INSTRUCTIONAL USE OF REAL-LIFE SITUATIONS AND ITS EFFECT ON SECONDARY SCHOOL STUDENTS' PERFORMANCE IN STATISTICS IN THARAKA-NITHI COUNTY, KENYA

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DECLARATION

I declare that this thesis is my original work and has not been presented to any other university/institution for consideration of any certification. This research thesis has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures, and tables have been borrowed from other sources, including the internet, they are individually accredited. References are cited using the current APA system and under antiplagiarism regulations.

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DEDICATION

I dedicate this work to my mother, Patricia Kagendo Muthuri, for her support and encouragement throughout my studies. To my sister Faith Kathambi Mutegi for her diligence in contributing to this study as my reader and cheerleader. Her “It can be done” words of encouragement remained my mantra to the end of this study.

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LIST OF ABBREVIATIONS AND ACRONYMS

KICD:	Kenya Institute of Curriculum Development
KNEC:	Kenya National Examination Council
MAT:	Mathematics Assessment Test
MKO:	More Knowlegeable Others
MTQ:	Mathematics Teachers Questionnaire
MWU:	Mann Whitney U-test
MYR:	Milk Yield Records
NACOSTI:	National Commission for Science, Technology, and Innovation
RLS:	Real Life Situations
RME:	Realistic Mathematics Education
SPSS:	Statistical Package for Social Sciences
STQ:	Students Questionnaire
ZPD:	Zone of Proximal Development

ABSTRACT

The use of real-life situations is one of the techniques that has been proposed in Mathematics teaching to improve learners' conceptual knowledge. The purpose of this study was to determine the effectiveness of using real-life events on secondary school student's performance in Statistics in Tharaka-Nithi County, Kenya. The objectives the study were to: a) determine if there is a difference in performance in Statistics between students taught using real-life situations (RLS) and those taught without; b) establish gender responsiveness to the use of RLS on students' performance in Statistics; c) establish by gender students' opinions about the use of RLS in teaching; and d) determine teachers' opinions on the use of RLS in teaching Statistics. The study used a quasi-experimental research design. The target population was learners in Form Two and teachers in public secondary schools. Purposive sampling was used to select the schools' and teachers' samples. In schools with multiple streams, simple random sampling was used to select aa single class. A sample size of six (6) schools, 232 students, and six (6) teachers was used in the study. Data were collected using Mathematics assessment tests (MATS), students' questionnaires (STQ), and Mathematics teachers' questionnaires (MTQ). Data was analysed using the latest version of the statistical package for social science (SPSS) version 25. The study findings show that the mean mark for the group taught using real-life situations was 11.43 and the standard deviation was 3.73. The mean mark for the group taught without integrating real-life situations was 8.18 and the standard deviation was 4.23. It is evident that the performance of the group taught while using real life situations was significantly higher, t (230) = -6.21, p = .01. The study findings also show that mean mark for girls was 13.20 and the standard deviation was 3.10. This achievement was significantly higher, X^2 (1, N = 118) = 44.65, p = .01 than mean mark for boys 8.81 and the standard deviation of 3.40. The Mann-Whitney U-test showed no difference in views about using RLS in teaching Statistics between boys and girls. However, the test showed that more girls than boys had stronger opinions about the use of RLS helping in improving their grades (U = 5359.00, P = .01) and showing the importance of Statistics in real life (U = 5359.00, P = .01). Three conclusions were made from the study: i) RLS could help improve learners' grades in Statistics; ii) girls had a higher mean mark than boys; iii) demonstrating the usefulness and relevance of Statistics concepts in real life is essential to the learners and should not be ignored; and iv) although Mathematics teachers are aware of the usefulness of RLS in the teaching process, the breadth of the curriculum and inadequate training restrain their use of RLS in the teaching of Statistics. On the basis, of the study's outcomes, it is suggested that teachers of Mathematics should endeavour to integrate different types of RLS that are closely related to learners' actual-life experiences in the instruction of Statistics. The study also recommends that teachers of Mathematics be supported through further training to enable them effectively use RLS in the teaching process. The findings of this study are significant for curriculum developers and teacher trainers.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Data analysis, a strand of Mathematical objects, is included in many nations' primary and secondary school curricula (Gonda et al., 2022; Kovacs et al., 2021). Since the commencement of the data analysis concept in the seventeenth century, the strand has been fundamental to applying Mathematics in a societal structure that invariably requires meaningful inference, interactions, and judgement based on data (Bokar, 2013; Xiayan, 2015). Statistics knowledge is essential in everyday life and other fields, hence the need to incorporate it into the mathematics curriculum worldwide (Gonda et al., 2022). This is the same case in Kenya, where the calculation of means and representation of data on charts and graphs are introduced at the primary school level. Statistics I is learned in Form Two and Statistics II is presented in Kenyan high schools at Form Four level (KICD, 2002). This study focused on Statistics I taught at the Form Two level. Statistics instruction is highly stressed at this level, allocating more lessons than other topics.

Additionally, the use of real-life situations during teaching is encouraged. This emphasis on using real-life situations in Statistics instruction made the topic suitable for this study. Despite the significance of Statistics in society, students have regularly fared poorly in the data analysis strand in their KNEC test (KNEC, 2014). Statistics concepts have been rigorously tested throughout the years. However, virtually all examine questions have consistently been listed among the tough questions in Kenya National

Examination Council (KNEC) Mathematics reports. For example, between the years 2017 and 2021, many of the tested Statistics questions were categorised as difficult (KNEC, 2017, 2018, 2019, 2020, 2021). This constant classification of Statistics questions as difficult illustrates the seriousness of low performance in the strand.

The same elements contributing to poor mathematical achievement also contribute to poor Statistics performance (Pale, 2016). The study notes that a lack of motivation towards learning Mathematics and insufficient resources are only a few of these difficulties. However, according to Wanjiru (2002), the Kenyan government through the Ministry of Education has addressed most of the issues related to human resource and policy making by ensuring proper teacher training, changing the secondary Mathematics curriculum, and providing appropriate teaching resources.

On the other hand, statistics, a component of secondary school Mathematics, has continued to be underperformed. According to KNEC reports (2017-2021), most learners find data analysis ideas abstract, resulting in poor performance in the data analysis strand. According to the findings, learners needed clarification about Statistics, which could have stemmed from using real-life examples in unneeded or inappropriate training. According to reports, irrelevant events and incorrect use of real-life scenarios can cause students to become distracted. Therefore, it is recommended that the teaching focus should be on Statistics ideas rather than the real-life situation. Unfortunately, except for reports, there are no scientific sources about using actual occurrences in Statistics instruction. Hence, this study must determine how integrating a specific actual-life event could affect learners' mean scores in Statistics.

The use of practical events in instructing Mathematics, also known as realistic mathematical education (RME), was proposed to reduce the mismatch between out-of-classroom and in-classroom Mathematics (Alsina & Salgado, 2022; Moschkovich, 2002). However, the mismatch obstructs arithmetic education and learning (Lens et al., 2012). Moreover, for various learners, the mismatch makes numerical accessibility more complicated, less motivating, and less engaging, denying them a context for applying and studying Mathematics (Altay et al., 2017).

According to Altay et al., (2017) realistic mathematics modelling inhibited students from making simple mathematical conclusions. Students' inability to apply their personal experiences to Mathematics instruction and learning was attributed to the discrepancy between outside-the-classroom mathematical vocabulary and in-classroom mathematical language. Learners' and teachers' evaluations of probabilistic and statistical concepts as challenging to understand are unaffected by the connection of ordinary life intuitions to the learning process (Koparan, 2014). However, there are few preliminary studies on applying actual-life situations in the instruction of Mathematics to draw firm conclusions.

According to (Gainsburg, 2008), to successfully integrate actual events in Mathematics instruction, research should be conducted in learners' natural environments to discover relevant real-life activities that may be effectively integrated into Mathematics teaching. This observation is the foundation of this research. This study intended to determine the effect of incorporating an actual-life situation into Statistics instruction in secondary schools in Tharaka Nithi County, Kenya. Real-life situations utilised in education are

divided into authentic and inauthentic events (Nazifah, 2016). Inauthentic real-life situations are engrafted in word questions that do not reflect life outside the classroom in actual-life conditions. This study used a short video to demonstrate a pair of dairy farmers with different record-keeping habits. One farmer needs to possess records, while the other keeps track of all farming activities in records. Actual milk yield records from the farmer with an archive of dairy output records were also used to teach Statistics principles. In Kenya, small-scale dairy farming is widespread (Nassiuma & Nyoike, 2014).). This popularity means that students in the country, including Tharaka Nithi County, have already encountered this event. Because most students are familiar with dairy farming, the study sought to determine the effect of incorporating this specific real-life situation into Statistics classes in Tharaka Nithi County.

1.2 Statement of the Problem

Real-life situations have been emphasised in classroom instruction because of their benefits in learning as they allow learners to learn first-hand application of the theoretical concepts being taught. Some of the listed gains are building a practical learning environment, changing learners' attitudes toward learning, and improving topic mastery. While there have been some studies examining interaction between real-life examples and students' enhanced understanding of the concepts being taught, none of these studies have been conducted in the Kenyan context. There is a need to determine how incorporating real-life situations in teaching statistics can affect students' overall learning and understanding of different mathematical concepts. This is motivated by the fact that the available studies have presented conflicting outcomes when it comes to

integration of real-life situations in the classroom environment. Additionally, previous studies have indicated that there is limited empirical evidence about using real-life situations in instructing Statistics and Mathematics, making it challenging to draw informed conclusions. In the Kenyan setting, there are no studies that indicate the present status of integrating real-life situations in Statistics instruction whose recommendations are inclusive. To fill this knowledge gap, this study was conducted in Tharaka Nithi County, Kenya, to determine how incorporating real-life situations in teaching affects students' performance in Statistics.

1.3 Purpose of the Study

This study aimed to determine how using real-life situations (RLS) in teaching affects students' performance in Statistics in Tharaka Nithi County, Kenya, secondary schools.

1.3.1 Objectives of Study

The study's objectives were to:

a) Establish if there is a difference in performance in Statistics between students taught while using real-life situations and those taught using conventional methods.
b) Determine gender responsiveness on the use of real-life situations on students' performance in Statistics.
c) Establish by gender students' views about using real-life situations in teaching Statistics.

d) Determine teachers' views on using real-life situations in teaching Statistics.

1.3.2 Research Hypothesis

This study tested the following null hypotheses:

$H_0$1: There is no significant difference in performance between learners taught using real-life situations and those taught without using real-life situations in the teaching methods.

$H_0$2: There is no significant difference in performance between boys and girls taught while using real-life situations in the teaching of Statistics.

$H_0$3: No significant difference exists between boys' and girls' opinions about the use of real-life situations in teaching Statistics.

1.3.3 Research Question

The study answered the following question:

a. What are secondary school teachers' opinions on the use real-life teaching Statistics?

