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Original Article

Principals' Transformative Leadership on the Performance in Science Subjects in Girls' Public Secondary Schools in Tharaka Nithi County

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*Influence,
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Performance.*

This study examined the influence of principals' transformative leadership traits on the performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya. It was guided by the following specific objectives: to ascertain whether principal-teacher role modelling influences performance in science subjects and to find out the relationship between the provision of supportive learning resources and the performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya. The study was guided by transformational leadership theory. A concurrent triangulation design was adopted. The sample size for the study constituted 11 principals, 1 county director, 330 students and 100 teachers. The study used questionnaires to collect data from teachers and students, while interviews were conducted with principals and the County Director of education. Quantitative data was analysed using the Statistical Package for the Social Sciences (SPSS) version 25. The data from quantitative instruments was presented using frequencies and percentages on tables, graphs, and pie charts. Qualitative data was analysed in themes, and the reporting was done in direct quotations and narratives. The results revealed that the transformational leadership of principals, as evidenced by their role modelling for teachers and the provision of supportive learning resources, plays a crucial role in shaping the academic performance of students in science subjects within girls' public secondary schools in Tharaka Nithi County. The study's findings led to the conclusion that school principals are not consistently able to converse with and uplift girls facing difficulties in science subjects. Additionally, it was concluded that students lack adequate resources necessary for excelling in science subjects, notably the insufficiency of laboratory equipment, which has consequently impeded their performance in these subjects. The study recommended that principals actively engage and motivate girls to pursue science subjects. Additionally, it proposes that the government should focus on maintaining well-equipped and modern school science laboratories, providing science books in libraries, and offering online resources, educational apps, and e-learning platforms. These measures would supplement traditional teaching methods, creating a more interactive learning experience and ultimately boosting girls' engagement and success in science subjects.

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INTRODUCTION

Effective leadership is an important aspect of any organisation, as it helps in the accomplishment of the organisation's goals and objectives. Effective leaders provide clarity of purpose, motivate, and guide the organisation to realise its mission and goals (Gunawan, 2020). As organisations strive to achieve their goals, they find it important to consider their leadership styles. It is vital to identify leadership methods capable of keeping abreast of development. Transformational leadership is the most well-known leadership approach (Abdillah, 2017). It is considered one of the main leadership styles that influence organisations and individuals to achieve their set targets. Transformational leaders help followers grow by aligning the objectives and goals of the individual followers, the group, and the larger organisation. Effective leaders provide clarity of purpose, motivate, and guide their followers to work towards the achievement of organisational goals and objectives (Gunawan, 2020).

As organisations strive to achieve their goals, they find it important to consider their leadership style, which makes it important to identify leadership methods capable of keeping abreast of development. As recommended by Ruman (2016), transformational leadership is the most well-known leadership approach that can allow organisations and individuals to achieve their set

targets. Transformational leaders help followers grow by aligning the objectives and goals of the individual followers and the group with the goals of the organisation. Abdillah (2017) argues that leadership is the most noticeable factor that drives significant transformations in teaching and learning. Transformational leaders in secondary schools are mainly responsible for leading the learners and teachers to achieve the best learning and teaching practices in an effort to help all learners achieve the best possible outcomes. Performance in secondary schools, including the performance of girls in science subjects, highly depends on the influence of transformational leaders in schools.

For instance, a study by Burns (1978) points out that transformational leadership is seen when leaders and followers influence each other to advance to a higher level of morality and motivation. Through the strength of their vision and personality, transformational leaders are able to inspire their followers to change their expectations, perceptions, and motivation to work towards common goals. Accordingly, Bass (1985) expanded Burns' (1978) original ideas and contended that transformational leadership can be described based on the impact that it has on followers. Transformational leaders, according to Bass (1985), are trusted, respected, and admired by their followers. Transformational leaders tend

to show four main characteristics: charisma, inspirational motivation, intellectual stimulation, and consideration of the needs of followers (Bass, 1985).

By the mid-eighties, the concept of transformational leadership had received significant attention from scholars, including those in education. For example, Hyseni and Hoxha (2021) and Bellibas and Liu (2018) mention that the leadership styles and practices followed by school leaders have a direct impact on the motivation of teachers. The scholars argued that teachers' performance is directly linked to their motivation, which, on one side, affects their attitude at work and, on the other side, impacts the students' motivation to study and perform academically.

Secondary schools are one of the foundational elements in realising Kenya's Vision 2030, where education in science, technology, engineering, and mathematics serves as a framework that can help meet the demands of this 21st-century era. This can be accomplished through secondary schools with principals who support the effective achievement of the plans, visions, and goals of the schools (Wambui, 2022). Secondary schools are considered one of the most important institutions for influencing and changing the attitudes and behaviours of learners as they strive to achieve their visions and aspirations. This is why secondary schools need conscious leaders equipped with the characteristics of transformational leadership, such as inspirational motivation, intellectual stimulation, idealised influence, and individual considerations, to achieve their development plans.

