the stakeholders in the education sector. The model STEM education school program was introduced by CEMASTEA to develop a culture that inspires learners to excel and take careers associated with mathematics and science to improve their innovativeness and creativity. However, the success of STEM highly dependent on numerous economic and education policies adopted in Kenya. This is the reason why vital policies and investments are required to ensure full execution of STEM. The study aimed to provide new knowledge on the influence on school systemic dynamics management on STEM subjects learning outcomes in secondary schools. The study also aimed to add to knowledge on school systemic management dynamics and STEM subjects learning outcomes. The study adopted the concurrent triangulation design and descriptive research design to determine the relationship between school systemic management dynamics and STEM subjects' learning outcomes.

1.7 Significance of the Study

The study may provide new knowledge on the school systemic management dynamics influence on STEM subjects learning outcomes in secondary schools. The study findings may be useful to the education ministry as it may provide an understanding on STEM subjects learning outcomes. The MOE may ensure that schools make use of systemic

dynamics to solve problems in STEM subjects and hence, enhance learning outcomes on the subjects.

The study may help teachers to improve in their instruction methods since school systemic management dynamics provide ways to solve complex problems in learning. Using the systemic dynamics may help in enhancing learning of STEM subjects. The head teachers of secondary schools may also find the study beneficial. They get know how important school systemic management dynamics is in ensuring STEM subjects learning outcomes. So, they may ensure that school systemic management dynamics is functional in their schools.

The study may also be important learners as it may enhance their learning on STEM subjects. This because school systemic dynamic is a student-centered mode of learning where the teacher acts as a coach and learners solves problems. The parents may also benefit from the study as they may encourage their children to choose the STEM subjects so that they can learn to solve problems by themselves.

The study may also be vital to the makers of policies. They may get to know that STEM education promotion is highly required to ensure a comprehensive education important to learners in Kenya and deal with the issue of education systems imbalance. Hence, the policy makers may develop policies that may ensure that STEM subjects are in all education levels in Kenya. The conclusions may assist to authenticate the theories validity and reliability that are related to the study and assist researchers to conduct further research on STEM subjects learning outcomes.

1.8 Scope of the Study

The study investigated the influence of school systemic management dynamics on STEM subjects' learning outcomes in secondary schools. Specific objectives were to investigate the influence of teachers' competence, students' attitude, syllabus coverage, school infrastructure and school management support on STEM subjects' learning outcomes in secondary schools. The study was anchored by the systems theory. The study adopted a descriptive survey design because it provides for investigation of relationships between variables without the researcher control or manipulation. The study population comprised of MoE officials in Kajiado North Sub-County, the principals, teachers and students in the schools because they teach the STEM subjects and they were in position give information on how school systemic management dynamics influence learning outcomes. Questionnaires were the tool for data collection because they allowed data to be collected from a large population. The study period was between January to December 2024.

1.9 Limitations of the Study

The following was considered to be the study limitations:

(i) One of the difficulties was that teachers and principals are reticent to share information that would help in this investigation. They were informed of the study's objective. They were also given the assurance that the results would only be used for the study and not for evaluating their own performance.

(ii) Some respondents said they don't have time to engage in the survey. The researcher left them with the questionnaire for several days and retrieved them later to address the issue of lack of time.

(iii) Some schools were doing exams and students and teachers were not available. The researcher gave them time to complete the exam first.

1.10 Delimitation of the Study

The following was regarded to be the study delimitations:

i. The study was confined to public secondary schools in Kajiado north Sub County. The results would only therefore be generalized to other areas of the county with similar conditions as Kajiado north sub-County.

ii. The study was delimited to MoE officials in Kajiado County, the principals and teachers and students because they are the one who understand the STEM subject's instructional management.

1.11 Assumptions of this Study

i. School systemic management dynamics positively influence STEM subjects learning outcomes.

ii. Reliable information was provided by the respondents and it was utilized for analysis.

iii. During the period for data collection, the respondents will be available to give information required for the study.

iv. The participants were willing to partake in this study. Hence, the study achieved a high response rate.

1.12 Operational Definitions of Significant Terms

Examinations: testing/judging the level of knowledge/abilities of learners by written question.

Laboratory: refers to a distinctive room in a school furnished with apparatus and chemicals and where STEM subjects are carried out.

Management: the process of dealing with or controlling educational processes, teachers, students, infrastructure and other shareholders in education.

Performance: refers to an evaluative aspect of students in KCSE examinations against a given scale.

Public secondary school: refers to government funded schools.

School infrastructure: basic physical and institutional structure and facilities that support learning like classroom, laboratory, library, dormitory electricity among others.

School systemic management dynamics: it is the co-ordination of different factors forming the parts of an overall management process, which are inter-related or inter-dependent. They include teacher's competence, student attitude and school management support.

School: An institution meant to give a learning space and learning environment for learners under the supervision of a teacher.

STEM subject learning outcomes: achievement**,** knowledge or skills acquired by students by the end of a certain assignment or class. For instance, student's academic achievement.

STEM subject: science, technology, engineering and mathematics subjects

Student's attitude: refers to the feelings that learners have towards STEM subjects.

Syllabus: it is a complete course of study offered by a school.

System: a set of principles or procedure according to which something is done.

Systemic dynamic: the characteristics of a system or process that promote growth, development, or change

Teachers' competence; it is the knowledge and skills that an instructor have

Universal education: refers to an education that encompasses all the children eligible within school going age.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter covered the literature review influence of school systemic management dynamics on stem subjects learning outcomes. This chapter reviewed the empirical literature, theoretical literature, theoretical framework, conceptual framework, research gaps, and literature summary.

2.1 Empirical Literature

The discussion is on what has been done regarding the evaluation on school systemic management dynamics and STEM subjects learning outcomes in secondary schools. Systemic management is the broad concept that encompasses leadership and focuses on ensuring that established organizational goals are met (Ahn & Rodkin, 2014). The goal is school systemic management is to ensure efficient teaching and learning (quality education). The aim is to ensure that education is delivered in a conducive surrounding (Dijkstra & Gest, 2015). Learning results and the quality of the learning process are both improved by STEM activities in the classroom (Cedefop, 2017). Additionally, there are differences in student learning outcomes in regards to higher order thinking skills, attitude, and academic learning accomplishment (Yildirim, 2016).

2.1.1 School Systemic Management Dynamics

According to Bush and Bell (2014) and Donald, Lazarus, and Lolwana (2014), management is the overarching notion under which leadership is subsumed; as a result, it is not an aim in itself. Management is about ensuring that established organizational goals are realized.

Promoting effective learning and teaching (high-quality education) is the main objective of good school management. That is delivery of education services at different levels to ensure a conducive environment so learners and teachers can make the most of when teaching and learning. As a result, the measure by which the effectiveness of management is measured is the degree to which effective learning is accomplished (Bush, 2017).

Shonubi (2016) determined the contribution of leadership and management dynamics to effectiveness in schools. Within two sampled schools, information was gathered from significant role participants who had been identified. In comparison to school B, it was discovered that school A had excellent leadership and management methods. The strength of school A in the management of the school was the policy of the school in decision-making, teaching, communicating, relationship management, delegating, conflict management, motivation, culture and school school-community coordination, despite the fact that school A and B had related but negligible features in school planning, organization, change management and coordination of learning and teaching. The differences in classroom control, climate, leadership, communication and motivation found in school A teacher on learning and teaching made it significantly better compared to the teacher in school B. However, teachers in both schools showed related features in teaching ability, planning and lack of classroom policies.

Isa, Mydin and Abdullah (2020) researched on school-based management practices in Malaysia. The responsibility of the school administrator and competency of teachers were two crucial concerns that emerged from this review. The study recommended the creation of a standardized tool to assess school-based management, emphasizing the engagement of the Parent-Teachers Association (PTA) and officers of state education in fostering empowerment

between teachers and school administrators. While teachers' empowerment includes greater motivation and professional assistance in a variety of areas, including professional development, pedagogy, integrity and accountability, school leaders' empowerment includes leadership potential.

Bush and Glover (2016) conducted a study on management and leadership in South African schools. All works published since 2007 were systematically reviewed for this study, while sources from before 2007 were reviewed more carefully. The results showed that the management and leadership of schools in South Africa faced some challenges like poor relationship with principals and governing bodies, teacher union conflicts, poor results from students and leadership that is mainly focused on managing rather than learning activities.

2.1.2. STEM Subjects Learning Outcomes

A key issue in the field of education is the contribution of STEM education to students' learning outcomes (Bybee, 2013). In order to prepare learners for the advancements of a novel competitive era, STEM education places a strong emphasis on practical application. Soft skills like collaborative work, problem-solving and higher-order thinking abilities, should be the main focus for learners in STEM learning activities (Li, Huang, Jiang, & Chang, 2016).

Academic learning attainment, motivation, attitude, and higher-order thinking abilities are only a few of the varied student learning outcomes. Additionally, Marton, Alba, and Kun (2014) noted that a variety of elements, including the study topic, the length of the course, and even the setting, could affect both the learning process and the results of the course. According to research, STEM instruction helps children learn more effectively in terms of

academic accomplishment, learner motivation, attitude, and ability to solve problems (Saraç, 2018; Yildirim, 2016).

In the United States, Cheryl and Brooks (2016) focused on understanding stem learning outcomes using a phenomenographic approach. In order to understand the qualitatively distinct methods that 18 STEM professionals acquired the specialized knowledge and skills required to succeed as engineers and scientists, the study conducted interviews with these individuals. The findings showed that a variety of pertinent, practical experiences can enhance a student's capacity to apply mathematical, scientific, and engineering principles, solve problems, and find, arrange, and evaluate data from many sources. These experiences, which are not limited to internships, can also be had through problem-based learning classes, makerspaces, research projects, design projects, and student organizations.

Wahono, Lin, and Chang (2016) investigated the effectiveness of STEM enactment on Asian student learning outcomes. According to the study, higher-order thinking skills in kids provide the foundation for academic learning achievement in STEM subjects, followed by motivation. In order to maximize outcomes in STEM education, the suggestions take into account a variety of factors, including learning technique, orientation, and duration of instruction. A universally important instrument for preparing kids from all nationalities and cultural backgrounds for better learning outcomes is STEM education.

Twiningsih (2024) investigated how STEM-based magic boxes could enhance student learning results. The study aim was to ascertain whether student learning outcomes might be improved through the use of the STEM-based media Magic Box (Magic Box) on the idea of addition. The research focused on 24 class one students from a public elementary school in Surakarta City in the first semester of the 2018–19 academic year, with 7 male and 17 female

learners. The research was conducted using the CAR methodology, which follows the steps of planning, carrying out, observing, reflecting, and reviewing. From cycle I to II, it was discovered that student learning results had improved.

2.1.3. Teachers' competence on STEM subjects learning outcomes

Competency, according to Parker-Stanford (2014), is the professional capacity to use skills, knowledge, and experiences in doing tasks in specific positions in order to generate the desired results. In order to fulfill particular requirements when doing educational duties, teachers must possess certain abilities (Musau & Abere, 2015). According to Prasertcharoensuk, Somprach, and Ngang (2015), teacher competencies include both educational and professional competencies. According to Gietz and McIntosh (2014), teaching skills include pedagogical proficiency, subject-didactic proficiency, pedagogical organizational proficiency, and the capacity for self-reflection. There are four teaching competences, according to Carreker & Boulware (2015); Redding (2014) emotional/social, metacognitive, cognitive and motivational competencies. Competencies must be cultivated since they are crucial to instructors' ability to facilitate successful learning.

Lomarak, Nuansai, Promden and Sangsila (2018) did an evaluation of in-service science teaching abilities in unified STEM area. Focusing on university of Buriram Rajabhat the study goal was to explore the outcomes of a professional development instruction programs in unified STEM for primary schools in Thailand's rural setting. Assessment tools used in the study included achievement tests, observational records, and assessments of STEM-related content knowledge. According to the study, the integrated STEM ought to be used to improve the teaching abilities of in-service science teachers. The outcomes also showed that the teaching capabilities of teacher's in-service science were at or near proficient levels. One

sample t-test's findings showed that after implementing the integrated STEM curriculum, instructors' accomplishment scores on science topic understanding were much higher than before.

Song and Zhou (2021) looked at STEM teachers' preparation, teaching beliefs, and perceived teaching competences. The mediating variable was teaching beliefs; the goal was to ascertain the long-term impacts of training teachers on instructor's assessed teaching ability. The study gathered information from 219 beginning instructors from various K–12 institutions in China. The research revealed that perceptions of teaching proficiency among STEM teachers were positively correlated with knowledge training, teaching practice, and teaching beliefs during education programs of teachers. The link between teaching practices and perceived teaching competency was mediated by teaching belief.

Fauth, Decristan, Deckner and Butter (2019) researched on teacher competency effect on learner's outcomes in science in elementary schools and moderating effect of teaching quality. The study aim was to investigate the association of teacher competency, quality and performance of students in the science subject. Using a pre-post design, the interest and conceptual understanding of students were tested in two teaching units. The results indicated that the competence of a teacher that enthusiasm, self-efficacy, content and knowledge was related positively to the interest of learners; self-efficacy was related positively to achievement of learners. Three areas of quality of teaching that is supportive climate, management of classroom and cognitive activation, which means the interactions between students and teachers, mediated the association.

Tunc and Bagceci (2021) examined instructors' perceptions of the STEM approach's adoption in secondary schools and its effects on pupils. These research questions were addressed by

the study: What do teachers think about the benefits their pupils will experience if they participate in STEM activities? What do they think of the STEM approach being used in their schools? A case study like this one. Twenty-three teachers of math, science, and information and communication technologies (ICT) participated. Data collecting methods included an assessment form for the activities and a questionnaire for the evaluation of the implementation of STEM training in schools. The findings demonstrated that, despite teachers' reservations about incorporating STEM activities into the classroom, they believe that doing so will significantly benefit students' learning in terms of the abilities they will develop, the level of knowledge they will gain about STEM subjects, and their understanding of the learning process.

Thuy, Bien and Quy (2020) conducted a study on developing teachers' proficiency in integrated STEM education. The goal was to pinpoint the skills instructors needed to teach STEM subjects together more effectively and to satisfy their desire for professional development programs. It used the qualitative analysis. To answer the research questions, teachers were surveyed and interviewed in semi-structured interviews. The study discovered that the four components of teachers' competence in integrated STEM education include awareness, developing, implementing, assessing, and modifying the STEM teaching plan.

2.1.4. Students' attitude on STEM subjects learning outcomes

Students' attitudes towards the STEM subjected can be linked to learners' accomplishments in mathematics and science disciplines according to (Gokhale, Rabe-Hemp, Woeste & Machina, 2015; Gokhale and Machina, 2014). According to Astalini, Kurniawan, Kurniawan, and Anggraini (2019), students' attitudes toward science are also used as a gauge for how well STEM-related lessons are taught and learned. However, Suyatno, Mardati,

Pambudi, and Amurdawati (2019) found that student attitudes regarding the learning process continue to have the greatest impact at school. Expectations, motivations, student features, previous achievements, interests and related experiences (Kazár, 2014); family support, gender, teachers, environmental factors and classroom factors (Ing & Nylund-Gibson, 2013) are a few of the factors affecting the attitude of students toward STEM in secondary schools. A supposed lack of relevance to learners' daily lives, inefficient practical teaching techniques, the school's ethos, management, curriculum, teacher effects, and career counseling given to students are other school factors (Bennett et al. 2014; McDonald, 2016).

Using a systemic review and meta-analysis in Asia, Wahono, Lin, and Chang (2020) investigated STEM implementation success in student learning outcomes. The results showed that STEM implementations in Asia were effective at improving students' learning outcomes at a moderate level. Additionally, the implementation of STEM begins with students' higher-order thinking abilities, progresses on to their academic accomplishment, and concludes with their motivation.

Gok (2021) concentrated on determining the attitudes of high school pupils about STEM. The study aim was to ascertain how high school pupils felt about STEM. For the pilot survey, exploratory and confirmatory factor analyses were conducted. The study's sample included 2118 high school students from 12 high schools in Izmir, Turkey, during the academic year 2018–2019. The findings indicated that, in both the city's urban and suburban areas, the mean score of students' attitudes toward STEM subjects declined from ninth grade to twelfth grade. Results for gender differences indicate that, in both urban and suburban locations, male high school students' attitudes toward STEM were rated as having a higher mean score than those of female high school students.

Krkç and Uluda's (2021) did a study on STEM student attitudes as a predictor of success in secondary school technology and design courses. The goal was to determine if students' performance in the technology and design course (T&DC) and their views toward STEM fields are related. The model used was a correlational survey one. 400 kids in the seventh and eighth grades make up the population. Data were gathered using an attitude test for STEM and a personal data questionnaire. The data analysis process employed regression analysis and Pearson correlation analysis techniques. The study discovered an association between STEM attitudes and students' performance in technology and design courses that was both favorable and substantial. Students' success in the T&DC is predicted by their attitudes toward STEM. Student success in (T&DC), helps learners to gain the needed design abilities to generate future technology, can be further enhanced by students establishing positive STEM attitudes.