1.4 Significance of the Study

This study aimed to determine how applying real-world examples affects students' Statistics comprehension and performance. The findings of this study will add to the theory and practice of integrating real-world situations in Mathematics education. The findings will enlighten policymakers on incorporating real-life situations into Statistics instruction and inform their decisions on emphasising using RLS in teaching. The results will be valuable in improving and establishing new strategies relating to the

utilisation of everyday life events in the instruction of Statistics and the entire Mathematics curriculum.

The findings will be instrumental in sensitising secondary school teachers about the learners' views on using daily life events in Statistics education. In addition, teachers of Mathematics will be aided in making informed decisions on the finest real-life examples that effectively teach Statistics and Mathematics.

1.5 Limitations and Delimitations of Study

1.5.1 Limitations of Study

This study was confined to the Meru South sub-county of Tharaka Nithi County, Kenya. The addition of Schools from other sub-Counties within the County could have been included in the research to provide a solid foundation for generalising the findings. However, due to budgetary and time restrictions, this was not achievable. Therefore, the study included only some schools, teachers, and students but instead utilised a sample of the target population.

Students' visits to the dairy farms, which was the intended experimental group treatment, were not possible due inability of the dairy farmers to host a large group of people in the farms and the covid-19 gathering restrictions since the study was carried out during the pandemic period. To overcome this hurdle, the study used a short video shot in the dairy farms and the milk yield records collected in one of the farms to teach the experimental group.

The teachers' views were obtained from only six teachers of Mathematics teaching in the six sampled schools. This number might be limiting in extrapolating the study findings about teachers' views to the entire county and country. However, the teachers' views can provide an overview of the teacher's Mathematics perceptions about using RLS in teaching Statistics. Furthermore, the views can be used as a basis for more studies in the future.

There needs to be more empirical research in Kenya on incorporating real-life problems into Statistics instruction. Therefore, the literature review was derived from studies outside Kenya.

1.5.2 Delimitations of Study

The scope of this research could have been more extensive in several ways. First, students from government-sponsored or public secondary schools in Tharaka Nithi County participated in the study. The study focused solely on government-sponsored schools because there are only three non-government-owned schools in the sub-County, and if included in the study, they would not affect the target population. Their participation would also not impact the study's reliability and validity because they would be subjected to the same sampling method as the other schools. The sub-county was chosen because it represents other sub-counties nationwide, with a diverse range of schools. According to the Ministry of Education, national, regional, County, and sub-County schools are the categories of schools mentioned.

Although the high school Mathematics curriculum has many topics, this study focused on the Statistics sub-strand. Therefore, the study was restricted to Statistics I, a topic taught at the Form Two level of the Kenyan secondary school Mathematics curriculum. To attain specified research goals, the study employed a quasi-experimental research design. Although numerous real-life situations might be used in instruction, this research focused on dairy farming.

1.6 Assumptions of Study

This study was based on the assumptions that:

1. The treatment group's post-test results resulted from the intervention given to the group, not any other uncontrolled variable such as students' and teachers' temperament, content knowledge, or self-belief.
2. The comparison group did not have any contact with the real-life situation utilised to instruct the treatment group, enabling the comparison between the students' post-test results.
3. The questionnaires and mathematics achievement tests were sufficient tools for collecting data needed in this study.

1.7 Theoretical Framework

Lev Vygotsky's social constructivism theory was the bases of this study. According to the concept of social constructivism, an individual's mechanisms of thinking and gaining knowledge are the outcome of their interactions with the social surroundings.

The goal of social constructivism theory is to derive meaning from individuals' interactions with one another and with their surroundings (Vygotsky, 1978).

The zone of proximal development (ZPD) and the more knowledgeable others (MKO) are the principles that the social constructivism theory is based on (Vygotsky, 1978). According to Vygotsky, the ZPD exists between the point at which the actual product of a child's mental functions is established as a result of the completion of some developmental cycles and the level at which the student can resolve challenges once instructed by a grownup or an older child who has mastered the concepts (MKO). The ZPD is also critical to Vygotsky's constructivist theory because it emphasizes that students' problem-solving requires adult instruction or working alongside more proficient peers. Proper assistance improves students' understanding of content, allowing activities to be completed even when support is withdrawn. This is why the interaction between students and competent people in the society from whom they might learn is important (Bunyakarte, 2010). Furthermore, learning should be a social activity in which the instructor or the MKO serves as an advisor rather than the source of information. In this regard, the student is expected to be an active participant in the learning process rather than a passive consumer of knowledge in order to have a greater comprehension of the topic being taught.

According to social constructivist perspectives on learning, learners' engagement with their culture, classmates, and adults in their surroundings is part of their learning. The formal and social contexts of Mathematics are inseparable. Additionally, the use of real-life situations (RLS) in teaching Mathematics should be a platform for learners to

connect their knowledge acquired during social interactions into the mathematics classroom. This allows them to present their preconceived ideas and construct their mathematical knowledge, changing their views and performance in mathematics. When using RLS in teaching, the role of the teacher should be to guide students to build upon the prior mathematics knowledge acquired outside the classroom and address any misconceptions rather than treating them as an impediment to learning. However, to achieve the maximum benefits of using RLS in teaching and learning Mathematics, teachers of Mathematics ought to be informed about the various real-life contexts that can be used in teaching and how they affect instruction. Therefore, it is essential to find out how various cultural activities affect the learning process. This informed the decision to carry out this study to determine the effect of using a selected real-life situation in the instruction of Statistics.

1.8 Conceptual Framework

The teaching approach employed in the teaching process affects students' performance in Statistics. The choice of the teaching approach depends on factors like teachers of mathematics content and instructional knowledge, availability of teaching resources, and students' mindset about the content being taught. Teaching approaches with exciting and familiar backgrounds, such as integrating real-life situations, assist in piquing learners' attention in studying, resulting in better performance in Statistics. However, a teacher's choice of the real-life situation to use in the teaching process may be impacted by their mastery of the topic or the instructional techniques they

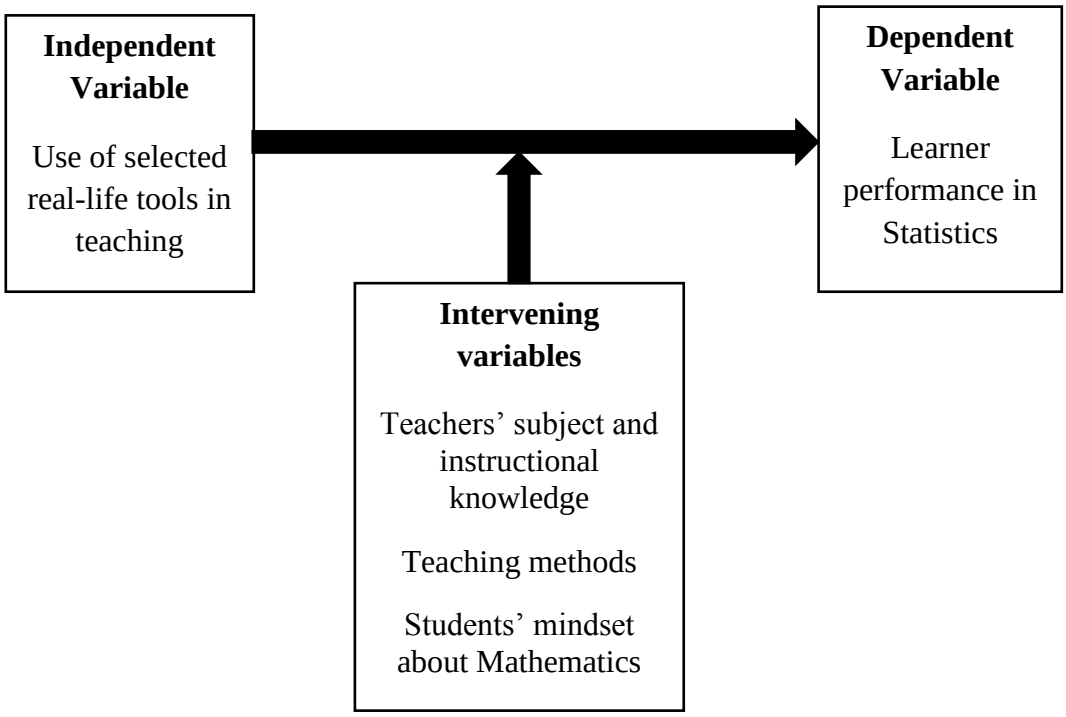
implement. A teacher not acquainted with a specific topic is likely to leave it out and teach the content they are more confident with.

Similarly, teachers familiar with the material will teach and look for more resources to use in the classroom (Batanero & Diaz, 2010; Goni, 2019). Teachers' understanding of the data analysis strand material may influence their attitudes about teaching its ideas. This might be translated to the students, affecting their Statistics grades.

Additionally, students' perceptions of the existence, quality, usefulness, and difficulty of Statistics impact their attitude and, ultimately, their performance. However, when real-world situations are integrated into teaching, they demonstrate the applicability of Statistics in everyday life, reduce the abstraction of Statistics concepts, and aid in reversing the negative mindset toward Statistics, leading to better performance in Statistics. Figure 1.1 demonstrates this interaction between variables

Figure 1

Conceptual Framework



1.9 Operational Definition of Terms

Formal Mathematics: Mathematics taught/learned in a classroom setting.

Mathematics education: A system that includes teaching and learning Mathematics.

Real-world examples/Realistic exemplifications: Mathematics exercises/illustrations derived from real-world situations.

Real-life situations: Natural settings or conditions relating to the everyday world. They are also referred to as actual-life events.

Real-world Mathematics: Mathematics that exists outside of the educational setting.

Statistics: A section of Mathematics involves the collection, grouping, analysis, explanation, and presentation of data.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter offers an overview of preceding studies concerning integrating RLS in teaching Mathematics and Statistics. It has also discussed the definition of RLS as used in Mathematics instruction and the effects, teachers' and students' views, and implications of integrating RLS in teaching Statistics.

2.1 Need for Statistics Knowledge in Society

As society has grown increasingly data-oriented, data analysis knowledge has become the foundation of daily life (Park City Mathematics Institute, 2017). For example, political analysis, weather prediction, heredity, sports, insurance plans, and many other everyday events need a fundamental comprehension of statistical or probabilistic theories (Gonda et al., 2022; Taylor, 2011). In addition, tables and graphs show essential information in newspapers, periodicals, and scientific studies. As a result, probabilistic literacy is critical for interpretation and an objective outlook on the world (Koparan, 2014). Furthermore, individuals in modern society are continuously confronted with circumstances requiring statistical expertise, such as making financial decisions, identifying health risks, and following up on media coverage of current events.

In learning, Statistics plays a considerable part in improving students' problem-solving and logical reasoning abilities in students (Xiayan, 2015). In addition, other professions

benefit from random information (Makwakwa, 2012; Taylor, 2011). According to Koparan (2014), Statistics is employed in many domains to describe the current world condition, resulting in additional opportunities for statisticians and individuals with probabilistic abilities.