With transformational leadership, schools are able to keep up with rapid developments while influencing the behaviour of students and improving their abilities to perform in science subjects. This means that principals, as secondary school leaders, should be effective in guiding students to improve their performance in all subjects, including science. The 21st century is a period marked by scientific innovations and technology. Therefore, there is a need for

principals who are early adopters of new ideas and constantly seek new ways to improve the performance of all students in science subjects. As noted by Abdullateef (2022), the 21st century is a digitised period that calls for expansive growth and development in the scientific fields. Therefore, empowering the youth with science and technology not only fulfils their career prospects but also trains their mind systems to be able to address the challenges of life. This can be achieved through transformational leaders in schools who would ensure that the students have the opportunity to participate and effectively succeed in science subjects.

UNESCO (2021) stressed the importance of quality science education, contending that it enhances competencies to analyse, synthesise, and evaluate information in a critical manner in decision-making, planning, and solving day-to-day problems. Maranan (2017) defined science as the ability to apply information in a relevant context, analyse it, and then synthesise it from various points of view to eventually give a wholesome evaluation that determines the course of action to be taken. The cited studies (UNESCO, 2021; Maranan, 2017) suggest that science education enables a grasp of the scientific method and enables the application of information based on evidence to a wide range of challenges that call for both individual and group action.

Education in science, technology, engineering, and mathematics (STEM) serves as a framework that can help meet the demands of the 21st century. STEM careers are considered innovative and inclusive. They enhance the social well-being of people and foster sustainable development (UNESCO, 2017). Though STEM subjects are crucial for development, the field is highly male-dominated, and girls are underperforming in science subjects. Women's participation in the science field has been a concern of many governments around the world (UNESCO, 2021). According to the Corporate Planning & Policy Division (2017), it has been frequently reported that women step out of the study of science-related fields after university studies while men

remain. Wiley (2016) mentioned that it is obvious that women are underrepresented in STEM-related industrial and academic leadership positions. This study by Wiley, however, did not establish if leadership in schools contributes to women's underrepresentation in STEM subjects, hence the need for the current study.

In 2000, European countries had 40% of women in the natural sciences, and Japan had only 20% of women in the same field (UNESCO, 2021). In the same year, according to UNESCO, women's participation in science, education, and technology industries was as follows: Europe had 15%, the United States of America (USA) had 19%, and Japan had only 6%. In the USA, only a quarter of the workforce with a background in STEM was female (Breda & Ly, 2019). The study by OECD (2019) estimated that 90% of future jobs would require some form of information and communication technology (ICT) skills, and the fastest-growing job categories are related to STEM.

A study by Hallinger and Heck (2003) was conducted about leading educational change in Bangkok. Their study contends that transformative leadership influences the behaviours and attitudes of learners toward learning. Therefore, the principals, as transformational leaders, should encourage the learners to embrace science subjects and pay attention to the learners' specific needs and abilities. A transformational leader provides support, encouragement, and coaching to individual learners depending on their personal needs. The study further revealed that a school principal who adopts transformational leadership inspires and motivates the students by transforming their belief systems, attitudes, and values. This enhances commitment and eventually translates to positive academic performance among students.

Ullah (2020) conducted a study about girls' academic performance in science subjects in Islamabad, Pakistan. The study revealed that girls, as compared to boys, are not doing well in science subjects such as technology, engineering, and

math (STEM). This study attributed the poor performance of girls in science subjects to the community's portrayal of the subjects as difficult and meant for boys. The study, however, did not mention how the principals' transformational leadership traits influence the performance of girls in science subjects, which is the gap that the current study seeks to fill.

Gender disparities in terms of educational performance have also been observed in Zambia. Ullah (2020) mentioned that girls' performance in science subjects is not up to par, particularly in STEM education, not only at the primary and middle school levels but also at the secondary level. The study also found that performance is worse, especially in higher education. Thus, it can be argued that in Zambia, STEM education is deemed boys' territory.

The poor performance in science subjects for girls and the low enrolment rate in the science faculties at tertiary institutions are a threat to South Africa's development and economy (Mbalenhle, 2016). As a result, the government has made efforts to improve science pass rates in secondary schools. Similar findings have been realised in Namibia, where the arts are considered appropriate for female students, and STEM is deemed suitable for male students (Ullah, 2020). The study reveals that the performance of girls is very low in STEM fields, not only at the middle levels but almost at all educational levels. Girls fail in science subjects because these are considered masculine; the current study sought to find out if the same challenges are experienced in Kenya, particularly in girls' public secondary schools in Tharaka Nithi County.

In the context of Tanzania, findings show that girls have remained behind in STEM education at the secondary school and college levels (Matete, 2022). Boys are outperforming girls in STEM subjects in high school and college-level tests, owing to the girls' perception of science as a male-dominated field. These studies (Mbalenhle, 2016; Ullah, 2020; and Matete, 2022) portray science subjects as meant for males, and they are silent on how the principals' transformational leadership

traits influence the performance of girls in science subjects. As a result, the current study sought to find out the influence of principals' transformative leadership traits on the performance in science subjects in girls' secondary schools in Tharaka Nithi County, Kenya.

Koehn (2017) attributed the poor performance of girls in science disciplines to the high costs involved in the process. This is a challenge for most poor parents, as they find it difficult to educate their children in STEM subjects. These gender disparities are a serious concern and necessitate the focus of transformational leadership in schools. Mwangangi (2022) contended that a school principal, as a transformational leader, sets the school environment that improves the academic performance of the students. It is also the responsibility of transformational leaders in schools to ensure that the teaching staff, non-teaching staff, and students have a conducive environment that allows both boys and girls to study and excel in the science disciplines. It is the role of the principal to hold teachers accountable for their understanding of gender equity and to educate them in both the theory and practice of gender-sensitive education.