In Bayelsa State, Nigeria, Offor, Bubou, and Gumus (2020) evaluated the impact of teachers on students' attitudes toward STEM topics in selected secondary schools. The study specifically sought to determine whether certain teacher traits, including pedagogical content knowledge (PCK), temperament, enthusiasm and subject-matter expertise influence secondary school learners' attitudes toward choosing STEM subjects and ensuing future careers. The study utilized a survey design and a specially created questionnaire to obtain data, and the findings showed that the characteristics of learners had an impact on students' views toward STEM disciplines.

In public secondary schools in Kiambu County, Kenya, Langat (2015) conducted study on students' attitudes and their effects on mathematics learning and accomplishment. Due to the implicit nature of the study, a descriptive survey approach was employed. It was discovered

that while most children had a positive attitude toward mathematics and believed it to be possible, attainable, and significant, this did not convert into high academic performance. The results also demonstrate that students' attitudes and beliefs, perceived learning capacities and skills, and prior mathematics performances had an impact on their level of motivation, which led to poor results.

2.1.5. Syllabus coverage on STEM subjects learning outcomes

Great efforts must be made to finish the curriculum in order to enhance both the learner's and the teacher's performance (Nakhanu, 2012). The likelihood of successful learning outcomes increases when syllabuses are covered on time. This is because timely coverage increases students' understanding of both theoretical and practical ideas. According to Mwikya (2013), in order to improve how students study science in the classroom, instructors' pedagogical practices will need to change in order to meet the obstacles associated with the delivery of the science subject and syllabus covering.

Dennis, Mereku and Alhassan (2018) looked at how teachers' use of mathematics curricular materials (MCM) affected math test scores at their respective schools. This study, which examined a total of 99 junior high schools, was carried out in the Agona West Municipality. Data was gathered for the study utilizing questionnaires and interviewing teachers using a survey design. Even though teachers acknowledged in interviews that they hold extra lessons for the pupils, the results showed that only 62% of the mathematics curricular materials (MCM) were implemented. This suggests that the majority of instructors are not teaching roughly 38% of the material in the MCM, and that certain topics were consequently frequently left out or skipped in the municipality. According to the ANOVA results, there

was no discernible difference between the high, average, and low school performance categories in terms of their teachers' coverage of the mathematics curriculum.

In Kenya, secondary school students' performance in mathematics was investigated by Nakhanu (2012). Three questionnaires were utilized to obtain data in a descriptive survey approach. Correlation was utilized to ascertain the correlation of syllabus covering and student performance, and the regression equation helped to find out the significance of the correlation. It was discovered that student performance in mathematics at the KCSE level was significantly impacted by syllabus coverage.

Musasia, Nakhanu, and Wekesa (2017) conducted research on elements affecting the coverage of the secondary school mathematics curriculum in Kenya. This study, which involved a total of 85 secondary schools, was conducted in the Kakamega South district. The primary goal was to calculate the proportion of the curriculum that was covered and link it to learner achievement. From each of the 16 schools, the study's participants included the mathematics heads of department, head teacher and maths teachers. The correlational analysis was employed for analysis. The study found that mathematics performance at the KCSE level is significantly impacted by syllabus coverage.

Using the mixed research approach and a triangulation design, Wafula, Kisilu, and Mukwa (2019) conducted research on the effects of syllabus scope and coverage on execution of the physics curriculum in secondary schools in Kenya. The population was from three physics teachers and learners in schools in Bungoma County. Data collection was by use of questionnaires. The results indicated that a broad scope of the curriculum hinders timely completion of the program, which affected how the physics curriculum was implemented. The study found that the syllabus's scope should be thoroughly and promptly covered.

2.1.6. School infrastructure on STEM subjects learning outcomes

In the subject of education, infrastructure amenities are acknowledged as having an impact on educational achievements. The main factors influencing educational goals are curriculum, teacher effectiveness, public relations, and school management (Yildirim, 2016). Activities involving student teaching and learning are influenced by the school's infrastructure. For instance, a well-maintained classroom that is a part of the school building would promote learning continuity. The students' learning environment will be improved to make it more fun, exciting, and cozy (Yildirim & Turk, 2018). In order to assess how to manage current infrastructure to its fullest potential, the control mechanism for facilities and learning infrastructure is crucial (Ugras, 2018).

In Rwanda, Assoumpta and Andala (2020) investigated the connection between educational facilities and students' academic achievement in twelve-year basic education. The study employed a correlation research design with a 200-person sample size. The research tools employed were a questionnaire and a guided interview. The data was processed with SPSS Vision 21 software, and the data from the guided interview was analyzed thematically. The showed that, on average, 70.5% of people disagreed with the statement that the Twelve Years Basic Education (12YBE) district had enough school infrastructure. Students' academic performance is negatively impacted by the subpar school infrastructures that are apparent after twelve years of basic education. The study also discovered a weak but substantial positive association between student academic performance and school infrastructure. The qualitative findings showed that school infrastructures including finished classrooms, well-equipped libraries and laboratories, adequate playgrounds, and school sanitation are things that will be present in 12YBE.

Nugroho and Wibowo (2020) conducted research on how school infrastructure affects students' engagement in their learning. The study described how school infrastructure affects learning, how it is developed to improve learning outcomes, and how it is used to raise student learning activity levels, including both their physical and psychological participation. According to the study, educational infrastructure and amenities are necessary for the learning process to function at its best, particularly when reaching learning goals. The fundamental goal of infrastructure management is to optimize potential both inside and outside of educational institutions, taking into account the institution's vision and objectives as well as the external environment, in this case the community.

Cele (2016) looked into how well-managed school infrastructure and facilities affect both students and teachers. The study was approached quantitatively. Targeting the iLembe district, a survey was carried out in the classrooms. An important instrument for obtaining data was a questionnaire. The survey depicted that there were deficient health and safety policies in place at schools, as well as poor infrastructure management, a disregard for the learning environment there, and insufficient funding for facility planning and infrastructure development.

Jmail and Mustafa (2018) conducted research on how Khyber Pakhtunkhwa schools' pedagogical resources and physical facilities affected students' academic performance. The study utilized a sizable data collection from 23 districts in Khyber-Pakhtunkhwa, which included 1642 schools, to concentrate on the factors that influence school performance. According to research, power, gas, a good library, and good teachers all improve student achievement in Khyber-Pakhtunkhwa. Results also indicated that the scientific labs and the playground have little bearing on student achievement.

Mokaya (2016) investigated how Kajiado County, Kenya's public secondary schools' physical facilities impacted pupils' academic achievement. The study aim was to determine how school infrastructure affects the delivery of high-quality instruction in Kajiado County's public secondary schools. The survey was descriptive. Teachers, pupils in forms three and four, and other participants were the target group. Qualitative and quantitative data were utilized. The data was examined using Microsoft Excel and SPSS. According to the study, appropriate and well-spaced classrooms, adequate and ample library space, adequate science labs, adequate water and sanitation facilities, and adequate engagement in extracurricular activities all contribute to increased academic performance.

2.1.7. School management support on STEM subjects learning outcomes

According to Garza et al. (2014), school management has an impact on long-term school success by providing the right guidance, caring about teachers' professional growth to increase teacher capability and leadership, ensure resiliency and motivation, commitment to make a difference and supporting a sense of community in schools. In addition, management methods like performance monitoring, target setting, and incentive programs were found to be favorably associated with students' math proficiency. Setting clear school objectives and communicating the goals to staff were found to be strongly linked to student progress (Tavares 2015).

Khan, Ahmad, Ali, and Rehman (2016) investigated how principle attitudes and school management trainings affected students' learning results. The study goal was to evaluate how management trainings affects student learning outcomes and to determine how much principals' attitudes mediated the association between management trainings and student learning outcomes. The necessary information was gathered from students, teachers, and

principals. The results showed that school management trainings give principals the needed school management abilities, enabling them to successfully manage their specific schools. The study also statistically confirmed that such trainings had a considerable impact on principals' attitudes. Principals with training shown a conscious commitment to ensuring the motivation and happiness of both their staff and pupils. Trained principals deploy their resources to enhance learning environments, provide appealing study spaces, ensure proper community involvement, and advance the professional development of their teaching staff.

Davis (2015) conducted research on the views of administrators on STEM education and how they affected teaching methods in Louisiana schools. The study's goal was to use a mixed-methods approach to investigate how administrators understood and perceived STEM education and how this affected classroom practices. Interviews and surveys were employed to obtain quantitative and qualitative data. According to the survey, there is no single, accepted definition of STEM education. Similar to this, there were many different perspectives on STEM education. As STEM education does need certain distinctive administrative thinking and activities, the study also discovered that not all administrators felt qualified to oversee the implementation of STEM programming. There is proof that administrators' perspectives on STEM education can affect how programs are implemented and how teachers operate in the classroom.

Watson, Williams-Duncan and Peters (2020) looked at the school management awareness of parental STEM knowledge, ways to promote STEM knowledge, and student STEM preparation. The STEM Awareness Community Survey (SACS) received responses from a carefully chosen sample of Texas administrators. A questionnaire was employed to obtain data, which used a mixed-methods approach. Results showed that principals and

superintendents thought parents of students in grades K–12 were unaware of STEM (comprising STEM understanding in general). K-12 administrators expressed special worries that parents were unaware of: the range of preparation required in preparation of children in STEM-related employment; the availability of school-related STEM options; and the significance of engaging in STEM.

2.2 Theoretical Literature

Theoretical literature describes the theories that are there in regard to an issue, concept and situation. It helps in explaining the theory that exists in relation to the present study (Munn, et al., 2018). This study was about the influence of school systemic management dynamics on stem subjects learning outcomes. It was anchored on the systems theory and education function theory of learning.

2.2.1 System Theory

Von Bertalanffy introduced the systems theory for the first time in the 1930s and after World War II (Bertalanffy, 1972; Adams, Hester, and Bradley, 2013; Friedman and Allen, 2014). A theoretical attempt was made to understand the manner systems interchange activities within surroundings, as is seen in all living systems. An integrative approach to all systems in society, nature, and many scientific domains, systems theory provides a framework for examining occurrences holistically. In the case of a school, this could be a department, an academic division, or the entire institution. Katz and Kahn presented the organization with the concept of an open system in 1966 (Mele, Pels, & Polese, 2010).

A large number of managers have utilized and are adopting a systems technique and contingency view implicitly (Kast & Rosenzweig, 1972). This is an attempt to resolve problems with their methods of organization. In an expanded theory of living systems,

Vancouver (1996) characterized societies and businesses as parts of the systems and proposed that the systems maintain their regularity in spite of environmental anomalies. This suggests that environmental conditions don't necessarily affect how systems function. As a result, principles can be gradually obtained in the system for providing school instruction even in the face of opposition from outside the system.

Since a system is composed of a whole consisting of interdependent components, systems scientists in the natural and social sciences study how parts interact to better understand the complexities of reality (Lalande & Baumeister, 2015). As a result, a system is characterized as a collection of interconnected components that work together to accomplish a common goal. As an example, consider school groups and the institutional elements that enable them to operate collectively (Bozkus, 2014). Inputs, the transformation process, outputs, feedback, and the environment are the five main parts of the system theory of organizations (Daft, 2010). According to this idea, all of the labor, money, information, and raw materials needed to create goods and services of various sizes and standards are considered inputs. In order to transform inputs into outputs, management should make use of production technology. The organization's outputs are the actual products and services that are valuable to the consumer or have a market value.

There are similarities between the theory of systems dynamics and the production function of education. John (2010) asserts that the production function is a link between the input and auxiliary parts needed to generate a particular good while accounting for its quality, and that education is highly valued in the production of human resources. In education, the functional relationship between student and school inputs and the associated output measure is represented mathematically by a production function. During the production process,

managers must establish precise objectives as well as the inputs and procedures that will be utilized to convert raw materials into final products. Additionally, they must possess particular capacities in the form of expertise and information that may be successfully transferred to the economies. This hypothesis aided in describing how systemic management dynamics in schools affect learning outcomes in STEM disciplines.

2.2.2 Educational Function Theory

The study used Schulz's (1960) Education Function Theory. The definition of the education production function, which has its origins in the economic production theory, is all the inputs combinations that lead in any particular set of educational outputs. Learning outcomes are the shared outputs, while the common inputs are things like school resources, syllabus coverage, school infrastructure, and teacher quality. According to the education production function, which is used by certain scholars (Glewwe & Lambert, 2010; Hanushek, 2010; Harris, 2010), educational results can be explained by factors such as school resources, teacher competence, and student attitude.

The idea behind this function of producing education is that better inputs lead to better learning results. Hanushek (2010) established a weak negative link between inputs and output using this equation since this straightforward function is predicated on the irrational assumptions that inputs are utilized effectively (Harris, 2010). These findings suggest that educational systems utilize educational inputs ineffectively.

In order to understand the residual element in the 1950s American economic growth rate, the production function was utilized in this study to determine the maximum output from a diverse inputs combination.

Educational production function definition is as follows:

Where;

A = f (X1 … Xn

A … Output

X1 … Xn …… Input

The response variable is "A" the output and predictor variables being X1, X2, X3, X4 and X5. The output, A, STEM subjects learning outcomes is a function of X1, X2, X3, X4 and X5, which are teachers' competence, students' attitude, syllabus coverage, school infrastructure and school management support are the inputs that influence the output, STEM subjects learning outcomes. This theory was used in the study to explain how school systemic management dynamics that is teachers' competence, students' attitude, syllabus coverage, school infrastructure and school management support influence STEM subjects learning outcomes.

2.3 Theoretical Framework

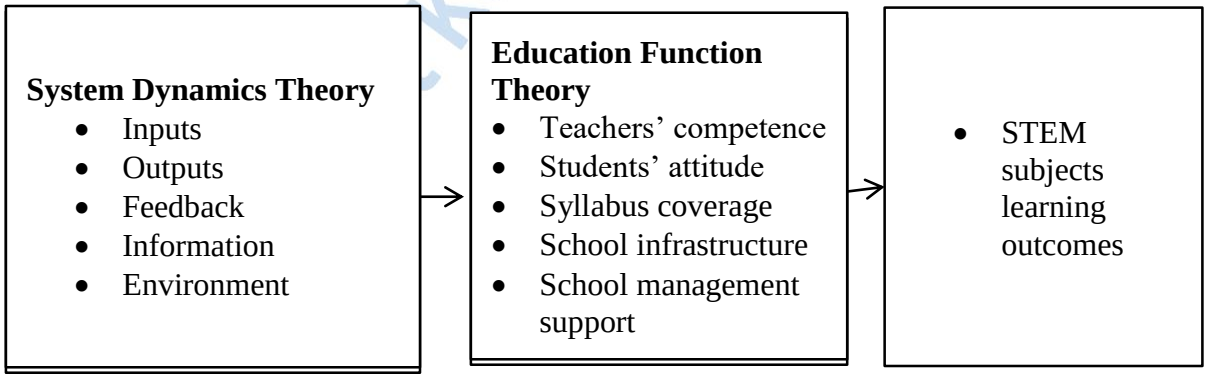

Figure 1: Theoretical Framework

2.3.1 System theory

Von Bertalanffy introduced the systems theory for the first time in the 1930s and after World War II (Bertalanffy, 1972; Friedman and Allen, 2014; Adams, Hester, and Bradley, 2013). A

theoretical attempt was made to understand the way systems interchange matter with their surroundings, as is seen in all living systems. This theory was used in this study because it showed that different parts in an organization interact to provide the needed output. The basis of systems dynamic theory is that an organization operates as a whole. Hence, in a school system the different departments are integrated to function as one. Hence, systemic management ensured that the inputs in the schools provide outputs. The education function theory indicates that inputs in education results to outputs that is learning outcomes.

2.3.2. Education Functional theory

Schulz (1960) established the Education Function Theory. The production function for education basis is the economic production theory and is referred as the combination of input-output that result in school outputs. This theory is used in the study because it focuses on inputs and outputs hence it suitable in describing systematic management dynamics as the inputs and STEM subjects learning outcomes. The educational functional theory was used in the study to explain how school systemic management dynamics that is teachers' competence, students' attitude, syllabus coverage, school infrastructure and school management support influence STEM subjects learning outcomes.

The theoretical framework shows the relationship between inputs in the education system and outputs as the learning outcomes. From the theoretical framework inputs comprises of information and environment which influence learning outcomes. The conceptual framework, which demonstrates how independent factors affect dependent variables, is relevant here.

2.4 Conceptual Framework

In the conceptual framework, the independent variables are teacher's competence, student's attitudes, syllabus coverage, school infrastructure and school management support while the dependent variables are STEM subjects learning outcomes.