However, according to to Damlamian and Sträßer (2009), most individuals do not see the importance of data analysis ideas in real life. This is because the real-life topic is not introduced as it is taught in school. Instead, data analysis is incorporated into other mathematical techniques. According to the study, the inconspicuousness of the data analysis strand has created the perception that learning data analysis concepts are unnecessary in primary and secondary schools and that the pathways of Probability or Statistics should be left to higher levels of learning for those interested in research. This persistent gap between real-life and classroom data analysis must be bridged for the data analysis strand to remain relevant.

2.2 The use of Real-Life Situations in Mathematics Instruction

Utilising analogies obtained from actual-life events in instructing mathematics has unique connotations and is signified by many allusions. According to Rangel et al., (2016) the integration of real-world situations in Mathematics instruction is referred to as mathematical modelling or mathematisation. It is characterised as a complex process that includes multiple strategies such as understanding the problem, modifying it, using mathematical equations to discover answers, interpreting the results, and finally communicating them. Julie (2013) describes real-life scenarios in Mathematics as using statements that describe a learner's known location in a Mathematics issue. According

to Asempapa and Sturgill (2019) the use of real-life situations in teaching also referred to as mathematical modelling is a repetitive process which involves finding a real-world problem, making assumptions, and creating a mathematical problem from it, coming up with a mathematical representation, building a mathematical solution and finally making interpretations. The process, therefore, is complete whenever a task is set in a meaningful context. The studies define everyday Mathematics as "the use of Mathematics in everyday life." According to Hakadiva (2017) the real-life situations used in teaching might not be necessarily linked to students' everyday life situations but when used appropriately they make the learning process engaging and captivating.

According to Alsina and Salgado (2022), incorporating real-world circumstances in education helps students become used to solving real-world difficulties they may encounter in and out of school. Real-life events should serve as the beginning point for teaching Mathematics, where learners' mathematical concepts and methods are established, progressively leading to fewer context-specific formal generalisations (Drijvers & Heuvel, 2014). It is worth noting that real-life scenarios can be pulled from the real world or made up if they are experientially genuine in the eyes of the learners. Real-life experiences serve as a tool for developing learners' Mathematics conceptual comprehension throughout the learning process (Robert, 2016). Moreover, employing real-world situations for learning goes against the usual teaching technique in which applications are made at the end.

RME contains six concepts which are: The activity, realism, intertwinement, interaction, and guiding principles (Drijvers & Heuvel, 2014). The concepts of realism,

activity, and interaction are complementary and summarise the relevance of adopting RME in Mathematics education. According to the reality principle, teaching Mathematics should begin with significant issues for the learners, giving them a chance to attach meaning and the capacity to apply Mathematics in real-life situations. The activity principle, emphasises that RME should utilise activities that engage learners as active participants in the learning process. Finally, the interaction principle asserts that RME transforms Mathematics instruction into a social setting where students share techniques and innovations. This interaction encourages learners to incorporate new concepts and elicits reflections, allowing pupils to attain greater levels of thinking and comprehension. Other studies highlight the three RME principles as making studying Mathematics more engaging, relevant, intriguing, and accessible to learners (Hakadiva, 2017; Karakoc, 2012). Furthermore, ordinary life circumstances are hypothesised to motivate learning and provide learners with familiar settings and purposes for understanding and utilising mathematical procedures. Familiarising with environments improves the accessibility of Mathematics topics to diverse learners (Gainsburg, 2008). The refence adopted for this study was real-life situation (RLS). The real-life situation implied in the study was one drawn from students' everyday life and which they could easily relate to.

2.3 RLS Integration Effects on Students' Performance in Statistics

Statistical concepts are sometimes seen as abstract, and Statistics instruction can be challenging for certain teachers (Sawers et al., 2016). Furthermore, statistical idea presentation has been criticised as abstract and inflexible, making it difficult for learners

to understand (Neuman et al., 2013; Pale, 2016). Students may find applying Statistics ideas learned in the classroom challenging to real-world difficulties. This gap between real-life and classroom concepts may lead to learners developing unfavourable impressions of Statistics, making learning less enjoyable and formula cramming to pass examinations. As a result, effective Statistics instruction should strive to apply statistical notions to actual-world scenarios (Neuman et al., 2013). Using actual data in education fits with the social constructivist image; children develop intelligence for their observations, thereby boosting mastery of the topic, which is critical in learning (Gonda et al., 2022; Neuman et al., 2013). Moreover, when authentic examples are included in teaching, the emphasis switches from solely arithmetic operations to practical exercises critical in supporting students in establishing logical thinking.

A quasi-experimental study in Indonesia by Goni (2019) on the effect of using the RME approach revealed that students taught while using RME recorded better grades at the end of the study than students taught using conventional methods. A similar study in Indonesia by Nuraina et al., (2021) showed that students taught while using RME demonstrated a better understanding of the mathematics concepts, presented ideas more logically, and were more motivated to participate in the classroom as opposed to the students taught without integrating RME. Similar studies by Lago & Cruz (2021) and Ruijia et al., (2023) carried out in the Philippines and China respectively showed that students taught while integrating real life situations improved students' performance. On the contrary, a study conducted in the United Kingdom by Jones (2010) revealed that students preferred solving fewer engaging problems to more demanding real-life situations. Furthermore, the same study noted that girls preferred solving the short

algorithm-related questions to boys, who chose more challenging questions based on real life. Studies in Africa have shown varied results. For instance, a study carried out in Ghana by Ali (2021) showed that using artefacts and materials from students' surroundings brought new ideas and structures into the mathematics classroom. In return, students were able to engage and conceptualise mathematical ideas related to their everyday life thus boosting their performance in mathematics is boosted.

However, according to Wessels' (2008) assessment of Statistics education in South Africa, although using real-life data in Statistics has been highly emphasised, teachers in South Africa preferred real-life examples highlighted in textbooks. Similar results were revealed in Opolot et al. (2008) study in Ugandan schools, which showed that a lack of clear guidelines for exploiting real-life data in teaching the data analysis strand restricted teachers in its application in the teaching process. As a result, Statistics education has grown more traditional, with less engaging and stimulating lessons. In Kenya, as stated in the mathematics curriculum, real-life occurrences are a critical precondition in teaching Statistics (KICD, 2002). However, according to Gainsburg (2008), while the benefits of RME in teaching Mathematics have been extensively documented, only some studies have illustrated how integrating real-life circumstances in teaching affects learners' performance. Therefore, more studies need to be conducted to determine how an incorporating real-world situation in teaching Mathematics affects students' performance. This was the focus of this study.

2.4 Learners' Views on Integrating RLS in the Instruction of Mathematics

Numeracy should teach learners to distinguish and implement arithmetic ideas within and outside formal contexts. Mathematical concept mapping should help students draw conclusions, solve difficulties, and discuss social and work-related issues (Saluot et al., 2013). Several studies on students' views about using real-life teaching have been conducted worldwide. For instance, findings from Neuman et al. (2013) study on determining students' perceptions of using real-life data in teaching introductory Statistics to Canadian university students showed that the students' found real-life data more meaningful, thought-provoking, engaging and presented an opportunity to apply their prior knowledge in the learning process thus enhancing their conceptual understanding. Another study in Iran by Saluot et al. (2013) on high school students' perception of using real-life situations in teaching mathematics showed that different student groups had different views about using RLS. The study showed that the high school students who had specialised in science and mathematics found the connection between mathematics and real-life meaningful to their learning process. However, students who specialised in humanities found it challenging to figure out the importance of connecting real-life situations in learning Mathematics. Nonetheless, students from both the science and mathematics and humanities groups agreed that continued use of real-life contexts would help make learning engaging, eventually helping them to improve their Mathematics achievement in class.

A study by Assadi and Hibi (2022) amongst Israel seventh graders revealed that although using real-life situations took a longer period, students found learning linear

algebra more interesting and made students take more time to think through the solutions. Similarly, Kaygisiz and Şenel (2022) qualitative study on Turkish Fourth graders views on mathematics modelling showed that they primary school students felt that the use of real-life situations helped them learn mathematics with ease. Additionally, Ghanaian high school students found learning Statistics interesting whenever the teachers of Mathematics successfully linked real-life situations to the content being taught (Dissuo et al., 2018). Moreover, the high school students felt that their teachers of Mathematics needed to incorporate more real-life situations, especially those related to their immediate environment. The students noted that the incorporation of events they could relate to in the teaching of statistical concepts made learning interesting and easy to understand. However, not all studies revealed positive sentiments about integrating real-life situations in teaching.

For instance, a study conducted in the United Kingdom by Jones (2010) revealed that high school students' viewpoints on incorporating real-world context into Mathematics teaching might vary by gender. The study findings showed that more girls considered learning Mathematics more challenging if it included real-world settings and favoured pure Mathematics. On the other hand, boys thought using practical circumstances was a helpful and exciting way to learn and instruct Mathematics. Moreover, according to Salout et al., (2013), although learners realise the importance of numbers in ordinary life, those not interested in studying mathematics-related topics such as science and engineering do not recognise the mathematical relationships easily. Students' opinions on Mathematics influence their knowledge of the subject. Learners with a broader scope of Mathematics could easily perceive Mathematics as having immense applicability in

actual life. On the other hand, those with a narrow view of Mathematics fail to regard any activities as including Mathematics or numerical thinking (Lago & Cruz, 2021). However, the studies cited above-claimed that there is scarce research on learners' precepts on utilising actual-life scenarios and the impact of incorporating actual events on students' Mathematics achievement. Therefore, this was one of the research gaps that this study aimed at addressing.

2.5 Teachers' Views on RLS in Instruction of Mathematics

Teachers' view relating Mathematics to real-life situations as a compelling illustration of the subject's significance to students' daily lives. Real-life connections assist learners in developing social skills such as discussion and provide a secure channel for presenting their concepts, regardless of their mathematical skills (Jain & Rogers, 2019). In addition, clarity about how information obtained in the classroom may be used in real-life stimulates students to participate in challenging activities, such as Statistics (Williams & Williams, 2011). Educators must thus prove to students the significance of Mathematics in the actual world and select ordinary real-life events to teach specific mathematical concepts such as Statistics (Bokar, 2013).

A study by Karakoc (2012) showed Turkish Mathematics teachers and specialists believe that incorporating direct links in the classroom offers various benefits such as: Improving learners' enthusiasm and desire to learn Mathematics, building learners' favourable perceptions, establishing a vibrant and flexible classroom setting for each learner, and assisting in developing learners' Mathematical abilities. Similar observations were made in Indonesia by Rosalina & Duat's (2019) study, which showed

that teachers of Mathematics felt that when students establish mathematical links, they seek to grasp the ideas and research scarcely lives, which increases their mathematical reasoning abilities. Mathematics teachers in Ghana recognised that a mismatch between Mathematics and real-life situations might contribute to learners' difficulties comprehending Mathematics (Dissuo et al., 2018). According to the survey, teachers agreed that the effective link between Mathematics and real-life problems made instruction in Mathematics more fascinating.