The performance of girls in science subjects in most secondary schools in Kenya has been of great concern. Nyongesa (2019), Kariuki (2021), and Ndege (2014) stress that in Kenya, the overall performance of girls in science subjects is not satisfactory. The studies contend that girls' academic performance in STEM subjects is shaky, and male students are outdoing girls in STEM subjects. This has been the case despite the government's effort to invest in education through the professional development of principals and teachers and the provision of teaching and learning resources in public schools (Nyongesa, 2019). This has posed the question of whether the transformational leadership of the principals in these schools has an influence on the performance of girls in science subjects. Hence the need for the current study.

Statement of the Problem

Education is instrumental in enhancing the growth and development of a nation. Thus, the UNESCO Agenda 2030 for Sustainable Development calls on all nations to foster equal participation of both male and female genders in developmental initiatives, including education. According to UNESCO, less than 30% of women globally pursue careers in science, technology, engineering, and mathematics (STEM). Though the study of science is becoming a global goal, science subjects and careers continue to be male-dominated. Girls are underrepresented, and their performance in science subjects has been dismal, which poses a great challenge to the objectives of UNESCO (2021).

In Kenya, the performance of girls in science subjects has remained low despite the government's efforts to improve the performance of principals and teachers through professional development (Asuga et al., 2015). Girls who attend girls' secondary schools in Tharaka Nithi County do poorly in science subjects. This has raised the question of whether principals' transformative leadership has helped students do better in scientific subjects. The reviewed literature did not provide substantial information regarding how the transformational leadership of the principals influences girls' performance in science subjects, especially in Tharaka Nithi County. Therefore, this study sought to find out the influence of principals' transformative leadership traits on the performance in science subjects in girls' secondary schools in Tharaka Nithi County, Kenya.

Objectives of the Study

- To ascertain whether principal-teacher role modelling influences performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya.
- To find out the relationship between the provision of supportive learning resources and the performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya.

Research Questions

- How does principal-teacher role modelling influence the performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya?
- What is the relationship between the provision of supportive learning resources and the performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya?

LITERATURE REVIEW

Theoretical Review

This study was anchored on transformational leadership theory, which was introduced by Bass (1995). The theory stipulates that transformational leaders are those who transform their followers into leaders themselves. Transformational leadership is a leadership style that inspires followers to make valuable and positive changes. In this type of leadership, the leader boosts the motivation, morale, and performance of the followers. This may enable the school principals to motivate and inspire teachers and students to achieve extraordinary academic performance in science subjects. Transformational leaders go beyond incentives for performance to develop and encourage subordinates intellectually and creatively, as well as transform their own concerns into an essential part of the organisation's mission. Mwangangi (2022) noted that transformative leaders inspire their subjects and creatively lead them to exploit their potential to the fullest. The theory enables school principals to influence the values, beliefs, and goals of their teachers and students towards science subjects. They act as mentors and advisors, pay attention to personal development, and make the working environment conducive through the provision of what is needed for the girls to perform effectively in science subjects. Transformative principals give the teachers a broader perspective; they challenge, respect, and involve both the teachers and students, which results in the effective performance of students, particularly girls, in science subjects.

Bass (1995) described transformational leadership as having four dimensions, including idealised influence, inspirational motivation, intellectual stimulation, and individual consideration. Samina (2014) defined intellectual stimulation as the manner in which the leader enhances the interests of the members, makes them aware of the problems surrounding them, and motivates them to analyse those problems from a new perspective. Shahat (2023) contended that the principal is supposed to help the teachers and students be creative in solving problems related to science subjects. Idealised influence is when the principal is viewed as a role model who commands authority, respect, and trust. The principal instils life's virtues in the school's community. Vagisha (2022) defined the term "inspirational motivation" as a situation in which the leader (principals) shares the organisation's vision and goals in a clear and realistic manner so that they relate to the goals of the members (teachers and students). The leader also encourages the members to embrace the vision and the goals by supporting them and involving them in the decision-making process. Bellibas and Liu (2018) argued that individualised motivation occurs when the principal pays attention to the teachers' and students' specific needs and abilities. They offer support, encouragement, and coaching to teachers and students based on their specific needs concerning the study of science subjects. This would consequently lead to better performance by girls in science subjects.

Empirical Review

Principal-teacher role Modelling and its Influence on Students' Performance

Principals are key role models who can influence the attitudes, values, and behaviours of teachers and improve the performance of learners in a school. They can be role models for teachers so that they are inspired to keep growing through learning and improve the student's achievement. Zeinabadi (2014) conducted a qualitative study in Iran about principal-teacher high-quality exchange indicators and student achievement. The researcher collected data from teachers and

principals using an interview guide. The findings revealed that high-quality exchanges and modelling between principals and teachers resulted in positive outcomes in the form of student achievement. This study extends the line of inquiry in public schools. It also contributes to the literature on school effectiveness by providing empirical evidence concerning the link between trust in the principal, a principal as a role model, procedural justice, organisational citizenship behaviour, and student achievement. Thus, this study formed the basis for the current study, which looked at how principals, as role models to teachers, influence students' performance, particularly girls in science subjects.