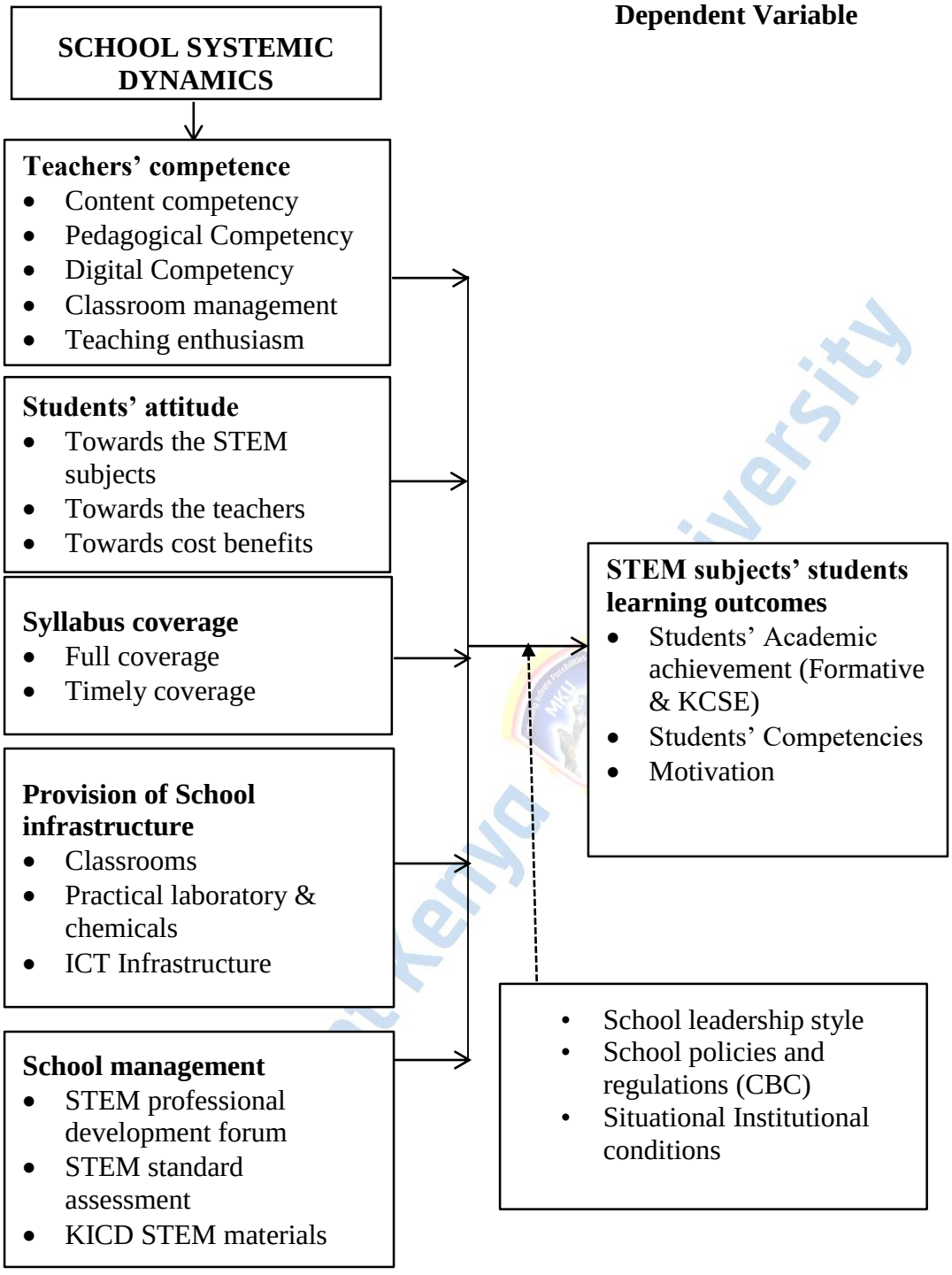

Figure 2: Conceptual Framework

2.5 Research Gaps

Some of the past studies include; Lomarak, Nuansai, Promden and Sangsila (2018) evaluated the teaching competencies of in-service science teachers in an integrated STEM program. This study failed to determine STEM subjects learning outcomes. Song and Zhou (2021) looked at STEM instructors' training, teaching beliefs, and perceived teaching competency. Fauth, Decristan, Deckner and Butter (2019) researched on the effects of elementary science teacher quality on students' performance. These studies failed to determine STEM subjects learning outcomes.

Wahono, Lin and Chang (2020) researched on using a systemic review and meta-analysis, the effectiveness of STEM implementation in Asian students' learning outcomes was demonstrated. This study was focused in Asia; the findings cannot be generalized to Kenya. Kırkıç and Uludağ (2021) researched on student attitudes toward STEM are a good indicator of success in secondary school technology and design courses. This study failed to determine STEM subjects learning outcomes. Langat (2015) researched on students' attitudes and how they affect math learning and success in Kenya's Kiambu County public secondary schools. This study only focused on one STEM subject.

Dennis, Mereku, and Alhassan (2018) investigated how Kenyan secondary school pupils' performance in mathematics was impacted by the scope of the syllabus. This study only focused on one STEM subject. Nakhanu (2012) studied the impact of curriculum coverage on Kenyan secondary school pupils' proficiency in mathematics. This study only focused on one STEM subject. Wafula, Kisilu and Mukwa (2019) researched on the effects of the syllabus's scope and coverage on the implementation of Kenya's secondary schools' physics curriculum. This study only focused on one STEM subject.

Assoumpta and Andala (2020) in Rwanda's twelve-year basic education, the relationship between school facilities and students' academic achievement were explored. Jmail and Mustafa (2018) researched on the influence of instructional resources and school infrastructure on students' academic achievement in Khyber Pakhtunkhwa. Mokaya (2016) studied the impact of school facilities on performance at Kenya's schools. These studies failed to determine STEM subjects learning outcomes.

Khan, Ahmad, Ali and Rehman (2016) studied the influence of principal attitudes and management trainings on student learning results. Davis (2015) researched on the administrators' views of STEM education and how they affect teaching methods in Louisiana schools. These studies failed to determine STEM subjects learning outcomes. Generally, the studies failed to establish the influence of school systemic management dynamics on stem subjects learning outcomes. This study filled the gap by establishing the influence of school systemic management dynamics on stem subjects learning outcomes.

2.6 Summary of Literature

Studies related to school systemic management dynamics on stem subjects learning outcomes have been reviewed. Shonubi (2016) aimed to determine the contribution of leadership and management dynamics to effectiveness in schools. Isa, Mydin and Abdullah (2020) researched on school-based management practices in Malaysia. The theories of the study include system dynamics theory and cognitive constructivism theory of learning. The conceptual framework showed the link between systematic management dynamics and learning outcomes. Gaps were determined from the reviewed studies. In Asia, Wahono, Lin and Chang (2020) researched on effectiveness of STEM on student learning outcomes using a systemic review and meta-analysis. This study was focused in Asia; the findings cannot be

generalized to Kenya. Kırkıç and Uludağ (2021) researched on students' attitudes on STEM as a measure of secondary school technology and design course accomplishment. This study failed to determine STEM subjects learning outcomes.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The research approach was addressed in this chapter. It covers the methodology and design, study location, study population, sampling techniques, sample size, research tools, study tool piloting, validity and reliability test, data collection techniques, data analysis techniques, and ethical considerations.

3.1 Research methodology

The study adopted the mixed research methods. In order to answer the research question, mixed research methodologies incorporate aspects of qualitative and quantitative research. The mixed approach helps in the integration of qualitative and quantitative methods hence ensuring a more detailed study than either method utilized alone (Johnson & Christensen, 2017). Mixed approaches enabled the researcher to contextualize findings and provide more depth to the conclusions. The study results are more reliable when data is gathered using a variety of methodologies on the same topic. Additionally, the validity of the results is strengthened if the qualitative and quantitative data coincide.

3.2 Research Design

This concurrent triangulation mixed approach and descriptive survey research designs was employed in determining the influence of school systemic management dynamics on STEM subjects learning outcomes. The concurrent triangulation mixed approach involved the use of qualitative and quantitative collection of data. This approach was appropriate because it

aided in validating the conclusions drawn by each approach using the evidence generated by the others.

This design provided a deeper knowledge of the research problem. According to Kothari and Berg (2014), descriptive survey approach integrates qualitative and quantitative data to provide pertinent and accurate information. Descriptive design was used to obtain qualitative data. This is because the study data was from interview. The survey design was used to obtain quantitative data using questionnaires. Large amounts of data can be collected using descriptive and survey designs, which the researcher can then analyze for frequencies, averages, and patterns (Creswell, 2013). Further, this design allowed for investigation of more than one variable and the variables of the study cannot be manipulated unlike experimental research. Hence, this design was suitable in investigating the influence of school systemic management dynamics on STEM subjects learning outcomes in secondary schools, in Kajiado County.

Figure 3 below shows that both quantitative and qualitative data was collected, results analyzed and compared and contrasted and interpreted**.**

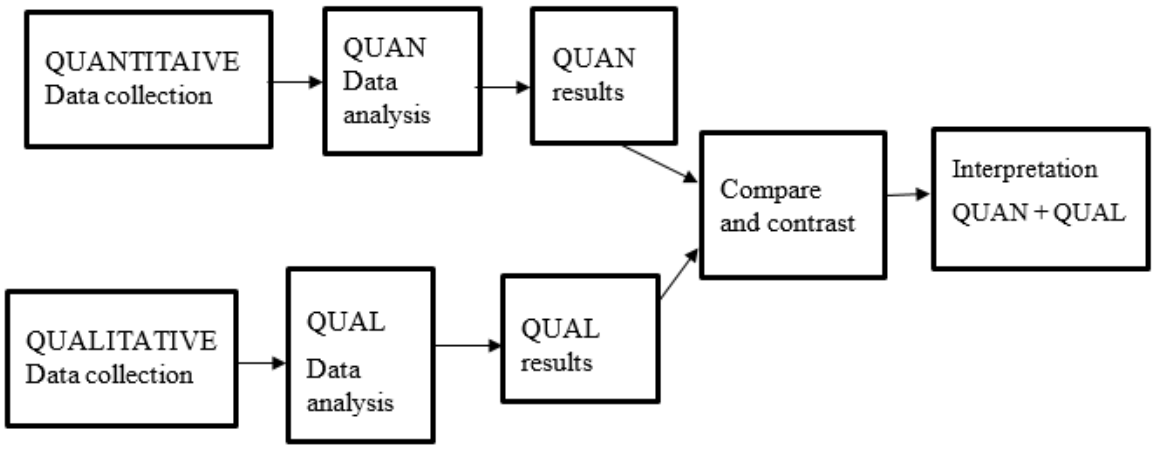

Figure 3: Triangulation design. Source: Creswell, 2006

3.3 Location of the study

Kajiado North Sub County is where the study was conducted. Located between latitudes -1º 50‟ 59.99" South and longitudes 36º 46‟ 59.99" East, Kajiado North Sub County is one of the five Sub Counties that make up the larger Kajiado County. (Integrated Development Plan for the County, 2013–2017). The Sub County is composed of three major towns, Ngong, Ongata Rongai, and Kiserian, with Ngong being the largest. It has a total size of 6,344.9 square kilometers. Since the 1990s, the area has had a tremendous expansion in population due to its close proximity to Nairobi city, which has led to the growth of other centers such Matasia, Rimpa, Nkoroi, Kware, Embulbul, and Olepolos. There are sixteen secondary schools in the sub county. This sub-county was selected because the performance of STEM subjects in the secondary schools has not been impressive as shown in Table 2.

Table 2: STEM Performance for the Last Five Years

	2016	2017	2018	2019	2020
Biology	29.19	18.93	24.65	26.94	27.20
Chemistry	23.71	24.05	26.88	26.09	26.04
Physics	39.77	35.05	34.27	35.09	34.17
Mathematics	20.78	24.48	26.44	27.54	26.66

Source: Ministry of Education (2021)

3.4 Target population

The population that the researcher intends to study and draw conclusions is referred to as the target population. This study was done in secondary schools, in Kajiado North Sub-County. According to the KNBS (2020), there are 16 secondary schools in the County. The study targeted the education sub county directors at the county level TSC, ministry of education and at Kajiado north sub county because the directors are in charge of education activities in the Sub-County they can provide insights on STEM subject performance in the sub-county,

the principals are in charge of the school management they provided information on STEMs subject performance in their schools over the years, teachers are in charge of providing STEM subjects instruction so they provided information about students attitude, syllabus coverage and school support regarding STEM learning, students provided information about how learning STEM subjects is. The population of the study was as distributed in Table 3.

Table 3: Target Population

Category	Frequency	Percent
Sub County Directors	2	0.3
Principals	16	2.5
STEM Teachers	80	12.5
STEM students	544	84.7
TOTAL	**642**	**100.0**

3.5 Sampling Procedures and Sample Size

The focus was on secondary schools, in Kajiado North Sub-County. The study population comprises schools, sub county director principals, teachers and students. Using the simple random sampling method, schools and principals was selected. This is a probability sampling approach which helps in selection of participants randomly. This technique was suitable since each individual in the population has similar opportunity of being selected. Hence, each school and principal had an equal chance of being selected. Mugenda and Mugenda (2006) explained that a sample of 30% of the population is suitable for a study. Hence, the sample size for the schools and principals was 30% of their populations.

Four sub-county directors of education were selected using the census method since the population is only two. The census method was used since it involves the enumeration of everyone in a population. The teachers and students were selected using the purposive

sampling method. This technique was used because just specific teachers teach STEM subjects and not all students take STEM subjects. Purposive sampling is a technique in which the researcher uses his or her own discretion in choosing people of the population to partake in the study. This approach was appropriate since it concentrates on a single subgroup in which all sample members are comparable. This study focused on STEM teachers and STEM students. The researcher selected 30% of the STEM teachers and students. This was as indicated in Table 3.1.

Table 3.1: Sample Size

Category	Population	Sampling methods	Sample
Schools	16	Simple random sampling	5
Sub County Director	2	Census sampling	2
Principals	16	Simple random sampling	5
STEM Teachers	80	Purposive sampling	24
STEM students	544	Purposive sampling	163
Total	**642**		**199**

3.6 Research Instruments

The study collected data using semi-structured questionnaires, interview schedules and document analysis checklists for secondary on learning outcomes. The questionnaires helped to obtain primary data. Interview helped to obtain primary data while document analysis checklist was employed to obtain secondary data.

3.6.1 Questionnaires for Teachers and Students

In order to gather primary data, questionnaires were employed. The questionnaires were semi-structured. It had questions that are open ended and close ended. Open-ended questions gave the participants an opportunity to provide a free-form answer. Closed-ended questions

had a limited set of possible answers. The Likert scale questionnaires were also used to rate the rate at which the respondents agree or disagree with the statements in the questionnaire. The questionnaires were used in this study because, they save of costs, participants can be reached easily, ensures respondent anonymity, data accuracy and ensures flexibility for respondents over where and when to complete their questionnaire (Cooper & Schindler, 2013).

The questionnaire was structured in seven sections. Section one covered the demographic data of the respondents, section two covered inquiries on teachers' competence, section three covered queries on students' attitude, section four covered queries on syllabus coverage, section five covered queries on school infrastructure, section six covered queries on school management support and section seven covered queries on STEM subjects learning outcomes.

3.6.2 Interview Schedules for the Principals and sub County Directors

Another tool utilized to gather primary data was an interview schedule. Principals and the subdirectors were visited at their places of employment and interviewed during business hours. Because the questions were leading, the interviews provided the researcher with detailed information (Creswell, 2013). The interview schedule had five sections. Section one covered the demographic information, section two covered teacher's competence, section three covered students' attitude, section four covers syllabus coverage, section five covered school infrastructure, section six covered school management support and section seven covered STEM subjects learning outcomes.

3.6.3 Document Analysis checklist for Secondary Data

Secondary data was gathered using the document analysis checklist. It is a type of qualitative research where the researcher does an interpretation of documents to give meaning and voice to an evaluation problem (Bowen, 2009). The tool had questions based on all objectives. It had questions on STEM student class attendance, syllabus coverage, the available school infrastructure, school management support and STEM subjects learning outcomes. The questions were rated using the scale never, rarely, sometimes, often, and always.

3.7 Piloting of Research Instruments

Pilot testing was done on the research tool. A tiny study intended to evaluate research procedures, data gathering tools, sample recruitment tactics, and other research methods prior to a bigger study is known as a pilot test. To find possible problem areas and weaknesses in the research instruments and protocol, the instrument is piloted before the whole study begins (Lancaster, Dodd, & Williamson, 2004). The piloting of the study instrument was conducted in Kajiado Central Sub-County. The piloting group was 10% of the study sample that is 1 school, 1 principal, 2 STEM teachers and 16 STEM students. Piloting of the research tool helped to determine whether the questionnaire had covered questions for all the variables adequately. It helped to determine whether the study was feasible. The validity of the research tool was determined using the content analysis method while the reliability was determined using the internal consistency method.

3.8 Testing for Validity, Reliability and Establishment of Trustworthiness

This section discussed the strategies used in testing for validity and reliability. The gathered data's validity demonstrates how accurately it reflects the actual field of study. Field (2005)

describes validity as "measuring what is intended to be measured." The capacity to consistently produce the same results using the same means is referred to as reliability.

3.8.1 Testing of Validity

In this study validity was determined using the content validity technique. The degree to which a research tool's items correspond to the subject matter that was measured is referred to as content validity. The study instrument's content validity was used during development. Content validity is the process of evaluating a new survey instrument to make sure it includes all required questions and eliminates unnecessary items from a certain construct domain (Cooper & Schindler, 2013). The judgmental strategy to establishing content validity included literature reviews, followed by evaluations by experts from the department of educational administration and curriculum studies, as well as peers in this field of study.