However, the wrong choice of real-life contexts and poor teacher preparation may result in certain drawbacks, such as making studying Mathematics difficult because the situations are often complicated (Karakoc, 2012). Teachers of Mathematics employ direct relationships haphazardly during instruction, making learners struggle to perceive mathematics' remarkable benefits in everyday life (Gainsburg, 2008). According to the findings, this is due to Mathematics teachers feeling under-trained in using meaningful connections in the classroom. For example, Dissou (2018), found that teachers needed more resources, training, and insight to make real-life connections. Many teachers of Mathematics believe connections drawn from the textbook are not enough to boost students' mathematical abilities and procedures (Suzzane, 2016). Similarly, based on Asempapa & Sturgill (2019) study carried out in the USA midwestern region, many public high school teachers lack the knowledge about the use of real-life contexts in teaching Mathematics. Moreover, teacher training programs lack programs necessary to expose teacher trainees to contextual teaching of Mathematics. This lack of common guidelines during training or in service training make teachers remains hesitant to incorporate real life situations in their teaching process. The teachers of Mathematics

instead choose to use real life examples which are outlined in the textbooks. The demands of delivering to much content within a short period of time made teachers of Mathematics opt for the textbook real-life situations (Sharmin & Tahmina, 2021). Furthermore, the textbook real-life examples require little to no effort and have a well laid out structure on how to implement.

Teachers of Mathematics felt that coming up with ideal real-life models necessary to make learning more interesting is a difficult task due to lack of prior training (Kaygisiz & Şenel, 2022). Therefore, teacher education programs and in-service training for teachers who are already teaching should also include classes on utilising actual-world relationships (Karakoc, 2012). According to Alsina and Salgado (2022) there is need for unified criteria for implementation of mathematics modelling in the classroom. This support through training will help enhance the implementation of the desired mathematical modelling and ensure its benefits are fully achieved. However, according to Gainsburg (2008), although many study findings on the usage of actual-life events concur on its merits and limits, the actual research volume is limited.

2.6 Implication needs to be improved in Instruction to the Teachers of Mathematics

According to Savard & Theis (2010), Statistics is founded on real-world principles and should be taught in real-world situations. The capacity to use real-world codes in instruction depends on the educators' awareness of the students' everyday activities. According to Ali (2021), teachers must understand their subject and other factors contributing to quality teaching. The study highlights selecting the best mathematical

links outside and in Mathematics classrooms, attaching purpose to mathematical algorithms, and relating the techniques to what learners know as some of the best teaching qualities. Moreover, teachers must be aware of students' initial inferences from their participation in out-of-class events, translate them into the appropriate base of formal Statistics study, and make the two topics fun to learn (Jones, 2010).

Inadequate information on the best actual examples in Statistics instruction makes the topics challenging and demotivating (Koparan, 2014; Lago & Cruz, 2021). Moreover, when teachers face the adversity of knowledge in a particular topic, there is a high likelihood of doing away with teaching the concepts. However, they are listed in the curriculum. When learners' daily activities are not linked to Statistics learning, it becomes difficult for them to apply statistical concepts to real life (Savard & Theis, 2010). Instead, formal concepts learned in class are perceived to be distinct from real-life activities with no cohesion at any point.

For instance, Savard and Theis's (2010) study findings revealed that teachers who participated in the study did not include gambling concepts in their lessons. Nevertheless, betting was legal in the school's location. Furthermore, learners who participated in betting did not use any ideas learned in the classroom when participating in betting and vice versa. However, once teachers were trained and could employ betting principles in teaching Statistics, more students were engaged in the classroom discussion an indication of mastery of the content. This communication of mathematical ideas outside the classroom illustrates that the applicability of real-life activities is essential to guarantee that instruction is engaging and offers conceptual comprehension.

However, for teachers to be able to pick meaningful and beneficial exercises to employ in teaching Statistics, they must be well-educated in the learners' daily activities.

2.7 Chapter Summary

This chapter reviews the literature on the importance of Statistics instruction, usage of real-life events, Mathematics instruction and its effects when used in teaching, students' and teachers' precepts, and ramifications of integrating widely known events into Statistics instruction. Statistics education is vital for developing students' problem-solving and logical reasoning skills in students (Xiayan, 2015). The recap of the effects of integrating real-life situations in Statistics teaching proffered making learning intriguing, increasing accessibility to all learners, and changing learners' attitudes toward Mathematics as some of the outcomes of incorporating actual word circumstances in learning (Makwakwa, 2012). However, a limited number of studies are dedicated to Statistics, many of which do not record student achievement. Instead, they are concerned with the affective domain of learning. As a result, more research was required to establish the influence of real-life contexts on secondary school student's performance in Statistics examinations.

The review of the literature revealed the following: First, teachers know the gains of incorporating real-life contexts into Mathematics instruction; second, the teachers admit that they would employ these contexts more effectively if they had received enough training; and third, students have differing opinions on using real-life examples in Mathematics instruction. For example, while boys find real-life connections exciting and inspiring, girls believe they make learning Mathematics difficult and demoralising

(Jones, 2010). However, all this material came from studies conducted outside Kenya. Therefore, carrying out this study to determine Kenyan students' and teachers' impressions of using real-life situations in the instruction of Statistics and its effects on students' performance in Statistics was essential.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

The research methodology used to evaluate the effect of integrating RLS in Statistics instruction on secondary students' performance in Statistics has been presented in this chapter. In addition, the chapter has discussed the research design, study variables, study location, target population, sampling techniques, and sample size, research instruments used to collect data in the study, the pilot study, research validity and reliability, data collection and analysis procedures, and finally, the ethical and logistical conditions observed in the study.

3.1 Research Design

In this study, a quasi-experimental research approach was used. The quasi-experimental research design characterised by the non-probability sampling of treatment and comparison groups, exclusive dispensing of treatment to the experimental group, and administration pre and post-tests is most relevant in testing causal hypotheses (Orodho, 2012, Creswell, 2014). The research design was most appropriate because this study's primary objective was to determine how integrating RLS in teaching affects high school students' Statistics performance. In this study, a Mathematics Achievement Test (MAT) was administered as a before-treatment test to both the comparison and the treatment group groups at the start of the study. This ensured that the two groups were comparable in terms of attributes. The intervention administered to the experimental group was

teaching using a short video clip depicting a pair of dairy farmers with different records tracking habits and using Milk Yield Records (MYR) data from the farmer with a records archive. This helped students to role-play the farmers' routine and eventually draw a conclusion on the significance of Statistics in the dairy farming business. The treatment was given to the treatment group. In contrast, the comparison group was taught the same topic using conventional means, mainly using textbook illustrations as prominent real-life examples. After the learners had been taught the complete topic, the after-treatment was given to both groups, and their mean scores were obtained. Following the post-test, the comparison group was shown the video clip to enable the students to express their thoughts on using real-life situations in teaching. Finally, the Students Questionnaire (STQ) was given to all the students. The Mathematics Teachers Questionnaire (MTQ) was issued to the teachers. The research design was as illustrated in Table 1

Table 1

The research design

Treatment	D1	T	D3
Comparison	D2	O	D4

KEY
T - Intervention
O - No Intervention
D1 and D2 - Pre-test
D3 and D4 - Post-test

3.1.1 Variables

Independent/Predictor Variables

A predictor variable is altered to determine its impact on another variable (Orodho, 2012). The predictor variable in this study was teaching while using a chosen real-life situation to teach Statistics principles. This study aimed at determining if a variation of a teaching approach from the conventional teaching that uses textbook examples to one that uses situations that students are acquainted with affects students' performance in Statistics.

Dependent Variable

The dependent variables result from altering the independent/output variable (Orodho, 2012). The output variable in this study was the learners' achievement in the post-test MAT. The study sought to ascertain whether using real-life situations in Statistics instruction would affect learners' performance in Statistics. After the learners had been taught the complete topic, the after-treatment test MAT was given to both groups. The mean scores of both groups were obtained to determine if there was a statistically significant difference in the groups' results. Following the post-test, the comparison group was shown the video clip. This clip presentation to the comparison group allowed the learners to express their opinions on using real-life events in the Statistics instruction.

Intervening Variable

These are uncontrolled elements that may influence the study's findings. They include teachers' content and pedagogical understanding, teacher experience, and students' attitudes toward Mathematics. To offset these obstacles, the participation of cooperative and willing respondents was sought. It was also necessary to inform the respondents about the significance of the study. Furthermore, the confidentiality of the information supplied by respondents was assured.

3.2 Location of Study

This research was conducted in Meru South Sub-County, Tharaka Nithi County, Kenya. The location offers a variety of school categories, including combined-gender, boys', and girls', making it ideal for this study. These schools offered a solid foundation for extrapolating the entire County and country research findings. Additionally, many of the schools in this area are reachable, making the collection process simple.

3.3 Target Population

Form Two students and Mathematics teachers from government-sponsored high schools in Meru South Sub-County were the study's target population.

3.4. Sampling Techniques and Sample Size

3.4.1 Sampling Techniques

A purposeful sampling strategy was applied to choose individual schools from each of the three categories of schools. This strategy identifies a comparison group almost equivalent to the treatment group, enhancing the comparison between the two groups (Kothari, 2004). A simple random sampling strategy was employed to choose a single class with more than one class in a stream. In this scenario, a letter representing the classes was randomly picked. This ensured that each class had an equal probability of being chosen.

Mathematics teachers were purposefully sampled. This was because the study was only concerned with Mathematics teachers in only the sampled schools.

3.4.2 Sample Size

The quasi-experimental research design is intended to have a small sample size, and its selection is limited by practical matters such as cost, time, and population variability, among other things (Kothari, 2004). Purposive sampling was used to select six schools that formed the actual sample for this study. This sample represented 14% of the schools sampled for this study. Non-random sample assignment is preferable for quasi-experimental research because it ensures that the control and the experimental groups have similar characteristics (Creswell, 2014). The sample size comprised two combined-gender schools, two girls and two boys. A school in each set formed the

comparison group, and the other was placed in the treatment group. Although the number of combined-gender schools in the population was higher than the one-gender schools, only two were included in the sample to cater to the school types' heterogeneity and minimise the possible error of non-responsiveness from the small population of the boys' schools. This decision was informed by Kothari (2004), highlighting that errors that result from small samples can be reduced by slightly increasing the sample size. This selection criterion did not affect the viability of the results since the study sought to compare the learners' performance and opinions by gender and not by school type. The teachers' sample was also determined purposively. Only the teachers of Mathematics teaching the experimental and the control groups in the sampled schools formed the teachers' sample. The actual sample size was as displayed in Table 2

Table 2

Actual Sample Values

School Type	No. Schools	Schools' Sample	Sample of Teachers	Sample of Students
Boys	3	2	2	71
Girls	5	2	2	78
Combined gender	34	2	2	83
Total	42	6	6	232

3.5. Research Instruments

The data collection tools in this study were Mathematics achievement tests and questionnaires.