A related study was conducted in Indonesia by Hikman and Sawan (2020) about the principal as a role model in personality and social competence. The study stressed that the principal, as a leader, must be a role model for teachers. The survey method was employed in this research, and the results showed that 95.5% of the teachers looked up to the principal as a role model for personality and social competencies, which improved not only their performance but that of the learners as well. This study expressed a geographical gap in that it was done in Indonesia, but the current study covered this gap since it was conducted in Kenya.

Mensah (2023) conducted survey research in Nigeria aimed at assessing the general roles of secondary school principals in sustaining and managing the quality of education in schools. According to the findings of the study, regular checking, including both internal and external school supervision, improves instructional delivery and standard maintenance in the school system. The study further established that, as the chief executive, the principal owes the school a duty to modify the attitude of the staff and motivate them through role modelling in order to enable them to put in their best effort at achieving educational goals. The principal, as a role model, influences the discipline of both academic and non-academic staff, which improves their performance and the academic achievement of the learners. The study was not clear on how

principals as role models influence the performance of girls in science subjects, which raised the need for the current study.

Aboye and Tasisa (2017) conducted a study aimed at investigating leadership behaviours and their impact on teachers' job performance in secondary schools in Ethiopia. The study employed a descriptive survey. Out of 38 secondary schools, eight selected simple random sampling techniques. A questionnaire, an interview, and a review of documents were used to collect data from respondents. The findings indicated that principals of schools played a big role as role models for teachers, supporting them in their jobs. The study further found that teachers' job performance was also found to be at a low level in schools where principals were not effective role models and did not support the development of teachers, which consequently affected the academic achievement of the learners. The study by Aboye and Tasisa (2017), however, was silent on the learners' performance, particularly girls in science subjects, which raised the need for the current study.

Nyenyembe and Maslowski (2016) explored the relationship between leadership styles applied by school heads and teachers' job satisfaction in Tanzanian secondary schools. Using a questionnaire, data for the study was collected from 180 teachers in ten secondary schools in Songea District. The findings of this study revealed that teachers were more satisfied with their jobs when their school heads worked closely with them by mentoring them as well as paying attention to their personal well-being. The study further mentioned that teachers' satisfaction was reflected in the learners' better academic performance. Different from this study by Nyenyembe and Maslowski (2016), the current study will focus more on the performance of learners, particularly girls, in science subjects.

The performance of any school is determined by the effectiveness of the principal and the leadership practices put in place. School leadership influences students' academic performance, and therefore, understanding how

different school leadership practices impact students' academic performance is important in setting the institutional direction that members should follow. A study was conducted by Kilonzo and Kasivu (2020) about principals' transformative leadership practice of setting institutional direction as a determinant of student's academic performance in public secondary schools in Machakos County, Kenya.

The study adopted a descriptive survey design. The results revealed that there was a statistically significant relationship between the setting of institutional direction by principals as role models and students' academic performance, which was positive. Based on the results, the study concluded that principals' transformational leadership practice of setting institutional direction influenced students' academic performance. It was therefore recommended that the principals increase their transformational leadership practices by setting the school's direction as role models not only to the teachers but to the learners as well, which will influence students' academic performance. However, the study was not specific to the performance of science subjects in girls' secondary schools, which is the gap that the current study sought to fill.

The Provision of Supportive Learning Resources and Students' Performance

Learning resources have a significant role in determining students' academic achievement (Mohammed, 2023). The availability of teaching and learning resources enhances the effectiveness of schools by enabling students to effectively perform academically. Such resources include human resources such as teachers and support staff and physical facilities such as laboratories, libraries, and classrooms. Such resources help to improve educational outcomes since students are less likely to be absent from schools that provide interesting, meaningful, and relevant experiences for them. Principals of schools should therefore, ensure that resources are provided in quality and quantity in schools for effective teaching and learning.

In order to reinforce efficiency and accountability, many countries have decentralised financial management to schools. Crouch and Winkler (2008) discovered that all schools and institutions in the United States place a high value on accountability. Performance funding policies influenced state budgets and priorities for resource allocation at public institutions. The study established that there is a drive towards decentralisation of financial resources to schools in a bid to enhance their management and learners' performance. A related study conducted in Sweden observed that tight budgetary control affects management behaviour in public schools throughout the country. Both studies confirmed that despite the expectations placed on financial resource management by the school principals to bring much-needed change, in some schools, resources are mismanaged and misappropriated by the school leaders. This affects the running of the school and, eventually, the academic achievement of the learners. The study does not, however, clearly elaborate on the connection between financial resources and the performance of learners in science subjects, which has necessitated the current study to fill the gaps.

Kien (2022) conducted a study in Vietnam about pre-recorded lectures, live online lectures, and student academic achievement. The study used a randomised experiment to compare the impacts of live online and pre-recorded lectures on student achievement. The study concluded that the use of digital resources was helpful, especially in the conduct of online lessons during the COVID-19 pandemic. It was further discovered that pre-recorded lectures lower the ability of students' academic achievement but have no effect on higher-ability students' academic achievement. In particular, being taught via pre-recorded lectures as opposed to live online lectures through the use of digital resources decreased the likelihood of answering exam questions correctly. Furthermore, being taught via pre-recorded lectures in the early weeks of the semester compared to the later weeks tended to be more harmful to students' academic achievement. The study expressed a geographical gap given that it was done in Vietnam. This gap

was filled by concentrating on Kenya, an eastern African country.