3.8.2 Testing of Reliability

The test-retest approach was used to test for reliability. The same respondents received the questionnaires at intervals of two weeks. Reliability was determined if the results of the pilot are similar at the different times the questionnaires was used. This method was suitable since it helps in showing the consistency of the results. Reliability is the degree to which a phenomenon's measurement yields a steady and consistent outcome. Repeatability is another aspect of reliability. A scale or test is considered dependable, for instance, if it consistently yields the same result after several measurements made under the same conditions (Creswell, 2013). Since it has to do with the parts of a measuring instrument's consistency, reliability test is significant. A scale is said to have strong internal consistency dependability if the items "hang together" and measure a similar construct. This study measured internal

consistency using the Cronbach Alpha coefficient. It was regarded as the most dependable measure when using Likert scales (Robinson, 2009)

3.8.3. Establishment of Credibility

The credibility criteria involved determining whether the study participants would find the outcomes of qualitative research credible or believable. Because the goal of qualitative research was to interpret or explain the relevant phenomena via the participants' perspectives, only the participants could appropriately judge the dependability of the results. Credibility was determined using the triangulation method. This involved using numerous data sets, methods and theories to address the research method. This method was used because it helped to enhance to validity and credibility of the findings (Sekaran, 2014).

3.8.4 Establishment of Dependability

The concept of dependability highlights the requirement for the researcher to account for the always changing context in which research takes place. The research is accountable for outlining how changes in the setting affect how the research approached the topic. Dependability was determined by tracking the specific techniques for data collection, processing, and interpretation and providing appropriate data, such that the study can theoretically be duplicated and produce steady outcomes. This method was used since it ensures accuracy and replicability of the methodology used (Winter, 2010).

3.9 Data Collection Procedures

Before data collection, an introduction letter and ethical clearance certificate was obtained from the university in the college of post graduate studies. A research permit was obtained from NACOSTI. This gave the researcher a go ahead to collect the data. The researcher also

sought permission from the education county director in Kajiado North Sub County in order to collect data from the schools. The principal's permission was also sought.

Piloting of the research instrument was done for a period of three weeks after which the actual data collection took place. The respondents were asked to partake in the study and those willing signed a consent form. The questionnaire was administered by the researcher to the teachers and students. The questionnaires were distributed in the different schools in Kajiado North Sub-County by the research. The researcher conducted interviews with the principals and the deputy county director. Document analysis checklist for secondary data was done by the researcher. Data was collected for a period of four weeks.

Table 4: Data collection procedures

RESEARCH QUESTIONS	QUESTIONNAIRES Students and Teachers	INTERVIEW SCHEDULES Principals & MoE/TSC Directors
What extent does teachers' compete influences the STEM subjects learn outcomes in secondary schools, Kajiado North Sub-County?	Q5	P Q4, Q5
What extent does students' attitude influence the STEM subjects learn outcomes in secondary schools, Kajiado North Sub-County?	Q6	P Q6, Q7
What extent does syllabus cover influences the STEM subjects learn outcomes in secondary schools, Kajiado North Sub-County?	Q7	P Q8, Q9
What extent does school infrastruct influence the STEM subjects learn outcomes in secondary schools, Kajiado North Sub-County?	Q8	P Q10, Q11
What extent does school managem support influence the STEM subj learning outcomes in secondary scho in Kajiado North Sub-County?	Q10	P Q12, Q13

Source: (The researcher, 2022)

3.10 Data Analysis Procedures

Data collected was cleaned and edited. The study will use the SPSS version 23.0. The quantitative data was analyzed utilizing the descriptive and inferential statistics. Descriptive statistics comprised mean, standard deviation and percentages. The information was displayed in form of tables, graphs and pie charts. Descriptive statistics was utilized because it enables the presentation of data in a meaningful way, which always for simpler interpretation of data (Creswell, 2014). Data collected from interviews was analyzed using the thematic analysis method. This involved data familiarization, data coding, themes generation, reviewing themes, definition and naming themes, and writing up. This allowed the presentation of data in a prose way.

The inferential statistics comprised the regression analysis and analysis of variance (ANOVA). The inferential statistics was used because they allow conclusions to be drawn based on extrapolations. They further allow generalizations regarding the population from which the sample is drawn (Kombo & Tromp, 2006). The ANOVA was used to determine whether or not the model was significant. The linear regression analysis was conducted to determine the association between school systemic management dynamics and STEM subjects learning outcomes in secondary schools.

The regression model was as follows;

$Y = \beta_0 + \beta_1 X_1 + \varepsilon$.....i

$Y = \beta_0 + \beta_2 X_2 + \varepsilon$.....ii

$Y = \beta_0 + \beta_3 X_3 + \varepsilon$.....iii

$Y = \beta_0 + \beta_4 X_4 + \varepsilon$.....iv

$Y = \beta_0 + \beta_5 X_5 + \varepsilon$.....v

Where:

Y = STEM subjects learning outcomes

X_1 = Teachers' competence

X_2 = Students' attitude

X_3 = Syllabus coverage

X_4 = School infrastructure

X_5 = School management support

β_0 = Constant, β_1 to 5_4, are the variables coefficients, ε = error

Table 5: Data analysis procedures

RESEARCH QUESTIONS	INDEPENDENT VARAIBLES	DEPENDENT VARIABLE	ANALYSIS APPROACHES
What extent does teachers' competence influences the STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County?	Teacher's competence	STEM subjects learning outcomes	%, frequencies, mean, standard deviation, tables, descriptions and inferential, interviews
What extent does students' attitude influences the STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County?	Students' attitude	STEM subjects learning outcomes	%, frequencies, mean, standard deviation, tables, descriptions and inferential, interviews
What extent does syllabus coverage influences the STEM subjects learning outcomes in secondary schools?	Syllabus coverage	STEM subjects learning outcomes	%, frequencies, mean, standard deviation, tables, descriptions and inferential,

			interviews
What extent does school infrastructure influence the STEM subjects learning outcomes in secondary schools, in Kajiado?	School infrastructure	STEM subjects learning outcomes	%, frequencies, mean, standard deviation, tables, descriptions and inferential, interviews
What extent does school management support influence the STEM subjects learning outcomes in secondary schools, in Kajiado?	Management support	STEM subjects learning outcomes	%, frequencies, mean, standard deviation, tables, descriptions and inferential, interviews

Source: (The researcher, 2022)

3.11 Ethical Considerations

The code of conduct was upheld during the entire study procedure. This includes ensuring the respondents' privacy, confidentiality, and freedom to participate in and leave the study. The respondents' true identities were not utilized in the reporting process to safeguard them. The respondents' permission was requested for the study. By referencing writers' prior work on the subject under investigation, the study prevented plagiarizing (Sanjari, 2014).

3.11.1 Intellectual ownership and plagiarism

This includes acknowledging the author's accomplishments, protecting property rights, and respecting the societal rights to the benefits of intellectual endeavor and unrestricted access to knowledge. The proposal contained the researcher’s original work. Informed that is borrowed from other sources was properly cited to acknowledge the author’s work. The researcher made sure to give proper credit and steer clear of plagiarism while employing a book chapter or research paper by skillfully paraphrasing, summarizing, or quoting the necessary material.

3.11.2 Participants Right to Informed Consent

The study asked NACOSTI, the sub county director of education in Kajiado North Sub-County and the sub county director TSC for permission to proceed. According to Bodgan and Bilken (2013), requesting approval to conduct a study entails more than simply receiving the official go-ahead; it also involves establishing the groundwork with the participants who the researcher would be dealing with.

3.11.3 Participants Right to Privacy

The information given in the study was kept confidential since it was only used for academic purposes. The information was stored in the university databases. Only authorized individuals were allowed to access the information. This was established by ensuring that students access the information for learning.

3.11.4 Participants Right to Confidentiality

The respondents were guaranteed that the data they provide was treated as classified information. All information was put together hence no one would be able to identify it with any individuals. This encouraged the respondents to offer accurate and reliable information. With the omission of a code that was seen only to the analyst, the names of the respondents were not included in the research tool to assure this. Analysts, according to Taylor and Bogdan (2008), should make sure that the members are safeguarded and categorized.

3.11.5 Freedom from coercion

The respondents were not coerced to partake in the study. Those willing to participate did so voluntarily. The respondents were requested to partake in the study. Those willing signed a consent form. If the respondents felt uncomfortable, they were free to leave the study.

3.11.6 Anonymity

The respondents were asked to answer questions without writing their names on the survey. Codes were used in the identification of the participants. No specific information regarding the respondents was made public in writing or by any other form of communication. This helped to avoid choosing volunteers who would give inaccurate feedback.

3.11.7 Right to voluntary participation

The participants were not forced to give information; the researcher just let them. A consent form was signed by those who are willing to take part in the study. There were no risks involved in the study. However, those willing to withdraw from the study did so. They were no penalties for those who are unwilling to partake in the study.

3.11.8 Permissions to Access the Sites

The researcher obtained a NACOSTI permit which allowed for data collection. A letter of introduction was gotten from the university. The researcher also obtained the authorization letter from the sub county directors. This helped in introducing the study to the participants and also to the institutions where the study was conducted. The study sought permission from the school heads to obtain data in their institutions.

3.11.9 Storage of collected data

The information obtained from the field was saved for further use. Hard copies of the processed data were filed, and soft copies were kept on flash disks and VDs. The information was kept in the university's database, where only those with permission to access it may do so.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter covers the analysis, presentation and discussion of the collected data. These include the sample size, reliability results, demographic analysis, descriptive analysis, correlational analysis and multiple regression analysis. The purpose of the study was to investigate the influence of school systemic management dynamics on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

4.1 Response Rate

The study sample was 199 respondents who comprised of 24 teachers, 163 students, 5 principals and 2 sub-county directors. Questionnaires were issued to teachers and students while interview schedules were for the principals and deputy county directors. The response rate was as shown in table 7.

Table 6: Response Rate

Research Item	**Teachers and**		**Students**		**Principals and**		**county directors**	
	Frequency	Percent	F	Percent	F	Percent	F	Percent
Response	142	87	21	88	5	100.0	2	100.0
Non-Response	21	13	3	12	0	0.0	0	0.0
Total	**163**	**100.0**	**24**	**100.0**	**5**	**100.0**	**2**	**100.0**

According to table 7, the questionnaires that were received back were 142 students, 21 for teachers, 5 principals and 2 sub-county directors. The response rate was 87%, 88%, 100% and 100% respectively. According to Fan and Yan (2010) a response rate of above 50% and above is adequate while response rate is 70% and above is excellent.

4.2 Reliability Analysis

The test-retest approach was used to test for reliability. This study measured internal consistency using the Cronbach Alpha coefficient. It was regarded as the most dependable measure when using Likert scales (Robinson, 2009). The results were as shown in Table 8.

Table 7: Reliability Analysis

Scale	Cronbach's Alpha	Number of Items
Teachers' competence	0.797	6
Students' attitude	0.752	5
Syllabus coverage	0.780	5
School infrastructure	0.775	5
School management support	0.741	5
Learning outcomes	0.802	3

The findings in table 8 show that teachers' competence had a Cronbach alpha of 0.797, students' attitude alpha of 0.752, syllabus coverage alpha of 0.780, school infrastructure alpha of 0.775, school management support alpha of 0.741 and learning outcomes of 0.802. The results show that the variables had an alpha of 0.7 and above. This implies that the variables were all reliable.

4.3 Demographic Analysis

4.3.1 Respondents Gender

The purpose of the study was to ascertain the respondents' gender. The results were as shown in table 9.

Table 8: Respondents Gender

	Students		Teachers		Principals		county directors	
	Frequency	**Percent**	**F**	**Percent**	**F**	**Percent**	**F**	**P**
Male	90	63%	13	62%	3	60%	2	100%
Female	52	37%	8	38%	2	40%	0	0
Total	**142**	**100%**	**21**	**100%**	**5**	**100%**	**2**	**100%**

According to table 9, 90(63%) of the students were male while 52(37%) were female. Also, 62% of the teachers were male while 38% were female. Also, 3(60%) respondents were male while 2(40%) were female principals and 2(100%) were male directors. This implies that majority of the respondents were male. It can be concluded that majority of the students taking STEM subjects are male. Also, majority of the teacher's instructors in STEM subjects are male. In their study Muhia (2024) concluded that in both public primary and private secondary schools, men made up 80% and 85% of the heads of the mathematics departments, respectively. According to Vooren, Haelermans, and Groot (2022), women are less likely to pursue STEM-related careers. According to Wang, Tan, and Zhou (2023), male students were substantially more interested in STEM occupations than female students.

4.3.2 Respondents Academic Qualification

The study sought to determine the academic qualification of the respondents. The results were summarized in table 10.

Table 9: Respondents Academic Qualification

	Teachers		Principals and county directors	
	Frequency	**Percent**	**Frequency**	**Percent**
Diploma	4	17	0	0
Degree	15	62	5	71
Postgraduate	5	21	2	29
Total	**21**	**100%**	**7**	**100%**

The results in table 10 show that 4(17%) of the teachers had diploma, 15(62%) had degree while 5(21%) had postgraduate studies. Further, 5((71%) of the principals and sub county directors had had degree while 2(29%) had postgraduate studies. It can be concluded that majority of the teachers in STEM subjects' academic qualification is degree. This relates to a study by Musau and Abere (2015) which found that The majority of SMT subject teachers were recent graduates with training, and most of them had taken refresher or in-service courses, which helped the students' performance in SMT subjects somewhat.

4.3.3 Period of Teaching in the Secondary School

The study sought to determine the period the teachers have been teaching in secondary schools. The results were as shown in table 11.

Table 10: Period of Teaching in the Secondary School

	Teachers	
	Frequency	**Percent**
1-5 years	8	33
6-10 years	11	46
Above 10 years	5	21
Total	**21**	**100%**

The findings show that 8(33%) of teachers had taught in their secondary school for between 1-5 years, 11(46%) had taught in their secondary school for between 6-10 years while 5(21%) had taught in their secondary school for above 10 years. This implies that majority of teachers have taught in secondary schools for less than 10 years. Teachers with few years of experience may not have adequate experience to enhance learning outcomes of STEM subjects.

4.3.4 Period of Teaching the STEM subjects

The study sought to determine the period the teachers have been teaching STEM subjects. The results were a shown in Table 12.

Table 11: Period of Teaching the STEM subjects

	Teachers	
	Frequency	**Percent**
1-5 years	8	33
6-10 years	11	46
Above 10 years	5	21
Total	**21**	**100%**

The findings show that 8(33%) of teachers had taught STEM subjects for between 1-5 years, 11(46%) had taught STEM subjects for between 6-10 years while 5(21%) had taught in STEM subjects for above 10 years. This implies that majority of the teachers have taught STEM subjects for less than 10 years. Teachers with few years of experience may not have adequate experience to enhance learning outcomes.

4.3.5 Years of Service

The principals and county directors were required to indicate their years of service. The results were as summarized in table 13.

Table 12: Years of Service

Research Item	**Principals**		**Sub county directors**	
	Frequency	**Percent**	**Frequency**	**Percent**
Below 5 years	1	20	0	0
6-10 years	3	60	0	0
Above 11 years	1	20	2	100
Total	**5**	**100**	**2**	**100**

The findings in Table 13 show that 1(20%) principal's years of service was below 5 years, 3(60%) years of service was 6-10 years while 1(20%) years of service was above 11 years. Also, 100% of the sub county director's years of service were above 11 years. This implies

that majority of principals have at least 10 years of service. Hence, they have been able to support STEM subjects learning.

4.4 Influence of Teachers' Competence on STEM subjects learning outcomes

The respondents were required to rate their level of agreement on the statements below about the influence of teachers' competence on STEM subjects learning outcomes in secondary schools, in Kajiado North sub County.

4.4.1 Descriptive Statistical Analysis

Descriptive analysis was done to determine influence of teachers' competence on STEM subjects learning outcomes. The results were presented in table 14.

Table 13: Influence of Teachers' Competence on STEM Subjects Learning Outcomes

Statements		1	2	3	4	5
The school has teachers with digital competency which influences STEM subjects learning outcomes	**F**	11	38	21	67	26
	P	6.75%	23.31%	12.88%	41.10%	15.95%
It is true that pedagogical competency influences STEM subjects learning outcomes	**F**	18	20	22	70	33
	P	11.04%	12.27%	13.50%	42.94%	20.25%
It is true that teacher's cognitive ability enhances STEM subjects learning outcomes	**F**	9	15	19	95	25
	P	5.52%	9.20%	11.66%	58.28%	15.34%
It is true that classroom management ensures effective learning and enhances STEM subjects learning outcomes	**F**	6	17	24	86	30
	P	3.68%	10.43%	14.72%	52.76%	18.40%
It is believed that the teachers' content competency influences STEM subjects learning outcomes	**F**	10	19	21	65	48
	P	6.13%	11.66%	12.88%	39.88%	29.45%
Your school support teachers hence they have a positive attitude which ensures effective STEM subjects learning outcomes	**F**	14	29	23	70	27
	P	8.59%	17.79%	14.11%	42.94%	16.56%

From the findings in table 14, majority off the respondents 67(41.10%) agreed that the school has teachers with digital competency which influences STEM subjects learning outcomes, 70(42.94%) agreed that it is true that pedagogical competency influences STEM subjects learning outcomes, 95(58.28%) agreed that it is true that teacher's cognitive ability enhances STEM subjects learning outcomes, 86(52.76%) agreed that it is true that classroom management ensures effective learning and enhances STEM subjects learning outcomes, 65(39.88%) believed that the teachers' content competency influences STEM subjects learning outcomes and 70(42.94%) agreed that their school support teachers hence they have a positive attitude which ensures effective STEM subjects learning outcomes. This concurs with Lomarak, Nuansai, Promden and Sangsila (2018) found that the integrated STEM ought to be used to improve the teaching abilities of in-service science teachers. The outcomes also showed that the teaching capabilities of teacher's in-service science were at or near proficient levels. Song and Zhou (2021) research revealed that perceptions of teaching proficiency among STEM teachers were positively correlated with knowledge training, teaching practice, and teaching beliefs during education programs of teachers.