Mathematics Achievement Tests (MATs)

These are formal evaluation quizzes used to assess the student's achievement in Mathematics. This study used the before-treatment (pre-test) and after-treatment (post-test) tests. Each test was worth 20 points and was completed in one hour. The pre-test included questions from previously taught topics, mostly Form One work. The pre-test questions were like the post-test in that they required learners to demonstrate their mathematical proficiency in solving questions related to the real world. The pre-test was needed to assess the learners' characteristics in terms of understanding of Mathematics concepts, capacity to solve actual-life relevant problems, and achievement for comparison after the treatment group was given the intervention. This sourcing of questions outside of Statistics also guaranteed that the learners had no previous engagement with the topic to be researched, assuring that the findings were due to the treatment. Statistics I and Treatment Probability were the topics of the post-test. Treatment Probability is presented to Form Two students as part of applying Statistics in real life. The ideas had to be included in the post-test MAT to assess learners' ability to apply Statistics principles in actual life. However, the treatment Probability ideas examined in the MAT were only those learned at the Form Two level. Before and after the intervention, the MATs assessed learners' understanding of statistical concepts and their ability to solve actual-life relevant problems. The test results could quickly reveal

this. Data acquired from the MATs were used to evaluate the effects of actual-life events on learners' Statistics scores and to compare the effect of integrating real-life events on the student's performance by gender.

Mathematics Teachers' Questionnaire (MTQ)

The MTQ obtained teachers' views on incorporating actual-life events in Statistics instruction. The closed-ended questionnaire offered respondents options and boosted the objectivity of the responses acquired. The questionnaire was distributed after conducting the post-test and displaying the RLS video clip to the comparison group. This choice of questionnaire administration period aided in determining if there would be a change in teachers' attitudes toward employing the selected real-life circumstance in Statistics teaching.

Students' Questionnaire,

The students' questionnaire gathered learners' views on using actual-world situations in Statistics instruction. The questionnaire was closed-ended and used a Likert scale to present responders with various possibilities, boosting the objectivity of the responses supplied. Following the post-test, the questionnaire was administered. The comparison group also provided the training clip and farm records to provide objective replies while completing the questionnaire. The delivery of the questionnaires following the post-test allowed students to provide feedback on their thoughts on utilizing chosen real-life events in Statistics education.

3.6 Pilot Study

Pilot research was undertaken at two schools outside but near the study's sub-county. According to Orodho (2009), piloting is supposed to be carried out using a small typical sample that matches but does not include the group under study. The selection of schools with characteristics comparable to the study's intended demographic guaranteed the comparability of the results acquired from the pilot study and the primary research. The research distributed thirty questionnaires to students from both schools and two questionnaires to teachers of Mathematics. The findings were examined to establish the methodology's practicality and the study equipment's efficacy.

3.6.1 Validity

Orodho (2012), defines validity as the level at which data collecting tools evaluate what was anticipated and may be attained by a logical analysis of specialist raters conversant with the area of interest. In this study, assistance was sought from experts in the field of Mathematics education to assess and rate the readability, clarity, and comprehensiveness of the questionnaires and Mathematics assessments.

3.6.2 Reliability

The capacity of data-gathering tools to deliver the same findings when administered several times is referred to as reliability (Orodho, 2012). The study expounds that when the identical tool is given to the same people twice, the differing outcomes are a source of mistakes. When the margin of error is large, the research instrument's dependability

suffers. The questionnaire items were adopted from a previous study which had already tested and verified the items' reliability. To guarantee the mathematics tests' reliability, this study divided the items in half, presented the two sets to the same people, and then calculated Cronbach's Coefficient alpha index using the obtained results indicated in the literature (Orodho, 2012). The Cronbach's Coefficient alpha index was found to be $\alpha = .82$. This value was above the acceptable value of $\alpha = .70$, which indicated that the research instruments were reliable (Taber, 2018).

3.7. Data Collection Techniques

The before-treatment and after-treatment MATs were used to gather data from Form Two pupils in the six sampled schools. The before-treatment test was given to the comparison and the treatment groups at the start of the study. The test results were specialist rated for comparative reasons. During the intervention, teachers were given instructional directions to follow. Before the teaching began, there was a discussion regarding the instructional methodologies. This debate ensured that the teachers adhered to the study's concepts. Frequent visits to the schools were made to check progress. The after-treatment test was given to both groups immediately after the treatment group finished treatment. This occurred after three weeks of Statistics instruction stipulated in the mathematics curriculum. Following the after-treatment, the students were given a questionnaire. This gave them enough time to review the items, providing honest answers under minimal pressure. After the treatment, a mathematics teachers' questionnaire was conducted to establish their views on using the chosen real-life situation in teaching Statistics.

3.8. Data Analysis

This study's data were analysed using qualitative and quantitative methodologies. After being coded and sorted into corresponding categories, data analysis was supported by the latest version of the computer application SPSS in 2022. The program was also used to do statistical computations and create tables, charts, and graphs. A t-test was used to analyse data acquired using MATs to assess the effects of applying actual-life situations in teaching on learners' performance in Statistics. According to Orodho (2012), t-tests are used to detect whether there was a difference in the scores of two parties. This study intended to determine if there was any inequality in the comparison and treatment group's means, which led to this inferential statistical test. The Chi-Square test was used to analyse the MAT results to determine the gender responsiveness to the use of the actual-life situation in the instruction of Statistics. To determine learners' and teachers' views of choosing actual-life situations in Statistics instruction, data from the STQ was analysed using a median and a Mann-Whitney U-test, and the MTQ's data were analysed qualitatively using a median. The data analysis used to achieve every objective is analysed in Table 3.

Table 3

Data Analysis Summary

Objective	Hypotheses	Tool	Data Type	Analysis
a	H_o1	MATs	Quantitative	t-Test
b	H_o2	MATs	Quantitative	One-way chi-square test.
c	H_o3	Questionnaire	Quantitative	Mann-Whitney U-test
d	A	Questionnaire	Qualitative	Percent, Median

3.8 Ethical and Logistical Considerations

The study was carried out after the NACOSTI granted a research clearance. The administration of the sampled schools was informed about the study, and approval was obtained ahead of time. Before creating the video clip, the dairy farmers were asked if they wanted to participate in the research. The anonymity of the information offered by the respondents was strongly valued and maintained.

CHAPTER FOUR

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the study findings and the interpretation and adds the discussion. This study aimed to determine the effect of integrating real-life situations on students' Statistics performance in Tharaka Nithi County, Kenya secondary schools. Data were analysed, and study findings were presented according to the study objectives. The following objectives guided this study:

a) Establish if there is a difference in performance in Statistics between students taught while using real-life situations and those taught using conventional methods.
b) Determine gender responsiveness on the use of real-life situations on students' performance in Statistics.
c) Establish by gender students' views about using real-life situations in teaching Statistics.
d) Determine teachers' views on using real-life situations in teaching Statistics.

The study collected data using questionnaires and MATs. The demographic information included in the questionnaires showed the respondents' general characteristics. It was also necessary for comparison purposes.

4.2 Overall Demographic Data

4.2.1 Gender Representation of Respondents

This research intended to establish if there was a difference in performance between learners taught while integrating RLS and those taught without integrating RLS in the teaching methods. It also determined the learners' opinions on integrating real-life situations in teaching. The study aimed to determine differences between the learners' views about using real-life situations in teaching Statistics by gender. The distribution of students' and teacher's samples by gender is represented in Table 4.

Table 4

Representation of Respondents' Gender

	Male		Female	
Respondents	N	%	N	%
Students	113	48.7	119	51.3
Teachers	5	83.3	1	16.7

Table 4 indicates that the figure for female students, 119 (51.3%), was greater than that of male students, 113 (48.7%), because of the uneven allocation of students by gender in schools and classes. Table 4.1.2 reveals that male teachers formed most of the teaching staff 5(83.3%) compared to their female counterparts 1(16.7%) female counterparts. The teachers' sample was purposively determined because they were teachers of either the treatment or the comparison group. Although there was no intention to compare the teachers' opinions by gender, it is worth noting that there is

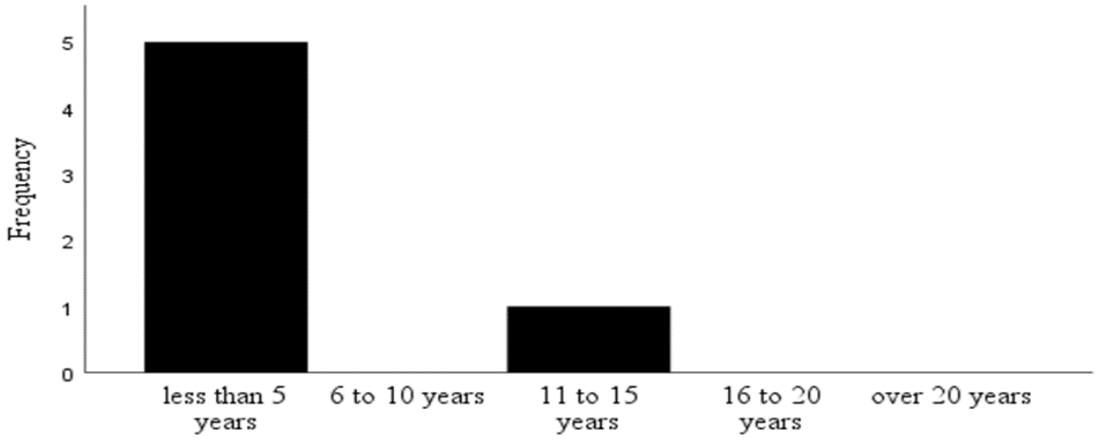
gender disparity among Mathematics teachers. However, it is worth noting that these results are coincide with (Otondi, 2020) findings that gender disparity among the teachers of mathematics still exists although the number of female teachers of mathematics has drastically increased with time.

4.2.2 Mathematics Teachers' Training Level and Length of Teaching Service

There were items on the teachers' questionnaire that required the teachers to state their education level and length of service. The requirements were essential for this study since the teachers' experience and expertise can significantly shape the opinions about integrating real-life situations in teaching Mathematics.

Figure 2

Teachers of Mathematics Length of Service



Note. The length of service implied in this graph is the number of years the teacher has been teaching Mathematics at high school level.

Figure 2 reveals that many of the teachers had only taught for a short period (5 (83.3%), with few having taught for more than ten years 1 (16.7%). The gap between the bars showed that amongst the respondents, there were no teachers who had been teaching for at least six years and no more than ten years. Similarly, teachers had been in the profession for at least 16 years. According to Asempapa and Sturgill (2019), teachers' level of training and experience plays an important part in making decisions about the choice of resources and the teaching methods employed in the classroom. For instance, the teacher trainees found it difficult to identify real life connections suitable for teaching mathematics at various levels as opposed to teachers who had taught for a longer period. Hence the need for determination of teachers' length of service.