Akinfolarin (2017) opined that the principal is a leader who must plan, coordinate, and supervise the affairs of the school so that they run smoothly. The principal is the chief administrator of a secondary school and is expected to effectively use various resources through the adoption of management practices for the realisation of school goals. If the education system must achieve national policies and goals, the school principal must ensure optimum management of human, material, financial, and time resources. Akinfolarin (2017) analysed principals' managerial competencies for effective management of school resources in secondary schools in Anambra State. The study adopted a descriptive survey design. The study found that secondary school principals in Anambra State do not have managerial competencies in the procurement of physical and instructional materials, the provision of e-library facilities, or equipping classrooms and offices with the needed furniture for effective teaching and learning. The study also found that school principals have managerial competencies in prioritising financial allocation according to school needs, keeping accurate financial information about the school, ensuring accountability for all school expenditures, carrying out periodic audits of school budgets, and adopting cost-saving strategies for effective financial resource management. The study recommended that school principals strive to acquire managerial competencies so as to effectively manage school resources such as the procurement of physical and instructional materials, the provision of e-library facilities, and equipping classrooms and offices with needed furniture. Though the study focused on the provision of resources, it did not discuss how the provision of resources leads to learners' performance in science subjects.

A study conducted in Tanzania by Wambiya (2016) assessed the perceptions of teachers and students on the adequacy of resources and facilities for the implementation of learner-

centred pedagogy in secondary schools in the Kilimanjaro region of Tanzania. The researcher adopted mixed research methods for data collection and analysis. Specifically, the researcher used a triangulation design. Data collection instruments were questionnaires for students and teachers, in-depth interview guides for heads of school and educational inspectors, an observation guide, and document analysis guides. The study found that teaching and learning resources were inadequate in most schools, which hindered teaching and learning. Different from the study by Wambiya, the current study will establish how the provision of learning resources affects girls' performance in science subjects.

The inadequacy of teaching and learning resources in secondary schools has been one of the greatest challenges facing the education system in Kenya. Yara and Omondi (2010) conducted a study about the effect of teaching and learning resources on academic performance in secondary school mathematics in the Bondo district of Kenya. The research design for the study was a descriptive survey design. The study established a positive correlation between the availability of teaching and learning resources and the performance of learners in mathematics. The study recommended recruiting more competent teachers and improving the student-book ratio in order to improve performance in mathematics. This study was only focused on mathematics; on the contrary, the current study was focused on the performance of all science subjects offered in secondary schools in Kenya.

Research Gap

The review of related literature demonstrated some gaps. Some studies reviewed revealed geographical gaps because they were conducted in other countries whose geographical backgrounds are different from the Kenyan setting. For example, Aboye and Tasisa (2017) conducted their study in Ethiopia, Mensah (2023) conducted the study in Nigeria, and Hikman and Sawan (2020) conducted their study in Indonesia. Some of the findings from some of these studies may not effectively be generalised to explain the situation

in Kenya, hence the need for the current study to fill such geographical gaps. There are also some studies that expressed a methodological gap. For example, Zeinabadi (2014) conducted a qualitative study in Iran about principal-teacher high-quality exchange indicators and student achievement. This necessitated the current study to fill the gap by incorporating both qualitative and quantitative approaches. Other studies expressed theoretical gaps by adopting different theories than the ones used in the current study, which revealed a theoretical gap that was covered through the adoption of transformational leadership theory.

RESEARCH METHODOLOGY

This study adopted a concurrent triangulation design. This design was used because it enabled the researcher to use both quantitative and qualitative techniques in the collection of data at the same time. The target population were public secondary school girls, the county director, principals, and teachers in Tharaka Nithi County. Tharaka Nithi County was chosen because girls who attend girls' secondary schools in this area do poorly in science subjects (Ogolla & Mwalra, 2019). This raised the question of whether principals' leadership qualities have helped students do better in scientific subjects.

The target population for the current study was 11 secondary schools, 11 principals, 165 teachers, 1650 students, and one county director in Tharaka-Nithi County. Purposive sampling was adopted to include all 11 girls' public secondary schools, 11 out of 11 principals, and one county director of education. Proportionate sampling was applied to collect data from 330 out of 1650 students. The use of proportionate sampling was because girls' public secondary schools in Tharaka Nithi County have a varying number of students. Consequently, the researcher used proportionate sampling to ensure that the sample from each school was proportionate to the total population of students. Simple random sampling was applied to collect data from 100 out of 165 teachers; this ensured that all teachers had an equal chance of participating in the study.

The study used questionnaires to collect data from teachers and students. The collection of data from principals and the county director of education was done through interview guides. Quantitative data was analysed using the Statistical Package for the Social Sciences (SPSS) version 25. The data from quantitative instruments was presented using frequencies and percentages on tables, graphs, and pie charts. Qualitative data was analysed in themes, and the reporting was done in direct quotations and narratives.