The principals and sub county directors were asked to indicate which of the teachers' competences influence STEM subjects learning outcomes. All 7(100%) of the principals and sub county directors indicated that content competency, pedagogical competency, digital competency, cognitive ability and classroom management influence students' academic achievement (formative & KCSE), students' competencies and motivation. This is line with Fauth, Decristan, Deckner and Butter (2019) who indicated that the competence of a teacher that enthusiasm, self-efficacy, content and knowledge was related positively to the interest of learners; self-efficacy was related positively to achievement of learners. Thuy, Bien and Quy

(2020) discovered that the four components of teachers' competence in integrated STEM education include awareness, developing, implementing, assessing, and modifying the STEM teaching plan.

4.4.2 Inferential Statistical Analysis

The objective was to determine the influence of teachers' competence on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. To determine the linear regression, the study regressed teachers' competence with STEM subjects learning outcomes. The results were as shown in table 15.

Table 14: Regression for Teachers' Competence

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.599	0.359	0.355	0.34000

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.406	1	10.406	90.015	0.000[b]
	Residual	18.612	161	0.116		
	Total	29.018	162			

Beta Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.316	0.249		5.285	0.0000
	Teachers' competence	0.344	0.101	0.301	3.406	0.0008

Predictors: Teachers' competence

From table 15, the model summary was used to analyze the variation of STEM subjects learning outcomes due to teachers' competence. The results show that the adjusted R square was 0.355, which implies that 35.5% of STEM subjects learning outcomes in secondary schools can be explained by teachers' competence. The results also mean that 64.5% variation in STEM subjects learning outcomes can be explained by other variables. Further,

the R value was 0.599, meaning that the model is significant in predicting variations of STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The ANOVA was used to determine whether the model was significant. The results show that the f-statistic 90.015 was greater that f-critical 3.899 front f-distribution tales. Also the p-value was 0.000 which was less than 0.05 selected significance level. This implies the model was significant in predicting STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The beta coefficients were used to determine the significance level between the variables. The regression model was fitted as follows;

$Y= 1.316+ 0.344X_1$

From the findings, holding teachers' competence at a constant, STEM subjects learning outcomes would be at a constant of 1.316. The results also show that teachers' competence had a significant influence on STEM subjects learning outcomes since p-value 0008<0.05. Further, teachers' competence had a positive influence on STEM subjects learning outcomes since the beta coefficient was 0.344. This implies that an increase in teachers' competence by a unit would result to an increase in STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County by 0.344 units

4.4.3 Thematic Analysis

The thematic analysis focused on the descriptive findings and interview schedule results which were addressing the influence of teachers' competence on STEM subjects learning outcomes. It was noted that majority of the schools have teachers with digital competence. Also pedagogical competency, content competency and teacher's cognitive ability are

important in STEM learning. It was also evident that the management of classroom by teachers can promote effective learning of STEM subjects. Further, majority of the schools support STEM teachers to promote positive attitude when teaching.

It was noted that teachers' competencies including content competency, pedagogical competency, digital competency, cognitive ability and classroom management influence students' academic achievement. However, in some schools teachers lack these competencies which affect STEM learning outcomes. The findings concur with Fauth, Decristan, Deckner and Butter (2019) who indicated that the competence of a teacher that enthusiasm, self-efficacy, content and knowledge was related positively to the interest of learners; self-efficacy was related positively to achievement of learners.

4.4.4 Triangulation of Qualitative and Quantitative Findings

The descriptive statistics showed that in most of the schools the teachers and students 67(41.10%) agreed that the school has teachers with digital competency while 70(42.94%) agreed teachers' pedagogical competency, content competency and cognitive ability influences STEM subjects learning outcomes. It is clear that the schools need to ensure that they have competent STEM teachers in order to achieve good performance. From the inferential statistics it was seen that teachers' competence had a significant and positive influence on STEM subjects learning outcomes. This shows that teacher's competence improves STEM subjects learning outcomes. What is required is to provide training for teachers and also supporting their professional development to enhance their competence in STEM subjects. This is in agreement with Song and Zhou (2021) who indicated that perceptions of teaching proficiency among STEM teachers were positively correlated with

knowledge training, teaching practice, and teaching beliefs during education programs of teachers

4.5 Influence of Students' Attitude on STEM subjects learning outcomes

The study sought to determine the influence of the students' attitude on STEM subjects learning outcomes. Hence, a descriptive analysis was conducted.

4.5.1 Descriptive statistical analysis

The respondents were asked to rate their level of agreement of the following statements about out the influence of the students' attitude on STEM subjects learning outcomes. The results were summarized in table 16.

Table 15: Influence of Students' Attitude on STEM Subjects Learning Outcomes

		D	SD	N	A	SA
The student's attitude impact on the STEM subjects learning outcomes	**F**	11	15	17	66	54
	P	6.75%	9.20%	10.43%	40.49%	33.13%
In your school, students are encouraged to choose the STEM subject they are interested to influence the STEM subjects learning outcomes	**F**	9	19	25	78	32
	P	5.52%	11.66%	15.34%	47.85%	19.63%
It is true that student's attitude towards the subject influences the STEM subjects learning outcomes	**F**	5	19	21	83	35
	P	3.07%	11.66%	12.88%	50.92%	21.47%
It is believed that student's attitude towards the teacher influences the STEM subjects learning outcomes	**F**	7	10	18	65	63
	P	4.29%	6.13%	11.04%	39.88%	38.65%
It is true that student's attitude towards the schooling influences the STEM subjects learning outcomes	**F**	10	17	23	77	36
	P	6.13%	10.43%	14.11%	47.24%	22.09%

The findings in table 16 show that, majority 66(40.49%) the respondents agreed that the student's attitude impact on the STEM subjects learning outcomes. Further, 78(47.85%) agreed that in their school, students are encouraged to choose the STEM subject they are

interested to influence the STEM subjects learning outcomes, also, 83(50.92%) agreed that it is true that student's attitude towards the subject influences the STEM subjects learning outcomes, 65(39.88%) believed that student's attitude towards the teacher influences the STEM subjects learning outcomes while 77(47.24%) agreed that it is true that student's attitude towards the schooling influences the STEM subjects learning outcomes. The findings concur with those of Pambudi, and Amurdawati (2019) found that student attitudes regarding the learning process continue to have the greatest impact at school. Gok (2021) findings indicated that, in both the city's urban and suburban areas, the mean score of students' attitudes toward STEM subjects declined from ninth grade to twelfth grade. Krkç and Uluda's (2021) discovered an association between STEM attitudes and students' performance in technology and design courses that was both favorable and substantial.

The principals and sub county directors were asked to indicate which of the students' attitude influence STEM subjects learning outcomes. All 7(100%) of the respondents indicated that students' attitude towards the STEM subjects, towards the teachers and towards the schooling influence students' academic achievement (Formative & KCSE), competencies and motivation. This relates to Offor, Bubou, and Gumus (2020) whose findings showed that the characteristics of learners had an impact on students' views toward STEM disciplines. Langat (2015) discovered that while most children had a positive attitude toward mathematics and believed it to be possible, attainable, and significant, this did not convert into high academic performance.

4.5.2. Inferential statistical analysis

The second objective was to determine the influence of students' attitude on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. To determine the

linear regression, the study regressed students' attitude with STEM subjects learning outcomes. The results were as shown in table 17.

Table 16: Regression Analysis for Students' attitude

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.529	0.280	0.275	0.40806

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.406	1	10.406	62.495	0.000[b]
	Residual	26.808	161	0.167		
	Total	37.214	162			

Beta Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.861	0.182		4.731	0.0000
	Students' attitude	0.308	0.091	0.280	3.385	0.0010

From table 17, the model summary was used to analyze the variation of STEM subjects learning outcomes due to students' attitude. The results show that the adjusted R square was 0.275, which implies that 27.5% of STEM subjects learning outcomes in secondary schools can be explained by students' attitude. The results also mean that 72.5% variation in STEM subjects learning outcomes can be explained by other variables. Further, the R value was 0.529, meaning that the model is significant in predicting variations of STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The ANOVA was used to determine whether the model was significant. The results show that the f-statistic 62.495 was greater that f-critical 3.899 front f-distribution tales. Also the p-value was 0.000 which was less than 0.05 selected significance level. This implies the model was significant in predicting STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The beta coefficients were used to determine the significance level between the variables. The regression model was fitted as follows;

$Y= 0.861+ 0.308X_1$

From the findings, holding students' attitude at a constant, STEM subjects learning outcomes would be at a constant of 0.861. The results also show that students' attitude had a significant influence on STEM subjects learning outcomes since p-value 0010<0.05. Further, students' attitude had a positive influence on STEM subjects learning outcomes since the beta coefficient was 0.308. This implies that an increase in students' attitude by a unit would result to an increase in STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County by 0.308 units.

4.5.3 Thematic Analysis

Thematic analysis was used for descriptive analysis and interview schedule. The researcher noted that majority 83(50.92%) of the students have attitude towards STEM subjects which affect their learning outcomes. The students can have attitude towards the subject, the attitude may be also on the teachers providing instruction and attitude towards schools which affect STEM subjects learning. The students may have positive or negative attitude towards the subject or teachers which both affect the STEM subjects learning outcomes. Due to their attitude, the students are encouraged to choose the STEM subjects they desire. Learning something they are interested in would help to develop a positive attitude towards STEM subjects learning. It was also noted that students' attitude towards the STEM subjects, towards the teachers and towards the schooling influence students' academic achievement, competencies and motivation. This agrees with Offor, Bubou, and Gumus (2020) who

indicated that the characteristics of learners had an impact on students' views toward STEM disciplines.

4.5.4 Triangulation of qualitative and quantitative findings

According to the descriptive analysis, majority of the teachers and students 83(50.92%) agreed that it is true that student's attitude towards the subject influences the STEM subjects learning outcomes. Also, 77(47.24%) agreed that it is true that student's attitude towards schooling influences the STEM subjects learning outcomes. Although some of the respondent also disagreed about these statements. The inferential statistics showed that the observations indicated that the p values obtained were greater than the α value, which was 0.05, indicating that the respondents' opinions were not coincidental but rather what was expected in a typical case. This means that the views of the participants were statistically acceptable as significant. Krkç and Uluda's (2021) discovered an association between STEM attitudes and students' performance in technology and design courses that was both favorable and substantial.

4.6 Influence of Syllabus Coverage on STEM subjects learning outcomes

The study objective was to determine influence of syllabus coverage on STEM subjects learning outcomes in secondary schools, in Kajiado North sub County.

4.6.1 Descriptive Statistical Analysis

The respondents were required to rate their level of agreement on the statements about the influence of syllabus coverage on STEM subjects learning outcomes. The results were as shown in table 18.

Table 17: Influence of Syllabus Coverage on STEM Subjects Learning Outcomes

Statements		1	2	3	4	5
The full coverage of STEM subject's syllabus enhances STEM subjects learning outcomes	**F**	5	9	17	84	48
	P	3.07%	5.52%	10.43%	51.53%	29.45%
There is timely coverage of STEM subject's syllabus to enhance STEM subjects learning outcomes	**F**	7	12	15	91	38
	P	4.29%	7.36%	9.20%	55.83%	23.31%
Your school provides a work plan that guides in teaching to enhance STEM subjects learning outcomes	**F**	3	8	25	94	33
	P	1.84%	4.91%	15.34%	57.67%	20.25%
Ensuring that all the topics in each of the STEM subjects are covered improves STEM subjects learning outcomes	**F**	4	5	23	76	55
	P	2.45%	3.07%	14.11%	46.63%	33.74%
Ensuring that all practical parts of the STEM subjects are covered improves STEM subjects learning outcomes	**F**	7	9	19	71	57
	P	4.29%	5.52%	11.66%	43.56%	34.97%
The teacher ensures that the students have understand both theoretical and practical concepts to enhance STEM subjects learning outcomes	**F**	9	11	16	63	64
	P	5.52%	6.75%	9.82%	38.65%	39.26%

From the findings, majority 84(51.53%) of the respondents agreed that the full coverage of STEM subject's syllabus enhances STEM subjects learning outcomes, 91(55.83%) agreed that there is timely coverage of STEM subject's syllabus to enhance STEM subjects learning outcomes, 94(57.67%) agreed that their school provides a work plan that guides in teaching to enhance STEM subjects learning outcomes, 76(46.63%) agreed that ensuring that all the topics in each of the STEM subjects are covered improves STEM subjects learning outcomes, 71(43.56%) agreed that ensuring that all practical parts of the STEM subjects are covered improves STEM subjects learning outcomes and 64(39.26%) of the respondents agreed that the teacher ensures that the students have understand both theoretical and practical concepts to enhance STEM subjects learning outcomes. Dennis, Mereku and Alhassan (2018) found that there was no discernible difference between the high, average,

and low school performance categories in terms of their teachers' coverage of the mathematics curriculum. Wafula, Kisilu, and Mukwa (2019) indicated that a broad scope of the curriculum hinders timely completion of the program, which affected how the physics curriculum was implemented.

The principals and sub county directors were asked to indicate if the indicated factors of syllabus coverage influence STEM subjects learning outcomes. They all agreed that syllabus coverage full coverage, relevance and work plan influence students' academic achievement (Formative & KCSE), competencies and motivation. This is line with Nakhanu (2012) who discovered that student performance in mathematics at the KCSE level was significantly impacted by syllabus coverage. Musasia, Nakhanu, and Wekesa (2017) found that mathematics performance at the KCSE level is significantly impacted by syllabus coverage.

4.6.2 Inferential statistical analysis

The third objective was to determine the influence of syllabus coverage on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. To determine the linear regression, the study regressed syllabus coverage with STEM subjects learning outcomes. The results were as shown in table 19.

Table 18: Regression Analysis for Syllabus coverage

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.561	0.315	0.311	0.35878

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.527	1	9.527	74.013	0.000[b]
	Residual	20.724	161	0.129		
	Total	30.251	162			

Beta Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.105	0.158		6.994	0.0000
	Syllabus coverage	0.329	0.098	0.310	3.357	0.0010

From the findings in table 19, the model summary was used to analyze the variation of STEM subjects learning outcomes due to syllabus coverage. The results show that the adjusted R square was 0.311, which implies that 31.1% of STEM subjects learning outcomes in secondary schools can be explained by syllabus coverage. The results also mean that 68.9% variation in STEM subjects learning outcomes can be explained by other variables. Further, the R value was 0.561, meaning that the model is significant in predicting variations of STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The ANOVA was used to determine whether the model was significant. The results show that the f-statistic 74.013was greater that f-critical 3.899 front f-distribution tales. Also the p-value was 0.000 which was less than 0.05 selected significance level. This implies the model was significant in predicting STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The beta coefficients were used to determine the significance level between the variables. The regression model was fitted as follows;

$Y= 1.105+ 0.329X_1$

From the equation, holding syllabus coverage at a constant, STEM subjects learning outcomes would be at a constant of 1.105. The results also show that syllabus coverage had a significant influence on STEM subjects learning outcomes since p-value 0010<0.05. Further, syllabus coverage had a positive influence on STEM subjects learning outcomes since the

beta coefficient was 0.329. This implies that an increase in syllabus coverage by a unit would result to an increase in STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County by 0.329 units.

4.6.3 Thematic Analysis

Thematic analysis was used for descriptive analysis and interview schedule. It was noted that full coverage of syllabus is very essential in STEM learning outcomes. The syllabus should also be covered at the right tome so that the students grasp all the areas of the STEM subject in order to enhance their learning outcomes. The schools provide work plans which guide in teaching STEM subjects. It also seemed that covering all topics in STEM subjects and also ensuring that the practical parts are covered improves STEM subjects learning outcomes. Also teachers are required to ensure that the learners understand all areas in a subject including the theoretical and practical concepts. It was also observed that coverage of syllabus and its relevance influence the academic achievement of students. This is line with Nakhanu (2012) who discovered that student performance in mathematics at the KCSE level was significantly impacted by syllabus coverage.

4.6.4 Triangulation of qualitative and quantitative findings

From descriptive analysis, syllabus coverage is an essential thing in the schools and efforts have been made to ensure that there is full coverage of syllabus in STEM subjects. Majority 84(51.53%) of the respondents concurred that the full coverage of STEM subject's syllabus enhances STEM subjects learning outcomes. Other than full coverage, covering the syllabus at the required time is also important. Also, to improve on the coverage, the schools have devised work plans to guide in teaching the STEM subjects and to show what should be covered by a certain period. It was also established that majority of the participants

64(39.26%) concurred that ensuring that the students have understand both theoretical and practical concepts enhances STEM subjects learning outcomes.