4.3 Characteristics of the Comparison and Treatment Groups by Performance

The study used Mathematics Assessment Tests (MATs) to determine students' performance. A before-treatment test was conducted for both the comparison and the treatment groups. The before-treatment test was to verify the characteristics of the pair of groups before administration of the treatment that is teaching using a selected actual-life situation to the treatment group. An independent-samples t-test was carried out to check if a meaningful difference existed in the mean performance of the comparison and treatment groups. The descriptive statistics are displayed in Table 5

Table 5

Before-intervention Test Mean Scores

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pre-test	Comparison	114	7.80	3.817	.357
	Treatment	118	7.29	4.032	.371

Table 5 presents that the comparison group's mean performance (M = 7.80, SD = 3.82) was slightly higher than the treatment group's (M = 7.29, SD = 4.03). To assess if the difference in the two groups' means were statistically significant, a t-test was executed.

Table 6

Pre-test Independent Samples t-test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pre-test	Equal variances assumed	.246	.621	.989	230	.324	.510	.516	-.506	1.526
	Equal variances are not assumed.			.990	229.906	.323	.510	.515	-.505	1.526

From Table 6 the t-test for equality of means results indicates no statistically significant difference in performance between the treatment group (M = 7.29, SD = 4.03) and the comparison group (M = 7.80, SD = 3.8); t (230) = .99, p = .32. Hence the comparison group had similar characteristics in terms of performance as the treatment group. This observation set the premise for comparing the after-treatment test results of the two groups.

4.3.1 Comparison of the Treatment and Comparison Group After-treatment Test Means

The comparison and treatment groups received an after-treatment test, MAT. The Kenyan high school mathematics curriculum teaches statistics for three weeks (KICD, 2002). The after-treatment test MAT administration was done three weeks after the topic had been fully presented to the learners in the comparison and treatment groups. The treatment group was taught using an actual-life situation, the dairy records obtained from a local dairy farmer, and a short video clip depicting two dairy farmers' daily routines. The comparison group was taught using conventional ways. An independent samples t-test on the post-test MAT assessed whether a performance gap existed between the comparison and treatment groups. A t-test is a quantitative statistical test for comparing the known scores of two independent groups (Creswell, 2014). The comparison and treatment groups were independent of one another. The t-test was the appropriate statistical test to ascertain if the difference in the means between the two groups was statistically significant. Table 7 displays the descriptive statistics.

Table 7

After-Treatment Average Scores

	Group	N	Mean	Std. Deviation	Std. Error Mean
Post-test	Comparison	114	8.18	4.231	.396
	Treatment	118	11.43	3.731	.343

Table 7 illustrates that the treatment group's Statistic post-test MAT score (M = 11.43, SD = 3.73) was higher than the comparison group's (*M* = 8.18, *SD* = 4.23). The t-test results are displayed in Table 8

Table 8

Post-test Independent Samples T-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% CI	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Post-test	Equal variances assumes	2.07	.152	-6.207	230	.000	-3.248	.523	-4.279	-2.21
	Equal variances not assumed.			-6.193	224.3	.000	-3.248	.524	-4.281	-2.21

The outcomes in Table 8 reveal that the treatment group mean (M = 11.43, SD = 3.73) was significantly higher, t (230) = -6.21, p = .01, than the comparison group's score (M = 8.18, SD = 4.23). The null hypothesis $H_0$1, there is no significant difference in performance between learners taught using real-life situations and those taught without integrating real-life tools in the teaching methods, was rejected. Hence there is a statistically significant difference in the Statistics test performance between learners

taught using real-life situations and those taught without integrating real-life tools in the teaching methods.

Regarding the comparison of achievement between the comparison and treatment group shown in Table 8, the increase in the treatment group students' performance may be due to integrating the selected actual-life event during the teaching of Statistics. The demonstration of the practicality of Statistics using a situation that is well known to the learners might have made the learning process more engaging, interesting, and accessible to all learners hence facilitating a better understanding of Statistical concepts. The study findings concur with Goni (2019) and Ruijia et al. (2023) observations that information drawn from everyday life events fosters active engagement in the learning process makes learners develop data analysis arguments and eventually elicit in-depth learning that facilitates a deeper understanding of ideas. The results, however, disagree with Koparan (2014) that the use of real-life connections does not play a part in motivating learners to learn Statistics.

4.4 Post-test MATs Results Comparison by Gender.

The second objective was to establish gender responsiveness of integration of RLS on students' performance. The study compared the treatment group's post-test scores by gender to achieve this objective. The treatment group was considered because it was the group that had received the treatment, hence the need to test its effects on learning by gender. The treatment group's post-test scores grouped by gender are displayed in Table 9.

Table 9

Post-Test Scores by Gender

Gender	Mean	N	Std. Deviation
Female	13.20	60	3.096
Male	8.81	58	3.477
Total	11.04	118	3.947

Table 9 shows that girls performed better in the Statistics post-test MAT (M = 13.20, SD = 3.10) than boys (M = 8.81, SD = 3.48). A one-way chi-square test was used to ascertain if there was a meaningful difference in the learners' performance. The Chi-square test is a non-parametric statistical test that compares nominal variables such as gender (Creswell, 2014). The Chi-square test was performed in this study to see if there was a statistically significant difference between the boys' and girls' means. The gender distribution of learners in the treatment group is displayed in Table 10.

Table 10

Observed and Expected Values

	Observed N	Expected N	Residual
Female	60	59.0	1.0
Male	58	59.0	-1.0
Total	118		

Table 10 shows that 60 females and 58 males were in the treatment group. All their mean scores were used to compute the Chi-square test since gender is nominal data. The Chi-square test outcomes are displayed in Table 11.

Table 11

Chi-Square Test Results

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	44.648[a]	16	.000
Likelihood Ratio	53.990	16	.000
Linear-by-Linear Association	36.476	1	.000
N of Valid Cases	118		

The Chi-square test results in Table 11 show a statistically significant difference in the boys' and girls' performance X^2 (1, N = 118) = 44.65, p = .01. The null hypothesis that there is no statistically significant difference in performance between boys and girls taught while integrating actual-life situations in the teaching of Statistics was rejected. Hence, the difference in the treatment group's boys' and girls' performance in the post-test quiz was statistically significant.

This difference in performance between boys and girls shown in Table 11 might be attributed to the difference in opinion about using RLS in teaching Statistics. These study findings show that more girls than boys believed that the use of real-life situations helped improve their Statistics grades (U = 5359.00, P = .01). These study findings are in line with Kaygisiz and Şenel (2022) study which showed that learners with more robust views about the use of Mathematics in real life were more likely to post better results in Mathematics tests compared to those who have weak opinions about the use of mathematical ideas in everyday life. Additionally, according to Jones (2010), boys

and girls have distinct views of incorporating actual-life situations in Mathematical instructions, which is ultimately transferred into their performance on various Mathematical activities and test scores.

More girls believe that real-world contexts made studying Mathematics more difficult, while boys believed that contextual learning of Mathematics was more stimulating and gratifying. Additionally, the study showed that girls would opt for pure Mathematics instead of applied Mathematics questions for fear of failure than boys who would opt for applied Mathematics instead of applied Mathematics (Jones, 2010). However, this study's results differ since girls outdid boys in the post-test scores. This study's results show a higher possibility that more girls highly considered using real-life connections during teaching or, generally, highly regarded the entire learning process.

4.5 Students and Teachers' Views about Integration of Actual-life Events

Integration in the Instruction of Statistics

The third objective of this study was to establish the learners' and Mathematics teachers' opinions about integrating RLS in Statistics instruction. The STQs collected data from the students, and the MTQs from the teachers. The data were coded and analysed separately using SPSS version 25.

4.5.1 Students' Views about RLS Integration in the Instruction of Statistics: This study's third objective was

This study's third objective was establishing students' views on RLS integration in Statistics instruction. The STQ was split into two parts, where one part collected the students', biographic information used to group students by gender. The other part had three items to collect data about the student's perceptions of the real-life situations used in the teaching and learning of Statistics.

4.5.2 RLS Commonly Used in the Instruction of Statistics.

The study sought to determine the students' views about the real-life situations commonly used during Statistics instruction. The item on the questionnaire had five options, and only one option was to be selected. The outcomes are displayed in Table 12

Table 12
Commonly Used RLS

	Frequency	Percent	Cumulative Percent
Textbook examples and questions	96	41.4	41.8
Authentic visual materials, e.g., videos	29	12.5	54.3
Authentic listening materials e.g., radio news	25	10.8	65.1
Authentic items, e.g., cards, real filled-in farm records	28	12.1	77.2
Authentic printed materials, e.g., sports reports, current weather reports, farm records	53	22.8	100.0
Total	232	100.0	

Table 12 shows that 232 participants responded to this part of the questionnaire. The respondents were to point out the actual-life events commonly used in Statistics instruction. Textbook examples were the most common real-life examples, 96 (41.4%). The results show that the real-life examples in the textbooks remain the commonly used tool for teaching Statistics. Authentic printed materials like sports, weather, and farm records were the second most common real-life tools in the teaching process, 53 (22.8%). Authentic visual materials like videos 29 (12.5 %), authentic items like cards and filled-in records 28 (12.1%), and authentic listening materials like radio news were the least popular real-life examples 25 (10.8%) were used in the teaching process. However, the percentage of use shows that they were less common than the examples drawn from the textbook.

These findings concur with Gainsburg (2008) and Otondi (2020) observations that there is over-reliance on the mathematics textbook in sourcing real-life application problems. Otondi (2020) observed that in Kenya, most teachers of Mathematics solely relied on textbook examples and situations with little connection or no relation to learners' immediate world.

4.5.3 Students' Views on RLS Integration in the Instruction of Statistics.

The research also intended to establish students' views about integrating RLS in the teaching of Statistics. The students expressed their degree of concurring with each statement by checking the corresponding boxes in a five-point Likert scale questionnaire. Table 13 displays the descriptive Statistics derived by analysing Questionnaire Item Four. The Likert scale data is ordinal, and answers can only be

categorised; however, the distances between replies cannot be quantified. As a result, using descriptive Statistics such as mean and standard deviation has ambiguous implications when utilised in analysing this data (Sullivan & Artino, 2013). According to the study, the mean is influenced by the non-normal distribution and excessive clustering of response data, making it ineffective in analysing Likert scale data. The mean problems are overcome by employing the median, unaffected by severe clustering of scores since it is a positional number. It may be used in analysing ordinal, interval, and ratio data with no previous normality constraints (Creswell, 2014). In this regard, the median was chosen to analyse all Likert scale questions in this study.

Table 13

Students' Views on Integration of RLS in Statistics Instruction

	Gender					
	Male		Female		Total	
	N	Median	N	Median	N	Median
Makes learning interesting	113	4.00	118	4.00	231	4.00
Time-consuming	113	4.00	119	4.00	232	4.00
Helps master formulas	113	4.00	119	4.00	232	4.00
Decreases interest in Statistics	113	2.00	119	2.00	232	2.00
Helps relate Statistics to real life	113	4.00	119	4.00	232	4.00
Demonstrates the importance of Statistics in real-life	113	4.00	119	4.00	232	4.00
Improves Grades	113	4.00	119	4.00	232	4.00
Shows why learn Statistics	113	4.00	119	4.00	232	4.00

Table 13 shows that most learners concurred with the positive assertions about using actual-life situations in Statistics instruction (*Mdn* = 4, *n* = 232). However, the learners also concurred with the negative statement that using RLS in teaching and learning is time-consuming (*Mdn* = 4, *n* = 232). The learners disagreed with the negative statement that the use of RLS decreases their interest in Statistics (*Mdn* = 2, *n* = 232). These results show that most learners had strong opinions about integrating RLS in the instruction of Statistics.