FINDINGS AND DISCUSSIONS

Principal-teacher Role Modelling and Students' Performance

The study sought to ascertain whether principal-teacher role modelling influences performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya. Under this objective, respondents were asked to respond to the statement using the 5-point Likert scale: strongly agree (SA), agree (A), undecided (UD), disagree (D), and strongly disagree (SD). *Table 1* below shows the findings.

The study sought to find out the opinion of teachers on the statement that the principal, as a role model, promotes a positive attitude towards science subjects. The results in *Table 1* indicate that a majority of teachers 74 (81.3%) agreed, while 13 (14.4%) disagreed with the statement. This finding implies that by actively demonstrating enthusiasm and curiosity for science, the principal sets a powerful example for both students and teachers. Engaging in science-related activities, such as participating in science fairs or encouraging scientific research within the school, showcases a genuine interest in the subject. Peeples (2023) added that in promoting science-based subjects, school principals can foster a culture of appreciation for science by recognising and celebrating students' achievements in science subjects, whether it be through awards, commendations, or showcasing their work.

The study also sought the opinion of teachers on whether the principal, as a role model, discusses

with students how to excel in science subjects. The majority of the teachers 43 (47.3%) strongly agreed, 29 (31.9%) agreed, 9 (9.9%) were undecided, 2 (2.2%) disagreed, and 8 (8.8%) teachers strongly disagreed with the statement. By demonstrating enthusiasm and passion for science themselves, principals can instill a sense of curiosity about science among students. When students witness their principal's genuine interest in science, they are more likely to develop a positive attitude towards the subject. Adan and Keiyoro (2017) made a similar observation when they reported that school principals show support for science subjects by providing necessary resources, professional development opportunities, and recognition for their efforts. By doing so, they show that science education is valued within the school community.

Regarding whether the principal, as a role model, is always available to talk to and encourage girls who have challenges in science subjects. The study results show that the majority of the respondents, 58 (63.7%) strongly disagreed with the statement. The principal's failure to discuss such matters may lead to a lack of female role models in STEM fields since principals play a crucial role as educational leaders and mentors, and their engagement with students is essential for fostering a positive learning environment. Girls may not receive the guidance needed to nurture their interests and talents in science, potentially leading to self-doubt and a loss of interest in the subject. Similar views were expressed by Adhiambo (2016), who observed that without the guidance of school principals, girls may remain unaware of educational and career opportunities in science, hindering their access to valuable experiences. The lack of engagement may also reinforce gender stereotypes, associating science with male interests and abilities, further deterring girls from pursuing their passions in the areas of science.

Concerning whether the principal, as a role model, ensures students have the resources they need to perform better in science subjects, the study results show that the majority of the respondents,

61(67%), disagreed with that statement. This negative response shows the failure of principals to provide the required equipment, materials, and technology that support hands-on learning and practical experiments, which may have severe consequences for the performance of science subjects. Further to this, principals play a vital role as educational leaders, responsible for creating an environment conducive to learning and academic excellence. When adequate resources are not allocated to science subjects, it hinders students' ability to engage in hands-on learning, practical experiments, and exploration of scientific concepts. In a study by Adan and Keiyoro (2017), it was found that insufficient resources can also place an unnecessary burden on science teachers, limiting their ability to create dynamic and engaging lessons. Without access to proper laboratory equipment, technology, and materials, teachers may struggle to effectively convey scientific principles and foster critical thinking skills in their students (Adan & Keiyoro, 2017). Concerning the availability of resources, the principal in the interview had this to say:

While encouraging girls to engage in science subjects, I also try my best to provide what they need to excel. For instance, I ensure the availability of research papers, articles, and journals that students can access for further exploration and in-depth study. I also provide science kits and supplies to students to encourage independent learning and experimentation. Students in my school can explore scientific concepts during their free time, reinforcing what they have learned in the classroom (Principal E, 17/07/2023).

The study further sought teachers' opinions on whether the principal, as a role model, encourages students to read hard and consult teachers to perform better in science subjects. *Table 1* shows that 70 (76.9%) agreed with the statement. This result demonstrates that, as educational leaders, principals inspire and encourage students to develop a genuine interest in science. In doing so, school principals play a crucial role in setting a vision and direction for the school, fostering a sense of purpose and commitment among the school community. In relation to these findings,

Eboka (2016) argued that the school principal has to be passionate and enthusiastic about science subjects in order to instil a strong work ethic and a thirst for knowledge that is required in science subjects.

The study also sought students' opinions on whether the principal, as a role model, promotes a positive attitude towards science subjects. Results in *Table 1* above show that 166 (53.5%) of the student respondents were undecided, and 53 (17.1%) agreed. This result shows that a majority of the students are unable to directly link the school principal to the development of positive attitudes towards science subjects. On whether the principal, as a role model, is always available to talk to and encourage girls who have challenges in science subjects. The study results were in the negative, with 110 (35.5%) disagreeing and 107 (34.5%) strongly disagreeing. This could mean that school principals are failing in their role of having instructional-focused interactions with students that involve problem-solving and student guidance.