According to the inferential statistics, observations showed that the P values obtained were more than the significance value 0.05, indicating that the participants' opinions were what would be expected under normal circumstances rather than being spontaneous. This suggests that the participants' opinions were not unplanned. The study found a significant relationship between the factors used. It was so determined that the responses were genuine enough to be acceptable. Musasia, Nakhanu, and Wekesa (2017) found that mathematics performance at the KCSE level is significantly impacted by syllabus coverage.

4.7 Influence of School Infrastructure on STEM subjects learning outcomes

The study aim was to examine the influence of school infrastructure on STEM subjects learning outcomes in secondary schools, in Kajiado North sub County

4.7.1 Descriptive Statistical Analysis

The respondents were required to rate the following statements using the scale; 1-SD, 2-D, 3-N, 4-A, 5-SA. Table 20 is a summary of the results.

Table 19: Influence of School Infrastructure on STEM Subjects Learning Outcomes

Statements		1	2	3	4	5
The school has the needed ICT infrastructure which influences STEM subjects learning outcomes	**F**	17	58	26	41	21
	P	10.43%	35.58%	15.95%	25.15%	12.88%
There are classrooms specifically for the purposes of learning STEM subjects which influences STEM subjects learning outcomes	**F**	14	49	30	36	34
	P	8.59%	30.06%	18.40%	22.09%	20.86%
There are laboratories which ensure that students have practical learning which influences STEM subjects learning outcomes	**F**	19	28	24	72	20
	P	11.66%	17.18%	14.72%	44.17%	12.27%
The school has a library facility which allows the students to research which enhances STEM subjects learning outcomes	**F**	32	63	31	24	13
	P	19.63%	38.65%	19.02%	14.72%	7.98%
The school gives STEM students an opportunity to compete in secondary schools' science competition which improves STEM subjects learning outcomes	**F**	12	25	26	79	21
	P	7.36%	15.34%	15.95%	48.47%	12.88%

From table 20, majority 58(35.58%) disagreed that the school has the needed ICT infrastructure which influences STEM subjects learning outcomes, 49(30.06%) disagreed that there are classrooms specifically for the purposes of learning STEM subjects which influences STEM subjects learning outcomes, 72(44.17%) agreed that there are laboratories which ensure that students have practical learning which influences STEM subjects learning outcomes, 63(38.65%) disagreed that the school has a library facility which allows the students to research which enhances STEM subjects learning outcomes and 79(48.47%) agreed that the school gives STEM students an opportunity to compete in secondary schools' science competition which improves STEM subjects learning outcomes. This concurs with Assoumpta and Andala (2020) who discovered a weak but substantial positive association

between student academic performance and school infrastructure. Nugroho and Wibowo (2020) noted that educational infrastructure and amenities are necessary for the learning process to function at its best, particularly when reaching learning goals. Jmail and Mustafa (2018) indicated that the scientific labs and the playground have little bearing on student achievement.

The principals and sub county directors were required to indicate which school infrastructure influence STEM subjects learning outcomes from provided items. They all agreed that classroom, practical laboratory & chemicals, ICT infrastructure and sanitation areas influence students' academic achievement, competencies and motivation. This relates to Mokaya (2016) who found that appropriate and well-spaced classrooms, adequate and ample library space, adequate science labs, adequate water and sanitation facilities, and adequate engagement in extracurricular activities all contribute to increased academic performance**.**

4.7.2. Inferential statistical analysis

The goal was to determine the influence of school infrastructure on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. To determine the linear regression, the study regressed school infrastructure with STEM subjects learning outcomes. The results were as shown in table 21.

Table 20: Regression Analysis for School infrastructure

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.622	0.386	0.383	0.33297

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.241	1	11.241	101.389	0.000[b]
	Residual	17.85	161	0.111		
	Total	29.091	162			

Beta Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.949	0.189		5.021	0.0000
	School infrastructure	0.360	0.095	0.325	3.789	0.0002

From the findings in table 21, the model summary was used to analyze the variation of STEM subjects learning outcomes due to school infrastructure. The results show that the adjusted R square was 0.383, which implies that 38.3% of STEM subjects learning outcomes in secondary schools can be explained by school infrastructure. The results also mean that 61.7% variation in STEM subjects learning outcomes can be explained by other variables. Further, the R value was 0.622, meaning that the model is significant in predicting variations of STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The ANOVA was used to determine whether the model was significant. The results show that the f-statistic 101.389 was greater that f-critical 3.899 front f-distribution tales. Also the p-value was 0.000 which was less than 0.05 selected significance level. This implies the model was significant in predicting STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The beta coefficients were used to determine the significance level between the variables. The regression model was fitted as follows;

$Y= 0.949+ 0.360X_1$

From the equation, holding school infrastructure at a constant, STEM subjects learning outcomes would be at a constant of 0.949. The results also show that school infrastructure had a significant influence on STEM subjects learning outcomes since p-value 0002<0.05. Further, school infrastructure had a positive influence on STEM subjects learning outcomes

since the beta coefficient was 0.360. This implies that an increase in school infrastructure by a unit would result to an increase in STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County by 0.360 units.

4.7.3 Thematic Analysis

Thematic analysis focused on descriptive statistics and interview schedule analysis. Most of the schools have no the needed ICT infrastructure for STEM subjects. Also, schools lack classrooms specifically for the purposes of learning STEM subjects. It was also evident that more than fifty percent of the schools lack laboratories which are important for practical learning of the STEMs. There is also lack of library facilities needed for STEM subject's research in the schools. However, the students get the opportunity to compete in organized STEM related school competitions. It can be concluded that school infrastructure like classroom, practical laboratory and ICT infrastructure influence students' academic achievement. This relates to Mokaya (2016) who found that appropriate and well-spaced classrooms, adequate and ample library space, and, adequate science labs all contribute to increased academic performance**.**

4.7.4 Triangulation of Qualitative and Quantitative Findings

The data indicated that school infrastructure is vital in STEM subjects learning outcomes. Majority of the participants 58(35.58%) consented that schools do not have the needed ICT infrastructure for learning STEM subjects. However, 44% agreed that most of the schools have laboratories which ensure that students have practical learning of STEM subjects. The schools lack library facilities. This shows why learning STEM subjects may be a challenge. According to the inferential statistics, the P values obtained were more than the significant value, which is typically 0.05, indicating that the participants' ideas were not the result of

randomness but instead what was expected based on routine observations. Since the link was sufficiently significant, the researcher accepted it. Nugroho and Wibowo (2020) noted that educational infrastructure and amenities are necessary for the learning process to function at its best, particularly when reaching learning goals.

4.8 Influence of School Management Support on STEM subjects learning outcome

The study sought to ascertain the influence of school management support on STEM subjects learning outcomes in secondary schools, in Kajiado North sub County**.**

4.8.1 Descriptive Statistical Analysis

The respondents were asked rate the following statements using the scale 1-SD, 2-D, 3-N, 4-A, 5-SA. Table 22 is a summary of the findings.

Table 21: Influence of School Management Support on STEM subjects learning outcomes

Statements	**1**	**2**	**3**	**4**	**5**
The school managers provide professional development forums which influences STEM subjects learning outcomes	13 7.98%	38 23.31%	26 15.95%	54 33.13%	32 19.63%
The school managers conduct quality assurance standard assessments which influences STEM subjects learning outcomes	16 9.82%	20 12.27%	27 16.56%	70 42.94%	30 18.40%
Teachers get pre and in-service training to enhance their STEM teaching skills which enhances STEM subjects learning outcomes	18 11.04%	29 17.79%	24 14.72%	65 39.88%	27 16.56%
The school top managers evaluate the performance in STEM subjects which influences STEM subjects learning outcomes	15 9.20%	19 11.66%	33 20.25%	55 33.74%	41 25.15%
Teachers are rewarded when there is an outstanding performance which influences STEM subjects learning outcomes	14 8.59%	21 12.88%	24 14.72%	67 41.10%	37 22.70%

From the findings, 54(33.13%) of the respondents agreed that he school managers provide professional development forums which influences STEM subjects learning outcomes, 70(42.94%) agreed that the school managers conduct quality assurance standard assessments which influences STEM subjects learning outcomes, 65(39.88%) agreed that teachers get pre and in-service training to enhance their STEM teaching skills which enhances STEM subjects learning outcomes, 55(33.74%) of the respondents agreed that the school top managers evaluate the performance in STEM subjects which influences STEM subjects learning outcomes, and 67(41.10%) agreed that teachers are rewarded when there is an outstanding performance which influences STEM subjects learning outcomes. This is in line with Khan, Ahmad, Ali, and Rehman (2016) whose results showed that school management trainings give principals the needed school management abilities, enabling them to successfully manage their specific schools. Davis (2015) indicated that STEM education does need certain distinctive administrative thinking and activities, the study also discovered that not all administrators felt qualified to oversee the implementation of STEM programming

The principals and sub county directors were required to indicate if the provided school management support activities influence STEM subjects learning outcomes. They all agreed professional development forums, quality assurance standard assessment, curriculum development and evaluation, pre and in-service training of teachers, and stakeholder M&E support influence students' academic achievement, competencies and motivation.

4.8.2. Inferential statistical analysis

The fifth objective was to determine the influence of school management support on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. To

determine the linear regression, the study regressed school management support with STEM subjects learning outcomes. The results were as shown in table 23.

Table 22: Regression Analysis for School management support

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.557	0.310	0.306	0.38307

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.638	1	10.638	72.496	0.000[b]
	Residual	23.625	161	0.147		
	Total	34.263	162			

Beta Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.112	0.247		4.502	0.0000
	School infrastructure	0.337	0.103	0.309	3.272	0.0013

From the findings in table 23, the model summary was used to analyze the variation of STEM subjects learning outcomes due to school management support. The results show that the adjusted R square was 0.306, which implies that 30.6% of STEM subjects learning outcomes in secondary schools can be explained by school management support. The results also mean that 69.4% variation in STEM subjects learning outcomes can be explained by other variables. Further, the R value was 0.622, meaning that the model is significant in predicting variations of STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The ANOVA was used to determine whether the model was significant. The results show that the f-statistic 72.496 was greater that f-critical 3.899 front f-distribution tales. Also the p-value was 0.000 which was less than 0.05 significance level. This implies the model was

significant in predicting STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

The beta coefficients were used to determine the significance level between the variables. The regression model was fitted as follows;

$Y= 1.112 + 0.337X_1$

From the equation, holding school management support at a constant, STEM subjects learning outcomes would be at a constant of 1.112. The results also show that school management support had a significant influence on STEM subjects learning outcomes since p-value 0013<0.05. Further, school management support had a positive influence on STEM subjects learning outcomes since the beta coefficient was 0.337. This implies that an increase in school management support by a unit would result to an increase in STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County by 0.337 units.

4.8.3 Thematic Analysis

From the data, the school management offer professional development forums for teachers. Quality assurance standard assessments on STEM subjects are done by the school managers. To enhance STEM learning through improved skills, teachers are provided with pre and in-service training. It can also be noted that the performance of STEM subjects is evaluated and teachers that achieved outstanding performance in their STEM subjects are rewarded by the school managers. All inclusively, professional development forums, quality assurance standard assessment, curriculum development and evaluation and pre and in-service training of teachers influence students' academic achievement. . This is in line with Khan, Ahmad, Ali, and Rehman (2016) whose results showed that school management trainings give

principals the needed school management abilities, enabling them to successfully manage their specific schools.

4.8.4 Triangulation of qualitative and quantitative findings

The contribution of school management to STEM subjects learning is evident. The participants 33.13% agreed that he school managers provide professional development forums. The school managers also carry out quality assurance standard assessments indicated by 70(42.94%). In addition, teachers get pre and in-service training to enhance their STEM teaching skills. Also, the participants agreed that the manager make assessment on STEM subject's performance and reward teachers whose subjects have been done well. According to the inferential statistics, the participants' views were not unplanned, but rather what was expected under normal circumstances, as observations revealed that the P values attained were greater than the significance value 0.05, implying that the participants' opinions were what would be expected under normal circumstances. The research revealed a strong connection between the variables used. It was so determined that the responses were genuine enough to be acceptable.

4.9 STEM Subjects Learning Outcomes

The respondents were required to rate their level of agreement on the statements about STEM subjects learning outcomes in secondary schools, in Kajiado North sub County. The results were summarized in table 24.

Table 23: STEM Subjects Learning Outcomes

Statements		1	2	3	4	5
The student's academic achievement has improved	**F**	19	46	30	53	15
	P	11.66%	28.22%	18.40%	32.52%	9.20%
The student's competencies in STEM subjects have improved	**F**	17	41	29	55	21
	P	10.43%	25.15%	17.79%	33.74%	12.88%
There has been an increase of number students taking the STEM subjects	**F**	15	39	27	58	24
	P	9.20%	23.93%	16.56%	35.58%	14.72%

From the findings, 53(32.52%) of the respondents agreed that the student's academic achievement has improved, 55(33.74%) of respondents agreed that the student's competencies in STEM subjects have improved and 58(35.58%) agreed that there has been an increase of number students taking the STEM subjects.

The principals and sub county directors were required to provide accurate and honest response of the items in this document analysis checklist which is available in their organization. The results were as shown in table 25.

Table 24: Learning Outcomes

Items	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
Teachers' skills development	9.20%	23.93%	45.40%	14.72%	6.75%
Classroom participation of STEM students	6.75%	14.72%	22.70%	42.94%	12.88%
Full STEM subject's syllabus coverage	11.66%	19.02%	38.04%	19.63%	11.66%
STEM subjects learning infrastructure availability	14.72%	34.97%	18.40%	21.47%	10.43%
Management decision making on STEM subjects learning	12.88%	17.79%	32.52%	24.54%	12.27%

The findings in table 25 show that, 45.40% of the respondents indicated that teachers' skills development in their school happen sometimes, 42.94% of the respondents indicated that often there is classroom participation of STEM students in their school, 38.04% indicated that sometimes there is full STEM subject's syllabus coverage in their school, 34.97% indicated that STEM subjects learning infrastructure availability is rare in their school and 32.52% of respondents indicated that sometimes their school management make decision on STEM subjects learning.

4.10 Discussion of Research Findings

The discussion was guided by the five objectives of the study. This section demonstrated how the study filled up the gaps identified in the second chapter of the thesis's literature evaluation

4.10.1 Teacher's competence on STEM subjects learning outcomes

This objective was guided by content competency, pedagogical competency, digital competency, cognitive ability and classroom management indicators. The system theory was used show teacher's competence is required in STEM subjects to enhance learning outcomes. The education function theory was used to explain that teacher's competence and STEM subjects learning outcomes are the inputs and outputs in education. Theory shows that teacher's content competency, pedagogical competency, digital competency, cognitive ability and classroom management influence STEM subjects learning outcomes.

The study also found that schools have teachers with digital competency which influences STEM subjects learning outcomes, also that teacher's cognitive ability and pedagogical competency influences STEM subjects learning outcomes. The findings showed that classroom management ensures effective learning and teachers' content competency

influences STEM subjects learning outcomes. The results also proved that schools support teachers hence they have a positive attitude which ensures effective STEM subjects learning outcomes. The findings showed that teacher's content competency, pedagogical competency, digital competency, and cognitive ability and classroom management influence students' academic achievement, students' competencies and motivation. Also, from the findings, teachers' competence had a significant influence on STEM subjects learning outcomes. According to Fauth, Decristan, Deckner and Butter (2019) the competence of a teacher that enthusiasm, self-efficacy, content and knowledge is related positively to the interest of learners; self-efficacy is related positively to achievement of learners.

4.10.2 Student's Attitude on STEM subjects learning outcomes

The indicators that guided this objective were students' attitude towards the STEM subjects, towards the teachers and towards the schooling. The system theory was used show students' attitude affect STEM subjects to enhance learning outcomes. The education function theory was used to explain that students' attitude and STEM subjects learning outcomes are the inputs and outputs in education. Theory shows that students' attitude towards the STEM subjects, towards the teachers and towards the schooling influences STEM subjects learning outcomes.

The findings indicated that student's attitude impact on the STEM subjects learning outcomes. Further, in the schools, students are encouraged to choose the STEM subject they are interested in and the student's attitude towards the subject influences the STEM subjects learning outcomes. The findings also indicated that student's attitude towards the teacher and schooling influences the STEM subjects learning outcomes. The results also showed that students' attitude towards the STEM subjects, towards the teachers and towards the

schooling influence students' academic achievement (Formative & KCSE), students' competencies and motivation. Also, form the findings students' attitude had a significant influence on STEM subjects learning outcomes. Offor, Bubou, and Gumus (2020) findings showed that the characteristics of learners had an impact on students' views toward STEM disciplines. However, Langat (2015) discovered that the majority of kids thought mathematics was important, feasible, and had a favorable attitude toward it, but this did not translate into strong academic performance.

4.10.3 Syllabus Coverage on STEM subjects learning outcomes

The objective was guided by syllabus coverage including full coverage, relevance and work plan indicators. The education function theory was used to explain that syllabus coverage and STEM subjects learning outcomes are the inputs and outputs in education. Theory shows that syllabus full coverage, relevance and work plan influences STEM subjects learning outcomes. John (2010) states that the production function is a relationship between the input and auxiliary parts needed to generate a certain good while accounting for its quality, and that education is highly valued in the human resources production process.