The results in Table 13 concur with other studies' findings related to using real life in teaching Mathematics. For instance, the learners' recognition of the grandness of real-life situations in making learning enjoyable, improving their grades, and demonstrating the practicality of Statistics in real-life coincides with Dissuo et al. (2018); Assadi and Hibi (2022); Ruijia et al., (2023); Savard & Theis (2010) findings that learners recognise the importance of using real-life situations in teaching which is directly translated into improving their Mathematics grades. However, the results disagree with Lago and Cruz (2021) and Salout, et al., (2013) that only learners interested in Mathematics or mathematics-related courses can easily recognise and benefit from real-life connections. A Mann-Whitney (MWU) test was performed to determine how the learners' responses varied by gender. The MWU test compares categorical variables and compares medians instead of means (Creswell, 2014). Since the objective was to compare the learners' responses by gender, a categorical variable, and considering that the Likert scale data were analysed using median, the MWU-test was the best test to use instead of the Analysis of Variance. The outcomes are in Table 14

Table 14

Comparison of Students' Views by Gender

	Gender	N	Mean Rank	Sum of Ranks	Mann Whitney U	Z	Asym Sig (2-tailed)
Makes learning Interesting	Male	113	104.29	11785.00			
	Female	118	127.21	15011.00	5344.00	-2.791	.005
Time-consuming	Male	113	120.09	13570.50	6317.50	-.871	.384
	Female	119	113.09	13457.50			
Helps master formulas	Male	113	109.19	12338.50			
	Female	119	123.44	14689.50	5897.50	-1.677	.094
Decreases interest in Statistics	Male	113	118.68	13410.50			
	Female	119	114.43	13617.50	6477.50	-.500	.617
It helps relate Statistics to real life	Male	113	128.67	14540.00	5348.00	-2.858	.004
	Female	119	104.94	12488.00			
Demonstrates the Importance of Statistics in real-life	Male	113	117.85	13316.50			
	Female	119	115.22	13711.50	6571.50	-.316	.752
Improves Grades	Male	113	104.42	11800.00			
	Female	119	127.97	15228.00	5359.00	-2.882	.004
Shows why learn Statistics	Male	113	112.46	12707.50			
	Female	119	120.34	14320.50	6266.50	-.963	.336
	Total	232					

Table 14 indicates that the students did not differ in opinions in most statements. However, the results show that more girls than boys felt that the use of real-life situations makes teaching and learning Statistics more interesting (U = 5344.00, P = .01). Additionally, more girls than boys believed that real-life situations helped improve their Statistics grades (U = 5359.00, P = .01). Finally, the results show that more boys than girls were persuaded that real-life situations helped demonstrate the importance of Statistics in real life (U = 5348.00, P = .01).

This study's results differ from Jones (2010) findings that girls have different opinions about using real-life situations in teaching Mathematics than boys. These study findings showed that girls highly regard real-life situations in teaching. Additionally, the findings do not correspond with Jones (2010) results. Those girls viewed real-life situations as a distraction to the learning of Mathematics.

4.5.4 Learners' Views on the Frequency of Integration of RLS in Instruction of Statistics.

To achieve this study's third objective, data on learners' views on the emphasis of using RLS in the teaching of Statistics was collected using a five-point Likert scale questionnaire. The data were analysed using medians. The outcomes are displayed in Table 15.

Table 15

Students' Opinions on Frequency of Integration of RLS Statistics Instruction

	Gender					
		Male	Female			Total
	N	Median	N	Median	N	Median
Using real-life situations in teaching should be done	113	5.00	119	4.00	232	5.00
Emphasise the benefits of Statistics	113	4.00	119	4.00	232	4.00
Emphasise why I should learn Statistics	113	4.00	119	4.00	232	4.00

Table 15 shows that both boys and girls agreed that the emphasis on the benefits of Statistics in real life and why they should do Statistics should be done often (*Mdn* = 4, *n* = 232). However, the results show that most boys believed that using RLS in teaching Statistics should always be used (*Mdn* = 5, *n* =113), while most girls felt that the frequency of use should be at intervals (*Mdn* = 4, *n* =119). These results show that the learners are interested in knowing how the knowledge gained in the classroom relates to and can be used outside the classroom.

The responses scores were subjected to an MWU test to determine if there was a statistically significant difference in views between boys and girls. The MWU test was the best test to evaluate if the difference in the boys' and girls' opinions was statistically significant since the Likert scale was analysed and interpreted using medians. Table 16 contains the MWU-test findings.

Table 16

Comparison of Students' Views by Gender

	Gender	N	Mean Rank	Sum of Ranks	Mann Whitney U	Z	Asym Sig (2-tailed)
Using real-life situations in teaching Statistics should be done	Male	113	127.50	14407.50	5480.50	-2.707	.007
	Female	119	106.05	12620.50			
Emphasise the benefits of Statistics	Male	113	122.23	13811.50	6076.50	-1.323	.186
	Female	119	111.06	13216.50			
Emphasise why I should learn Statistics	Male	113	120.49	13615.00	6273.00	-.927	.354
	Female	119	112.71	13413.00			
	Total	232					

Table 16 results (U = 5480.00, P = .01) show a statistically significant difference in learners' opinions on how often real-life situations should be used in teaching. These results indicate that more boys had more meaningful views about using real-life situations, believing that using RLS should always be used in teaching (*Mdn* = 5, *n* =113). In comparison, girls thought RLS should be used at teaching intervals (*Mdn* = 4, *n* =119). However, the results show no statistically significant difference in views by gender on the statements about the frequency of emphasising the benefits and explaining why to learn Statistics.

This study's results that boys and girls shared almost similar views on the frequency and use of real-life situations in teaching differs from Jones (2010) findings that boys and

girls had distinct opinions about using actual-life events in teaching and learning Mathematics. Second, this study's results that most girls prefer to be taught using real-life often (*Mdn* = 4, *n* =119) contradicts Jones (2010) findings that girls find real-life situations distracting and prefer pure to applied Mathematics. However, this study's findings showed that more boys had stronger opinions about using the real-life situation and believed its integration into teaching should always be done (*Mdn* = 5, *n* =113). At the same time, girls felt that it should be done at intervals (*Mdn* = 4, *n* =119) is in line with Jones (2010) findings that boys had a higher regard for real-life situations and preferred its integration in teaching Mathematics than girls.

4.6 Mathematics Teachers' Views on Integration of RLS in the Instruction of Statistics.

The research intended to determine the mathematics teachers' opinions on integrating RLS in teaching Statistics. To accomplish this goal, the MTQ was utilised to collect data. The data-collecting tool was separated into many sections, and a detailed discussion of each section is presented below.

4.6.1 Teachers' Views about the Lesson Stage of Integrating RLS in Statistics Instruction.

The research intended to establish the teachers' Mathematics opinions about the time they use RLS during Statistics instruction. According to Gainsburg (2008), more is needed to know about how real-life situations are used in teaching Mathematics. It was,

therefore, essential to find out how real-life situations are used in the teaching process. The descriptive Statistics are displayed in Table 17

Table 17

Time of use of RLS

	Frequency	Percent	Valid Percent	Cumulative Percent
End	5	83.3	83.3	83.3
Start	0	0	0	0
Throughout	1	16.7	16.7	100.0
Total	6	100.0	100.0	

Table 17 indicates that 5(83.3%) of the teachers used real-life connections at the end of the topic, and only 1(16.7%) used real-life connections throughout the entire topic. These results imply that only a few learners engage with engaging activities that would stimulate the link of learning Statistics to their real life. These results align with Gainsburg (2008) findings that most teachers make Mathematics connections at the end of the topic when the teacher is entirely done with teaching algorithms.

4.6.2 Teachers' Recommendations about Frequency of Use RLS in Teaching Data Analysis

Teachers' awareness of real-life situations and their importance in teaching Mathematics determines how often they use real-life connections in education (Savard & Theis, 2010). Seeking teachers' opinions on how much connections they think should be made during Statistics instruction was important in this study. The results from the analysis of the teachers' views about the rate of use of RLS are represented in Table 18

Table 18

Views on Rate of Use of RLS

	Frequency	Percentage	Valid Percent	Cumulative Percent
Less connections	0	0	0	0
More connections	6	100.0	100.0	100.0
None of the above	0	0	0	0

Table 18 shows that all the teachers 6 (100%) believed that more connections should be used in Statistics instruction.

Dissou et al. (2018) note that the disconnect between Mathematics and real life is attributed to traditional teaching methods that rely solely on textbook connections. According to Asempapa and Sturgill (2019), teachers who feel inadequately trained about using real-life connections use fewer connections in the teaching process. Since the teachers know the benefits of using real-life links in the learning process, they always desire to use more connections in the teaching process. This study's findings confirm that mathematics teachers wish to use more real-life links in teaching.

4.6.3: Teachers' Views on Integration of RLS in the Instruction of Statistics

Teachers' awareness and views about real-life connections are significant determinants of whether they integrate real-life situations and how they integrate the links in teaching (Wuolle, 2012). Seeking information about teachers' opinions about using real-life connections in teaching Statistics was necessary to achieve this study's fourth objective. This study used a Likert scale questionnaire to collect and analyse data using the median. The descriptive Statistics are shown in Table 19.

Table 19

Outcomes of Teachers' Opinions on the Use of RLS in Statistics Instruction

Statement	N	Missing	Median
Boosts Students' motivation and enthusiasm for learning Statistics	6	0	5.00
Enhances intellectual, meaningful, and lifelong learning of Statistics	6	0	4.50
Create a good attitude towards Statistics among students	6	0	4.00
Allows for the generalisation of statistical ideas	6	0	4.00
Is constrained by the breadth of the curriculum	6	0	4.00
Becomes a constraint if the example provided is unrealistic and unrelated to the student's experiences	6	0	4.50
It may make students believe that Statistics is only applicable in real life	6	0	3.50
Because specific subtopics remain abstract, it makes statistical reasoning harder	6	0	2.50
Is appropriate for every student group and is always beneficial	6	0	4.00
Is better suited to a group of students who are uninterested in Statistics	6	0	4.50
Is not required for a capable set of students	6	0	4.50

The results in Table 19 reveal that most teachers strongly agreed that real-life situations increase learners' motivation and enthusiasm to learn Statistics (*Mdn* = 5, *n* = 6). The majority of the teachers approved the positive assertions that the use of real-life situations enhances intellectual, meaningful, and lifelong learning of Statistics (*Mdn* =

4.5, *n* = 6), is better suited to a group of students who are uninterested in Statistics (*Mdn* = 4.5, *n* = 6), develop learners' positive attitude towards Statistics (*Mdn* = 4, *n* = 6), facilitates generalisation of statistical concepts (*Mdn* = 4, *n* = 6) and is appropriate for every student group and is always beneficial (*Mdn* = 4, *n* = 6). However, many of the teachers concurred with the negative assertions that the use of real-life situations becomes a constraint if the illustration provided is impractical and unrelated to the student's experiences (*Mdn* = 4, *n* = 6) and is not required for a capable set of students (*Mdn* = 4.5, *n* = 6). These findings imply that the teachers acknowledged that real-life situations could impede learning if not structured to relate to learners' experiences. Additionally, most teachers agreed that integrating real-life situations in teaching is constrained by the breadth of the curriculum (*Mdn* = 4, *n* = 6). A significant number of the teachers disagreed with the statement that real-life situations make statistical thinking difficult since some sub-topics remain abstract (*Mdn* = 2.5, *n* = 6). These results imply that most teachers believe using real-life situations does not make learning Statistics difficult. The results also show that the teachers had no opinion that using real-life situations facilitates the generalisation of statistical ideas (*Mdn* = 3.5, *n* = 6).