The study also sought the opinion of the students with regard to the provision of resources for use in science subjects. Study results in *Table 1* show that 215(69.4%) of the students' respondents agreed with the statement. This result shows that principals are aware of the specific resource needs of science classrooms and laboratories. By providing equipment, materials, and technology that support hands-on learning, practical experiments, and inquiry-based activities, school principals act as facilitators of science subjects. Kariuki et al. (2016) argued that the roles that principals play in ensuring adequate teaching and learning resources in schools include ensuring teaching and learning resources (library, e-learning resources, laboratory) are readily available; evaluating the extent to which the teaching and learning resources are adequate for effective teaching and learning in school; advising teachers on the most current textbooks to use in teaching and learning; and encouraging teachers to develop innovative teaching aids. Concerning resources, the County Director of Education

argued that though resources are limited in most of the schools, the principals are encouraged to ensure that the schools have the required materials for science activities for students to learn.

The study further sought the opinion of students on whether the principal, as a role model, is involved in teaching students some of the science subjects and participating in mentoring them to acquire the skills needed to be successful in science fields. The study results in *Table 1* show that most of the students, 216 (69.7%) strongly disagreed with the statement. This could mean that school principals do not go to class to teach, and in some cases, it may mean that school principals are not science teachers. It may be beneficial for the principal to teach a class since, by doing so, they can demonstrate their commitment to education and their passion for teaching, setting a positive example for both students and teachers. Teaching a class allows the principal to interact directly with students, understand their needs, and gain insights into the teaching and learning process within the school. It should also be mentioned that the failure of teachers to go to the classrooms to teach is due to having demanding administrative responsibilities, so taking on regular teaching duties could divert their attention from essential leadership tasks.

The participants unanimously concurred that a principal who serves as a role model within a school can have a substantial impact on student's academic accomplishments. When both principals and teachers establish elevated academic standards for both themselves and their students, a distinct message highlighting the significance of education is conveyed. This, in turn, serves as a potent motivator for students to aspire towards excellence and invest greater effort in attaining their objectives. Regrettably, this desirable dynamic has not been effectively realised in the context of girls' public schools in Tharaka Nithi County. The study's respondents widely shared the perspective that principals are not consistently accessible for dialogue and to provide encouragement to girls who encounter difficulties in scientific subjects.

Table 1: Principal-teacher role modelling and students' performance in science subjects

Statement	SA		A		UD		D		SD		
	f	%	F	%	f	%	f	%	f	%	
Teachers (n=91)	The principal as a role model promotes a positive attitude towards science subjects	0	0	70	76.9	17	18.7	3	3.3	1	1.1
	The principal, as a role model, discusses with students how to excel in science subjects.	43	47.3	29	31.9	9	9.9	2	2.2	8	8.8
	The principal, as a role model, is always available to talk and encourage girls who have challenges in science subjects.	6	6.6	23	25.3	1	1.1	3	3.3	58	63.7
	The principal, as a role model, ensures Students have the resources they need to perform better in science subjects.	3	3.3	13	14.3	-	-	61	67.0	14	15.4
	The principal, as a role model, encourages students to read hard and consult teachers to perform better in science subjects.	4	4.4	70	76.9	4	4.4	4	4.4	9	9.9
Students (n=310)	The principal as a role model promotes a positive attitude towards science subjects	6	1.9	53	17.1	166	53.5	59	19.0	26	8.4
	Our principal, as a role model, discusses with students how to excel in science subjects.	240	77.4	-	-	34	11.0	26	8.4	10	3.2
	Our principal, as a role model, is always available to talk to and encourages girls who have challenges in science subjects.	2	0.6	20	6.5	71	22.9	110	35.5	107	34.5
	Our principal, as a role model, ensures that we have the resources needed to perform better in science subjects.	58	18.7	190	61.3	19	6.1	24	7.7	19	6.1
	Our principal is involved in teaching us some of the science subjects	16	5.2	27	8.7	7	2.3	44	14.2	216	69.7

Source: Field Data (2023)

Table 2: Provision of Supportive Learning Resources and Performance in Science Subjects

Statement	SA		A		UD		D		SD		
	f	%	f	%	f	%	f	%	f	%	
Teachers	The principal provides the learning resources needed in the study of science subjects, such as laboratory equipment.	41	45.1	33	36.3	-	-	3.3	-	-	-
	The school has digital devices that enable learners to conduct research.	6	6.6	3	3.3	5	5.5	60	65.9	17	18.7
	A resource person is usually invited by the principal to encourage learners about the study of science	3	3.3	61	67.0	18	19.8	1	1.1	8	.8
Students	The principal provides the learning resources needed in the study of science subjects, such as laboratory equipment.	1	0.3	32	10.3	123	39.7	71	22.9	83	26.8
	The school has digital devices that enable learners to conduct research.	52	16.8	125	40.3	-	-	8	2.6	125	40.3
	The principal provides enough books for us to study and succeed in our exams.	58	18.7	53	17.1	3	1.0	11	3.5	185	59.7
	A resource person is usually invited by the principal to encourage us in the study of science subjects.	15	4.8	177	57.1	72	23.2	36	11.6	10	3.2

Source: Field Data (2023)

The Provision of Supportive Learning Resources and Students' Performance

The research further sought to find out the relationship between the provision of supportive learning resources and the performance in science subjects in girls' public secondary schools in Tharaka Nithi County, Kenya. To achieve this, participants were asked to respond to the statement using the following scale: strongly agree (SA), agree (A), undecided (UD), disagree (D), and strongly disagree (SD). *Table 2* shows the findings.