The results depicted that full coverage of STEM subject's syllabus enhances STEM subjects learning outcomes. Also, from the results the schools ensure timely coverage of STEM subject's syllabus. There are work plans that guide in teaching to enhance STEM subjects learning outcomes. From the findings ensuring that all the topics in each of the STEM subjects are covered and ensuring that all practical parts of the STEM subjects are covered improves STEM subjects learning outcomes. The findings indicated that teacher ensures that the students have understood both theoretical and practical concepts to enhance STEM subjects learning outcomes. Syllabus coverage including full coverage, relevance and work

plan influence students' academic achievement (Formative & KCSE), students' competencies and motivation. Nakhanu (2012) who discovered that student performance in mathematics at the KCSE level was significantly impacted by syllabus coverage. Musasia, Nakhanu, and Wekesa (2017) found that mathematics performance at the KCSE level is significantly impacted by syllabus coverage.

4.10.4 School Infrastructure on STEM subjects learning outcomes

The objective was guided by school infrastructure including classrooms, practical laboratory & chemicals; ICT infrastructure and sanitation areas. The system theory was used show school infrastructure affect STEM subjects to enhance learning outcomes. The education function theory was used to explain that school infrastructure and STEM subjects learning outcomes are the inputs and outputs in education. Theory shows school infrastructure including classrooms, practical laboratory & chemicals; ICT infrastructure and sanitation areas influences STEM subjects learning outcomes.

The findings indicated that schools have no needed ICT infrastructure for STEM subjects learning and there are few classrooms specifically for the purposes of learning STEM subjects. From the results, there are laboratories which ensure that students have practical learning, and some schools have no library facility which allows the students to research. However, schools give STEM students an opportunity to compete in secondary schools' science competition which improves STEM subjects learning outcomes. It was proved that school infrastructure including classrooms, practical laboratory & chemicals; ICT infrastructure and sanitation areas influence students' academic achievement (Formative & KCSE), students' competencies and motivation. Mokaya (2016) postulated that appropriate and well-spaced classrooms, adequate and ample library space, adequate science labs,

adequate water and sanitation facilities, and adequate engagement in extracurricular activities all contribute to increased academic performance.

4.10.5 School Management on STEM subjects learning outcomes

Professional development forums, pre- and in-service training, curriculum development and evaluation, and quality assurance standard assessment, and stakeholder M&E support were the indicators for this objective. The system theory was used show school management is important in STEM subjects to enhance learning outcomes. The education function theory was used to explain that school management and STEM subjects learning outcomes are the inputs and outputs in education. Theory shows that professional development forum, pre- and in-service training, curriculum development and evaluation, and quality assurance standard assessment influence STEM subjects learning outcomes.

The indicated that school managers provide professional development forums, conduct quality assurance standard assessments, and teachers get pre and in-service training to enhance their STEM teaching skills which enhances STEM subjects learning outcomes. The results proved that school top managers evaluate the performance in STEM subjects and teachers are rewarded when there is an outstanding performance which influences STEM subjects learning outcomes. Also forums for professional development, assessments of quality assurance standards, curriculum creation and evaluation, teacher pre- and in-service training, and support for M&E from stakeholders influence students' academic achievement (Formative & KCSE), students' competencies and motivation. Further, school management support had a significant influence on STEM subjects learning outcomes. Khan, Ahmad, Ali, and Rehman (2016) inferred that school management trainings give principals the needed school management abilities, enabling them to successfully manage their specific schools.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter involves summarizing the findings, providing conclusions and recommendations. The study objective was to investigate the influence of school systemic management dynamics on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

5.1 Summary of Findings

The findings are summarized in line with the study objectives as follows:

5.1.1 Teachers' competence and STEM subjects learning outcomes in secondary schools

The study found that the schools have teachers with digital competency which influences STEM subjects learning outcomes, also that pedagogical competency influences STEM subjects learning outcomes and further teacher's cognitive ability enhances STEM subjects learning outcomes. The study also established that classroom management ensures effective learning and enhances STEM subjects learning outcomes, teachers' content competency influences STEM subjects learning outcomes and schools support teachers hence they have a positive attitude which ensures effective STEM subjects learning outcomes.

The study further revealed that teacher's content competency, pedagogical competency, digital competency, and cognitive ability and classroom management influence STEM subjects learning outcomes which includes students' academic achievement (formative & KCSE), students' competencies and motivation. It was also established that that teachers' competence had a significant influence on STEM subjects learning outcomes.

5.1.2 Students' attitude on STEM subjects learning outcomes in secondary schools

The study found that the student's attitude impact on the STEM subjects learning outcomes. Further, in the schools, students are encouraged to choose the STEM subject they are interested to influence the STEM subjects learning outcomes, also, student's attitude towards the subject influences the STEM subjects learning outcomes. The study revealed that student's attitude towards the teacher influences the STEM subjects learning outcomes and that student's attitude towards the schooling influences the STEM subjects learning outcomes.

The study also established that students' attitude towards the STEM subjects, towards the teachers and towards the schooling influence STEM subjects learning outcomes which include students' academic achievement (Formative & KCSE), students' competencies and motivation. The study also established that that students' attitude had a significant influence on STEM subjects learning outcomes.

5.1.3 Syllabus coverage on STEM subjects learning outcomes in secondary schools

The study revealed that full coverage of STEM subject's syllabus enhances STEM subjects learning outcomes, in the schools there is timely coverage of STEM subject's syllabus to enhance STEM subjects learning outcomes, and that the school provides a work plan that guides in teaching to enhance STEM subjects learning outcomes. It was also noted that ensuring that all the topics in each of the STEM subjects are covered improves STEM subjects learning outcomes, ensuring that all practical parts of the STEM subjects are covered improves STEM subjects learning outcomes and the teacher ensures that the students have understand both theoretical and practical concepts to enhance STEM subjects learning outcomes.

The study also established that syllabus coverage including full coverage, relevance and work plan influence STEM subjects learning outcomes which includes students' academic achievement (Formative & KCSE), students' competencies and motivation. The study also established that that syllabus coverage had a significant influence on STEM subjects learning outcomes.

5.1.4 School infrastructure on STEM subjects learning outcomes in secondary schools

The study revealed that some schools have no the needed ICT infrastructure which influences STEM subjects learning outcomes and there are no classrooms specifically for the purposes of learning STEM subjects which influences STEM subjects learning outcomes. The study also found that there are laboratories which ensure that students have practical learning which influences STEM subjects learning outcomes, and some schools have no library facility which allows the students to research which enhances STEM subjects learning outcomes. However, schools give STEM students an opportunity to compete in secondary schools' science competition which improves STEM subjects learning outcomes.

The study found that school infrastructure including classrooms, practical laboratory & chemicals; ICT infrastructure and sanitation areas influence STEM subjects learning outcomes which are students' academic achievement (Formative & KCSE), students' competencies and motivation. The study also established that that school infrastructure had a significant influence on STEM subjects learning outcomes.

5.1.5 School management support on STEM subjects learning outcomes in secondary schools

The study found that school managers provide professional development forums which influences STEM subjects learning outcomes, the school managers conduct quality assurance

standard assessments which influences STEM subjects learning outcomes, and teachers get pre and in-service training to enhance their STEM teaching skills which enhances STEM subjects learning outcomes. It was also revealed that the school top managers evaluate the performance in STEM subjects which influences STEM subjects learning outcomes, and that teachers are rewarded when there is an outstanding performance which influences STEM subjects learning outcomes

The study also found that professional development forums, quality assurance standard assessment, curriculum development and evaluation, pre and in-service training of teachers, and stakeholder M&E support influence STEM subjects learning outcomes which include students' academic achievement (Formative & KCSE), students' competencies and motivation. The study also established that that school management support had a significant influence on STEM subjects learning outcomes.

5.2 Conclusions for the Study

This section covers the study conclusions which have been drawn from the findings.

5.2.1 Teachers' competence and STEM subjects learning outcomes in secondary schools

The study found that teachers' competence had a significant influence on STEM subjects learning outcomes. Teachers' competence had a positive influence on STEM subjects learning outcomes. This implies that an increase in teachers' competence by a unit would result to an increase in STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County. The study concluded that teachers' competence positively influences STEM subjects learning outcomes, in Kajiado North Sub-County.

5.2.2 Students' attitude on STEM subjects learning outcomes in secondary schools

It was established that students' attitude had a significant influence on STEM subjects learning outcomes. Further, students' attitude had a positive influence on STEM subjects learning outcomes. The study concluded that students' attitude positively influences STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County by 0.308 units.

5.2.3 Syllabus coverage on STEM subjects learning outcomes in secondary schools

The study revealed that syllabus coverage had a significant influence on STEM subjects learning outcomes. Further, syllabus coverage had a positive influence on STEM subjects learning outcomes. An increase in syllabus coverage by a unit would result to an increase in STEM subjects learning outcomes in secondary schools. The study concluded that syllabus coverage positively influences STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

5.2.4 School infrastructure on STEM subjects learning outcomes in secondary schools

The study found that school infrastructure had a significant influence on STEM subjects learning outcomes. Further, school infrastructure had a positive influence on STEM subjects learning outcomes. An increase in school infrastructure by a unit would result to an increase in STEM subjects learning outcomes. The study concluded that school infrastructure positively influences on STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

5.2.5 School management support on STEM subjects learning outcomes in secondary schools

The study found that school management support had a significant influence on STEM subjects learning outcomes. Further, school management support had a positive influence on STEM subjects learning outcomes. An increase in school management support by a unit would result to an increase in STEM subjects learning outcomes. The study concluded that school management support positively influences STEM subjects learning outcomes in secondary schools, in Kajiado North Sub-County.

5.3. Recommendations for the Study

The study recommendations have been drawn from the study conclusions. The researcher provides recommendation on policy and practice.

5.3.1. Recommendations for practice

Based on the study findings, the researcher recommended that:

i. There is need to implement regular and structured professional development programs for STEM teachers. These should focus on contemporary teaching methods, advancements in STEM fields, team and peer teaching and innovative instructional practices. It is also important to offer workshops on specific STEM topics not limited to advanced mathematics, to ensure teachers remain current with the latest developments in their fields. Schools should encourage and support teachers in pursuing advanced degrees or certifications in STEM subjects to deepen their knowledge and enhance their teaching capabilities

ii. There is need to integrate real-world applications of STEM concepts into the curriculum to demonstrate the relevance of STEM subjects to everyday life and future careers. The

principals should organize guest lectures by professionals in STEM fields and field trips to STEM-related workplaces to provide students with practical insights and inspiration. There is need to foster a classroom environment that encourages curiosity and experimentation. Create a space where students feel comfortable asking questions and exploring new ideas.

iii. STEM curriculum should be well-balanced, covering fundamental concepts while integrating advanced topics appropriate for students' grade levels. Regularly review and update the curriculum to align with educational standards and emerging STEM trends. A clear scope and sequence for the STEM syllabus should be developed to ensure that all required topics are covered systematically and in a logical progression throughout the academic year. Sufficient instructional time should be allocated for each topic within the STEM syllabus. Avoid rushing through content to ensure thorough understanding and mastery of key concepts.

iv. STEM labs should be equipped with modern and up-to-date equipment, including computers, scientific instruments, and specialized tools for subjects like biology, chemistry and physics and the right geometric apparatus for mathematics. Design and maintain classrooms specifically for STEM subjects, with adaptable spaces for experiments, group work, and ICT integration. Students should be providing with access to computers and software relevant to STEM education.

v. There is a need to allocate a significant portion of the school budget specifically for STEM-related resources, including laboratory equipment, educational technology, and classroom materials. Ensure that STEM programs receive sufficient funding to maintain and upgrade these resources. There is also need to invest in the development and

maintenance of state-of-the-art STEM facilities, such as science labs, computer labs, and innovation hubs. Ensure that these facilities are well-equipped and up-to-date.

5.3.2 Recommendations for Policy

i. The government should allocate adequate resources to support STEM learning. These include human and financial resources. Also, the government should engage in building and enhancing school infrastructure required for learning STEM subjects including modern laboratories, computers, and specialized teaching materials.

ii. The ministry of education should put in place strategies to ensure that teachers are adequately trained on STEMs subjects. There is need to develop and implement targeted professional development programs for STEM teachers that focus on innovative teaching methods, curriculum updates, and the integration of technology. There is also need to conduct regular reviews of the STEM curriculum to ensure it aligns with national standards and meets the evolving needs of students.

iii. The school leadership should develop initiatives to increase parental involvement in STEM education, such as workshops, informational sessions, and regular updates on student progress. There is also need to build partnerships with local industries, businesses, and universities to provide students with real-world STEM experiences and resources.

5.3.3 Recommendations for Further Research

The followings areas were recommended for further research:

i. Investigation of the effect of overall school climate and culture on STEM learning outcomes.

ii. Determine the impact of teacher-student relationships on student engagement and success in STEM subjects.

iii. Effectiveness of current teacher training and professional development programs in enhancing STEM teaching practices.

iv. To determine the effect of allocation of financial resources on the quality of STEM education in secondary schools.

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APPENDICES

Appendix I: Questionnaire for Teachers and Students

Please tick (√) in the provided spaces

Part A: Demographic Information

1. Kindly indicate your gender

   Male ( )

   Female ( )

2. Indicate your highest academic qualification?

   Ph. D ( )

   Masters ( )

   Bachelors ( )

   Any other.....

3. How long have you been teaching in the secondary school?.....

4. How long have you been teaching the STEM subjects?.....

Part B: Influence of Teachers' Competence on STEM subjects learning outcomes

5. The study sought determine the influence of teachers' competence on STEM subjects learning outcomes in secondary schools, in Kajiado County. Kindly rate the following statements using the scale;

   1-STRONGLY DISAGREE, 2-DISAGREE, 3-MODERATE, 4-AGREE, 5-STRONGLY AGREE.

Statements	**1**	**2**	**3**	**4**	**5**

The school has teachers with digital competency which influences STEM subjects learning outcomes					
It is true that pedagogical competency influences STEM subjects learning outcomes					
It is true that teacher's cognitive ability enhances STEM subjects learning outcomes					
It is true that classroom management ensures effective learning and enhances STEM subjects learning outcomes					
It is believed that the teachers' content competency influences STEM subjects learning outcomes					
Your school support teachers hence they have a positive attitude which ensures effective STEM subjects learning outcomes					

Part C: Influence of Students' Attitude on STEM subjects learning outcomes

6. Find out the influence of the students' attitude on STEM subjects learning outcomes in secondary schools, in Kajiado County. Kindly rate the following statements using the scale;

1-STRONGLY DISAGREE, 2-DISAGREE, 3-MODERATE, 4-AGREE, 5-STRONGLY AGREE.

	1	**2**	**3**	**4**	**5**
The student's attitude impact on the STEM subjects learning outcomes					
In your school, students are encouraged to choose the STEM subject they are interested to influence the STEM subjects learning outcomes					

It is true that student's attitude towards the subject influences the STEM subjects learning outcomes					
It is believed that student's attitude towards the teacher influences the STEM subjects learning outcomes					
It is true that student's attitude towards the schooling influences the STEM subjects learning outcomes					

Part D: Influence of Syllabus Coverage on STEM subjects learning outcomes

7. Establish the influence of syllabus coverage on STEM subjects learning outcomes in secondary schools, in Kajiado County. Kindly rate the following statements using the scale;

   1-STRONGLY DISAGREE, 2-DISAGREE, 3-MODERATE, 4-AGREE, 5-STRONGLY AGREE.

Statements	**1**	**2**	**3**	**4**	**5**
The full coverage of STEM subject's syllabus enhances STEM subjects learning outcomes					
There is timely coverage of STEM subject's syllabus to enhance STEM subjects learning outcomes					
Your school provides a work plan that guides in teaching to enhance STEM subjects learning outcomes					
Ensuring that all the topics in each of the STEM subjects are covered improves STEM subjects learning outcomes					
Ensuring that all practical parts of the STEM subjects are covered improves STEM subjects learning outcomes					
The teacher ensures that the students have understand both theoretical and practical concepts to enhance STEM subjects learning outcomes					

Part E: Influence of School Infrastructure on STEM subjects learning outcomes

8. The study sought to examine the influence of school infrastructure on STEM subjects learning outcomes in secondary schools, in Kajiado County. Kindly rate the following statements using the scale;

1-STRONGLY DISAGREE, 2-DISAGREE, 3-MODERATE, 4-AGREE, 5-STRONGLY AGREE.

Statements	**1**	**2**	**3**	**4**	**5**
The school has the needed ICT infrastructure which influences STEM subjects learning outcomes					
There are classrooms specifically for the purposes of learning STEM subjects which influences STEM subjects learning outcomes					
There are laboratories which ensure that students have practical learning which influences STEM subjects learning outcomes					
The school has a library facility which allows the students to research which enhances STEM subjects learning outcomes					
The school gives STEM students an opportunity to compete in secondary schools' science competition which improves STEM subjects learning outcomes					

9. Indicate any other infrastructure in the school that support STEM learning

……

……

Part F: Influence of School Management Support on STEM subjects learning outcomes

10. The study sought to ascertain the influence of school management support on STEM subjects learning outcomes in secondary schools, in Kajiado County. Kindly rate the following statements using the scale;

1-STRONGLY DISAGREE, 2-DISAGREE, 3-MODERATE, 4-AGREE, 5-STRONGLY AGREE.

Statements	**1**	**2**	**3**	**4**	**5**
The school managers provide professional development forums which influences STEM subjects learning outcomes					
The school managers conduct quality assurance standard assessments which influences STEM subjects learning outcomes					
Teachers get pre and in-service training to enhance their STEM teaching skills which enhances STEM subjects learning outcomes					
The school top managers evaluate the performance in STEM subjects which influences STEM subjects learning outcomes					
Teachers are rewarded when there is an outstanding performance which influences STEM subjects learning outcomes					

11. How else does the school top management support STEM subjects learning?

……

……

……

……

Part G: STEM Subjects Learning Outcomes

12. STEM subjects learning outcomes in secondary schools, in Kajiado County. Kindly rate the following statements using the scale;

1-STRONGLY DISAGREE, 2-DISAGREE, 3-MODERATE, 4-AGREE, 5-STRONGLY AGREE.

Statements	**1**	**2**	**3**	**4**	**5**
The student's academic achievement has improved					
The student's competencies in STEM subjects have improved					
There has been an increase of number students taking the STEM subjects					

THANK YOU

Appendix II: Interview Schedules for the Principals and Sub County Directors

Section A: Demographic Information

1. Age

   20-30 years ( ) 31-40 years ( )

   41-50 years ( ) Above 51 years ( )

2. Level of Education

   Certificate ( ) Diploma ( )

   Degree ( ) Postgraduate ( )

3. Years of Service

   Below 5 years ( )

   6-10 years ( )

   Above 11 years ( )

Section B: Influence of Teachers' Competence on STEM Subjects Learning Outcomes

4. Indicate which of the following teachers' competences influence STEM subjects learning outcomes

   a) Content competency
   b) Pedagogical Competency
   c) Digital Competency
   d) Cognitive ability
   e) Classroom management

5. How does the above teachers' competences influence STEM subjects learning outcomes?

   a) Students' Academic achievement (Formative & KCSE)

b) Students' Competencies

c) Motivation

Section C: Influence of the Students' Attitude on STEM Subjects Learning Outcomes

6. Indicate which of the following students' attitude influence STEM subjects learning outcomes

    a) Towards the STEM subjects

    b) Towards the teachers

    c) Towards the schooling

7. How does the above students' attitude influence STEM subjects learning outcomes?

    a) Students' Academic achievement (Formative & KCSE)

    b) Students' Competencies

    c) Motivation

Section D: Influence of Syllabus Coverage on STEM Subjects Learning Outcomes

8. Indicate which of the following factors of syllabus coverage influence STEM subjects learning outcomes

    a) Full coverage

    b) Relevance

    c) Work plan

9. How does the above syllabus coverage influence STEM subjects learning outcomes?

    a) Students' Academic achievement (Formative & KCSE)

    b) Students' Competencies

    c) Motivation

Section E: Influence of School Infrastructure on STEM Subjects Learning Outcomes

10. Which of the following school infrastructure influence STEM subjects learning outcomes

    a) Classrooms

    b) Practical laboratory & chemicals

    c) ICT Infrastructure

    d) Sanitation areas

11. How does the above school infrastructure influence STEM subjects learning outcomes?

    a) Students' Academic achievement (Formative & KCSE)

    b) Students' Competencies

    c) Motivation

Section F: Influence of School Management Support on STEM Subjects Learning Outcomes

12. Indicate which of the following school management support activities influence STEM subjects learning outcomes

    a) Professional dev' forums

    b) Qualityassurance standard assessment

    c) Curriculum development and

    d) evaluation (KICD)

    e) Pre and in-service training of teachers

    f) Stakeholder M & E support

13. How does the above school infrastructure influence STEM subjects learning outcomes?

a) Students' Academic achievement (Formative & KCSE)

b) Students' Competencies

c) Motivation

Appendix III: Document Analysis Checklist

Kindly provide accurate and honest response of the items in this document analysis checklist. Tick that, which is available in your organization.

Using the scale Never (1), Rarely (2), Sometimes (3), Often (4), and Always (5).

Items	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
Teachers' skills development					
Classroom participation of STEM students					
Full STEM subject's syllabus coverage					
STEM subjects learning infrastructure availability					
Management decision making on STEM subjects learning					

Appendix IV: ERC Certificate

Mount Kenya University

REF: **MKU/ISERC/4162**
TO: **KISALI DAVID**

Date: 10 August 2024

REG: **MED/2015/25794**

Dear Sir/Madam,

RE: INFLUENCE OF SCHOOL SYSTEMIC MANAGEMENT DYNAMICS ON STEM SUBJECTS LEARNING OUTCOMES IN SECONDARY SCHOOLS, IN KAJIADO NORTH SUB-COUNTY

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **2992.** The approval period is **10/08/2024 - 09/08/2025.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

MOUNT KENYA UNIVERSITY
ETHICS REVIEW COMMITTEE
P. O. Box 342 - 01000,
THIKA

Yours sincerely,

Dr. Alfred Owino, PhD
Chairman, Mount Kenya University ISERC

Appendix V: Introductory Letter

Mount Kenya University

P.O BOX

Dear Respondent,

I am conducting a research study on "**INFLUENCE OF SCHOOL SYSTEMIC MANAGEMENT DYNAMICS ON STEM SUBJECTS LEARNING OUTCOMES IN SECONDARY SCHOOLS, IN KAJIADO NORTH SUB-COUNTY"** this is a requirement for the award of degree of Master of Education Degree in Educational Management, Leadership and Administration of Mount Kenya University.

I have attached a questionnaire and I kindly request you to respond to all the questions providing your level of agreement to them. The information will be treated confidentially and applied for academic reasons only.

Thank you for your participation

Yours sincerely,

David Kisali.

Appendix VI: Informed Consent

DAVID KISALI

Mount Kenya University

Dear Respondent,

RE: DATA COLLECTION

Hello, my name is David Kisali and I am a student of Masters of Education Degree in Educational Management, Leadership and Administration of Mount Kenya University. I am currently working on my project and would greatly appreciate your assistance. You have been randomly sampled to participate in the study that aims at examining the **Influence of School Systemic Management Dynamics on Stem Subjects Learning Outcomes in Secondary Schools, in Kajiado North Sub-County**.

There are no foreseeable risks for you participating in the study or payment for you. If you may have questions while taking part, please stop and ask. You will be required to read and respond to the questions in the questionnaire that you will be provided with. Please answer the questions with honesty. The information given by you will be treated with anonymity and confidentiality. Your participation in this research is voluntary, and you will not be victimized if you refuse to participate or decide to stop. You have a right to withdrawal from this research at any time without any risk.

In case of any question feel free to contact

Chairman MKU ERC

P.O BOX 342...01000

Participant's Name……

Signature……Date……

Researchers Name……

Appendix VII: NACOSTI Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **745129**

Date of Issue: **02/September/2024**

RESEARCH LICENSE

This is to Certify that Mr.. DAVID KISALI of Mount Kenya University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kajiado on the topic: INFLUENCE OF SCHOOL SYSTEMIC MANAGEMENT DYNAMICS ON STEM SUBJECTS LEARNING OUTCOMES IN SECONDARY SCHOOLS, IN KAJIADO NORTH SUB-COUNTY for the period ending : 02/September/2025.

License No: **NACOSTI/P/24/39645**

745129

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)

Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

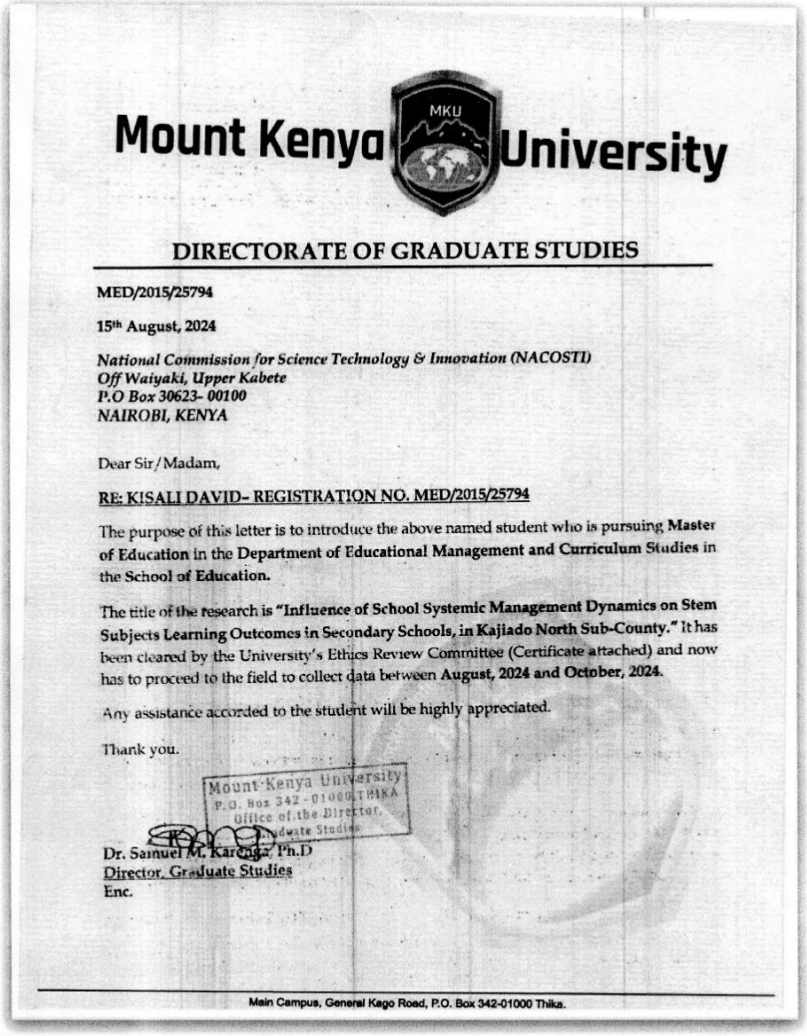
The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was the established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

CONDITIONS OF THE RESEARCH LICENSE

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way;
    i. Endanger national security
    ii. Adversely affect the lives of Kenyans
    iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
    iv. Result in exploitation of intellectual property rights of communities in Kenya
    v. Adversely affect the environment
    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. The license any rights thereunder are non-transferable
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

National Commission for Science, Technology and Innovation(NACOSTI),
Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
Telephone: 020 4007000, 0713788787, 0735404245
E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke

Appendix VIII: Postgraduate Letter of Introduction



Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

MED/2015/25794

15th August, 2024

National Commission for Science Technology & Innovation (NACOSTI)
Off Waiyaki, Upper Kabete
P.O Box 30623- 00100
NAIROBI, KENYA

Dear Sir/Madam,

RE: KISALI DAVID- REGISTRATION NO. MED/2015/25794

The purpose of this letter is to introduce the above named student who is pursuing **Master of Education** in the **Department of Educational Management and Curriculum Studies** in the **School of Education.**

The title of the research is **"Influence of School Systemic Management Dynamics on Stem Subjects Learning Outcomes in Secondary Schools, in Kajiado North Sub-County."** It has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data between **August, 2024 and October, 2024.**

Any assistance accorded to the student will be highly appreciated.

Thank you.

Mount Kenya University
P.O. Box 342-01000 THIKA
Office of the Director,
Graduate Studies

Dr. Samuel M. Kariuki, Ph.D
Director, Graduate Studies
Enc.

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.

Appendix IX: Authorizations from Sub County

TEACHERS SERVICE COMMISSION

Telephone: 0773833384
Email : scdirkajiadonorth@tsc.go.ke

When replying please quote
REF:TSC/KJDN/5

THE SUB- COUNTY OFFICE(TSC
KAJIADO NORTH
P. O. BOX 88-00208
NGONG HILLS

17th September, 2024

To whom it may concern

RE: PERMISSION
DAVID KISALI

The above named is a teacher at Enoomatasian Girls Secondary School in Kajiado North Subcounty, Kajiado County. He's currently a student at Mount Kenya University.

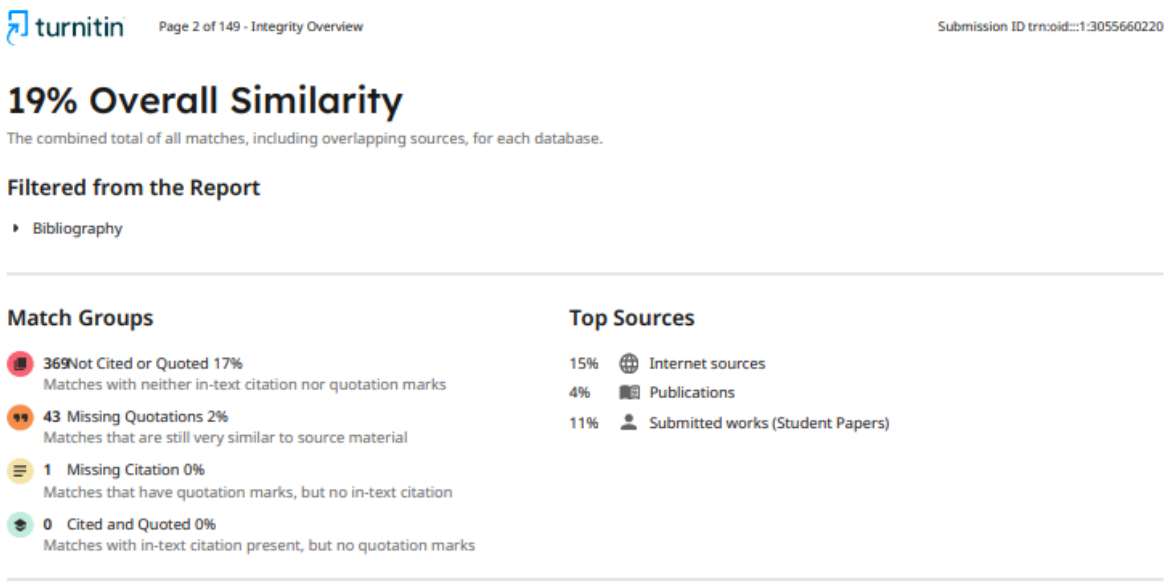
He's permitted to conduct research on **Influence Of School Systematic Management Dynamics On STEM Subjects Learning Outcomes In Secondary Schools In Kajiado North Subcounty.**

Any assistance accorded to him will be highly appreciated.

TSC SUB-COUNTY DIRECTOR
KAJIADO NORTH
Sign..... Date: 17/9/2024

JANE RONO
TSC SUB COUNTY DIRECTOR
KAJIADO NORTH.

Appendix X: Turnitin Report



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Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

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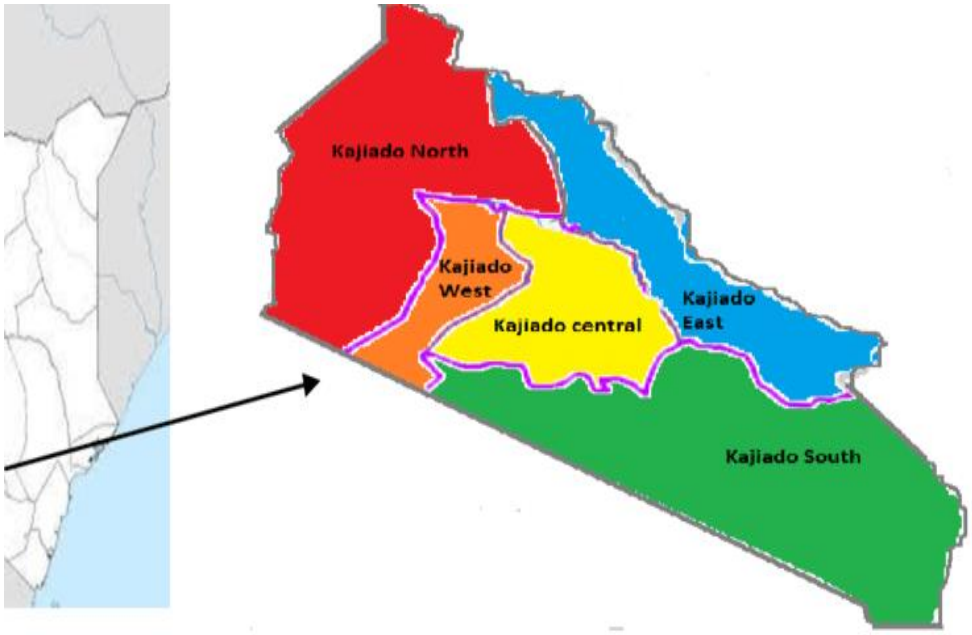
5	Internet	riu.austral.edu.ar 1%
6	Internet	ir.jkuat.ac.ke 0%
7	Internet	erepository.uonbi.ac.ke:8080 0%
8	Student papers	KCA University 0%
9	Internet	ir-library.egerton.ac.ke 0%
10	Student papers	Intercollege 0%

Appendix XI: Map of the Location of the Study



Kajiado North

306,596 Population [2019] – Census

110.6 km² Area