Table 2 above shows that the majority of the teachers, 75 (81.4%), agreed with the statement that the principal provides the learning resources needed in the study of science subjects. On the other hand, 14 (15.4%) strongly disagreed with the statement. This could mean that school principals actively source teaching resources and materials needed by both students and teachers to carry out science lessons. Further, by equipping classrooms with the necessary resources, such as laboratory equipment, scientific instruments, specimens, and multimedia tools, students can actively participate in practical activities that reinforce theoretical concepts. A similar observation was made by Ibrahim and Dalim (2019), who arrived at a positive correlation between resource availability and learners' development of critical thinking and problem-solving abilities in science. In an interview, the County Director of Education observed that:

Principals play a crucial role in the educational development of students, and providing learning resources for science subjects is essential to facilitate effective learning. They must understand that having access to a variety of learning resources, such as textbooks, laboratory equipment, multimedia materials, and online resources, can significantly enhance students' learning experiences. These resources cater to different learning styles and help students grasp complex scientific concepts effectively (County Director, 18/07/2023).

The study also sought the opinion of teachers on the statement that the school has digital devices that enable learners to conduct research. The study results in *Table 2* show that 77 (84.6%) of the teacher respondents disagreed with the statement. This shows that learners do not have enough ICT-based equipment to enable them to conduct scientific experiments. Only a small number, 9(10%) agreed with the statement. This finding may also imply that, with limited access to modern ICT tools, students may be deprived of valuable opportunities to engage in interactive and immersive learning experiences. This, in turn, hinders their understanding of complex scientific concepts. A study by Okpechi and Chiaka (2017) noted that the inadequacy of resources for use in science subjects hampers the students' continued mastery of scientific principles and, ultimately, their performance in science subjects.

The study also sought responses from teachers on the statement that a resource person is usually invited by the principal to encourage learners about the study of science. The study results in *Table 2* show that 64 (70.3%) of the teacher respondents agreed with this statement. However, 46 (14.2%) disagreed with the statement. This implies that over half of the sampled schools invite experts and motivational speakers to motivate learners in the field of science. Further to this, motivational speakers bring a fresh perspective and real-world experiences to the classroom, igniting a sense of passion and curiosity for the subject by sharing their own success stories. As was equally noted by Bukoye (2019), motivational speakers can shed light on the diverse career opportunities within the scientific domain, encouraging students to explore various paths they might not have considered before and thereby fostering a positive mindset and boosting self-confidence among students.

From the student's perspective, results in *Table 2* show that 123 (39.7%) were undecided, while 154 (49.7%) disagreed with the statement that the principal provides the learning resources needed in the study of science subjects, such as laboratory equipment. This finding shows that respondents were split in the middle, with the majority of the

school having few learning resources for science subjects. This failure of schools to provide adequate resources for learning science subjects in school has severe consequences for the learners' acquisition of critical knowledge in science.

Also, from the student's perspective, the study sought responses to the statement that the school has digital devices that enable learners to conduct research. Study results in *Table 2* show that 177 (57.1%) agreed while 133 (42.9%) disagreed with the statement. This finding could mean that some schools have digital devices and others do not. With regards to the provision of reading material as a resource for science subjects, 111 (36%) agreed, while 196 (63.2%) disagreed. This shows that a majority of the students feel that the books available for use in science subjects are inadequate. As noted by Bukoye (2019), schools without such critical resources may struggle to produce good grades in national examinations as opposed to those with adequate resources.

Finally, the study sought the opinion of students on the statement that a resource person is usually invited by the principal to encourage them in the study of science subjects. Study results in *Table 2* show that 15 (4.8%) strongly agreed, 177 (57.1%) agreed, 72 (23.2%) were undecided, 36 (11.6%) disagreed, and 10 (3.2%) strongly disagreed with the statement. This finding shows that over half of the sampled students are from schools that regularly invite motivational speakers in the field of science. This also implies that schools that invite motivational speakers are keen on good grades and the promotion of science subjects among the students, as opposed to schools that do not.

The findings from *Table 2* above seem to confirm that the provision of supportive learning resources can have a significant influence on the performance of students in science subjects. Supportive learning resources help to enhance the learning experience of learners and help students better understand and engage with the subject matter, which enhances learner's performance.

CONCLUSIONS AND RECOMMENDATIONS

The study's findings indicate that school principals are not consistently available to provide support for girls facing challenges in science subjects. Additionally, the research highlights that students lack adequate resources required for success in science, such as laboratory equipment. This inadequacy has been detrimental to their performance in these subjects.

The study further underscores the significance of principals' provision of supportive learning resources in influencing girls' performance in science subjects within public secondary schools. However, the study acknowledges the constraints posed by limited resources, notably the absence of digital devices and laboratory equipment that could enhance learners' ability to conduct research and experiments. This deficiency has a direct impact on their performance in science subjects.

To address these issues, the study proposes a number of recommendations. Principals are advised to consistently allocate time to interact with students and motivate them to pursue science subjects. Concurrently, the government should prioritise the enhancement of school infrastructure and the provision of essential resources such as textbooks, scientific equipment, and technology. These efforts are deemed crucial to fostering a more effective learning environment in the sciences.

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