These outcomes reflect previous research findings, such as (Karakoc & Alicia, 2015; Rosalina & Duat, 2019), indicating that many Mathematics teachers and experts know the benefits of incorporating actual-life links in Mathematics instruction. The known pros of using RLS in teaching include: improving learners' curiosity and desire to learn Mathematics, building learners' positive attitudes, establishing a creative and inclusive classroom environment, and assisting in developing learners' numerical capabilities. This study's findings that the use of RLS can be a limitation to the learning of Statistics

(*Mdn* = 4, *n* = 6) is aligned with Koparan (2014) idea that the use of RME to motivate learners when teaching Statistics may be difficult because the probabilistic and statistical ideas and rules are complex and sometimes different from their day-to-day life experiences. This implies that real-life situations should be used while considering their relevance and suitability to the learners being taught (Rangel et al., 2016).

4.6.4: Teachers' Readiness to Use RLS in Statistics Instruction

Studies on real-life events integration in Mathematics instruction should also investigate why teachers refrain from employing real-life scenarios in their classrooms (Suzzane, 2016). This is because other studies have shown that teachers have several reasons for using few or no connections in teaching. For instance, according to Asempapa and Sturgill (2019); Batanero and Diaz (2010), some of the impediments to making real-life connections in teaching may include insufficient teacher training. This implies that the programs did not emphasise Mathematics connections, lack of statistical content knowledge, and lack of awareness of what real-life connections to bring into the classroom. As a result, this research intended to establish the teachers' Mathematics views about their readiness to use real-life situations. The study used a questionnaire to collect data for this item. The data were analysed using medians, and the outcomes are represented in Table 20

Table 20

Teachers' Opinions on Level of Readiness in Using RLS in the Teaching of Statistics

	N	Missing	Median
I can successfully employ real-life connections in the teaching of Statistics	6	0	5.00
I require further assistance in the use of real-life circumstances in the teaching of Statistics	6	0	4.00
My in-service teacher training includes the use of real-life scenarios in teaching Statistics	6	0	2.00
My teacher training course emphasised the use of real-life connections in teaching Statistics	6	0	2.00
I can easily come up with actual-life situations for teaching Statistics	6	0	3.00

The results in Table 20 shows that most Mathematics teachers strongly agreed that they could effectively use real-life connections in teaching Statistics (*Mdn* = 5, *n* = 6). The teachers concurred with the assertion that they needed extra support in using real-life situations in teaching Statistics (*Mdn* = 4, *n* = 6). This showed that although teachers could use real-life situations in teaching, they still needed assistance in coming up with or sourcing the best real-life situations to use in the teaching process. Additionally, a more significant number of the teachers disagreed with the statements that RLS in teaching Statistics as part of their work progression training and use of RLS in teaching Statistics was emphasised in their teacher training course (*Mdn* = 2.00, *n* = 6). This implies that real-life situations were neither part of the teachers' training course nor in-service training, echoing the need for more support for RLS integration in teaching

Statistics. Additionally, this shows that teachers need more training involving real-life situations in teaching not only Statistics but all Mathematics strands.

This study's findings show that teachers needed assistance in developing real-life relationships and how to use them in the instruction of Statistics (Mdn = 5, n = 6) and that using real-life links should be included in teacher in-service training (Mdn = 5, n = 6) are consistent with Karakoc (2012), statement that teacher training programs and in-service training should include aspects relating to the use of real-life connections. Furthermore, the findings align with Asempapa and Sturgill (2019); Dissou et al. (2018) views that teachers of Mathematics were hampered from exploiting actual-life links due to insufficient resources, knowledge, and training to develop connections.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarises the study findings. It also presented the conclusions drawn from the study. Recommendations on the use of real-life situations in the instruction of Statistics and Mathematics for policy formulation and on areas for further studies are also included in this chapter.

5.2 Summary

This study aimed to determine the effects of using real-life situations in teaching-learning Statistics. To achieve this intention, the study was guided by four specific objectives. Additionally, three null hypotheses were tested, and one question was answered at the end of the study. The significant findings are as follows:

The first study objective was to determine if there was any difference in performance between learners taught using real-life situations and those taught without integrating RLS. The study findings showed that the learners taught integrating real-life connections post-test MAT mean performance (M = 11.43, SD = 3.73) was statistically significantly higher, t (230) = -6.2, p = .01, than that of learners taught without integrating real-life situations (M = 8.18, SD = 4.23). This implies that using RLS in teaching Statistics positively impacted learners' performance. The findings agree with Batanero & Diaz (2010); Goni (2019); and Ruijia et al. (2023) that demonstration of the practicality of Mathematics concepts using learners' own experiences makes learning

engaging, captivating, changes students' attitudes toward Mathematics, and eventually leads to improved grades.

The second objective was to establish gender responsiveness of integration of RLS on students' performance in Statistics. The study results showed that girls' mean performance in the Statistics post-test MAT (M = 13.20, SD = 3.10) was significantly higher, X^2 (1, N = 118) = 44.65, p = .01, than the boys' mean performance in the same test (M = 8.81, SD = 3.40). These findings dissent from Jones's (2010) observations that boys highly regard the use of more engaging activities in the learning of Mathematics than girls hence out-perform in related questions.

Establishing by gender students' opinions about the use of RLS in Statistics instruction was the third objective of the study. The study presented that most of the learners had strong views about the use of the real-life situation in the teaching and learning of Statistics, especially concerning helping them improve grades (Mdn = 4, n = 232), demonstrating why they need to learn (Mdn = 4, n = 232), and showing how and where to use Statistics is used in real-life (Mdn = 4, n = 232). The learners also agreed that the instruction should apply to real-life situations (Mdn = 4, n = 232). These findings align with Dissuo et al. (2023) and Assadi and Hibi (2022) findings that students always appreciate the use of real-life situations, especially those related to their everyday lives. The MWU test revealed no statistically significant difference in opinions toward most of the statements regarding using real-life situations. However, more girls had more robust views about some of the statements, especially those related to making learning enjoyable, improving grades, and showing the importance of Statistics in real life. The

students also pointed out that the textbook was the primary source of real-life situations during the teaching process. These findings concur with Sharmin and Tahmina (2021) that most teachers found it easy to use the real-life situations presented in the textbook since they were easy to reach and required less time to implement.

The fourth objective of this study was to determine teachers' opinions on using RLS in teaching Statistics. The results on teachers' views about integrating RLS in the instruction of Statistics revealed that most teachers acknowledged the usefulness of RLS in the teaching process. However, the teachers felt constrained by the breadth of the curriculum and inadequate training about using RLS since it was not part of their training. This observation coincides with Asempapa and Sturgill (2019); Dissou et al. (2018); Kaygisiz and Şenel (2022); Sharmina and Tahmina (2021) that most teachers fail to use real-life situations in the teaching process because they feel inadequately prepared due to a lack of training.

5.3 Conclusion

This study resulted in three main conclusions. First, using appropriate real-life situations, especially those that learners can relate to, improves performance in Statistics. Demonstrating the relevance of Statistics concepts outside the classroom is essential to the learners and should be addressed during the teaching process. Therefore, teachers of Mathematics should endeavour to demonstrate this to the learners throughout the teaching process. Second, learners' views about actual-life events in teaching Statistics do not entirely vary by gender. Girls, too, have strong opinions about using RLS in teaching and learning Statistics. Third, teachers of Mathematics are aware

of the usefulness of integrating RLS into the teaching process. However, the teachers expressed the need for both pre-service and in-service training to be fully equipped with knowledge regarding the use of real-life situations in teaching Mathematics.

5.4 Recommendations

5.4.1 Recommendations for Policy and Practice

Anchoring on the above findings and conclusions, the study came up with a few suggestions based on the above findings and conclusions. They include:

i. Since there is a constructive connection between the integration of RLS and learners' performance in Statistics, the teachers of Mathematics should incorporate more RLS in teaching Statistics. The use of RLS should be extended to other Mathematics topics to help learners improve their conceptual understanding of concepts that may result in better Mathematics performance.

ii. There was proof that the integration of RLS supported girls to post good performance in Statistics. Teachers should support students' learning by using captivating teaching approaches like teaching while integrating real-life situations.

iii. The finding that learners have high regard for real-life situations to which they can easily relate, it is recommended that teachers should link Statistics to real-life contexts closely related to learners' lives, to make learning less abstract and lead to better performance in Statistics.

iv. There was evidence that teachers of Mathematics felt inadequately trained on matters pertaining the use of real-life situations in teaching Mathematics. The Ministry of Education should, therefore, develop clear guidelines that ensure teacher training and professional growth programs equip teachers of Mathematics with the expertise and competencies required to integrate real-life contexts into their lesson designs. This will increase teachers' confidence in using more real-life situations in teaching Mathematics.

v. The Ministry of Education should facilitate the acquisition of extra educational materials, publications, and online resources that align with using real-world situations into Mathematics instruction to supplement the textbook real-life situations. The access to relevant and practical resources enhances learning experience for students. The provisions will maintain uniformity and consistency in the utilisation of real-life situations in Mathematics instruction.

5.4.2 Recommendation for Further Studies

The study proposes the following areas for further research:

I. Studies should be conducted to establish the effects of integrating RLS in teaching other Mathematics topics or Mathematics Strands.

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APPENDIX I: MATHEMATICS ASSESSMENT TEST 1 (PRE-TEST)

FORM TWO

20 Marks

Time: 30 Minutes

NAME.....CLASS.....

Attempt all questions

1. Every day, a household consumes 6000 ml of milk. In October, how much milk does the household imbibe? (2marks)
2. When buying food in a particular month, a man realised that cooking oil was five times the price of sugar. If he bought cooking oil worth 250 Kenya shillings that month that was the price of the sugar? (3marks)
3. Nana spent two-thirds of his pay on food, one-third on power, and the rest was saved. How much did he save from his pay check? How much did he spend on power if he spent KSH? 3000 on power? (3marks)
4. A person walks at a rate of five steps in a second. If he takes 30 minutes to walk from home to the shop, how many steps will he have made when he returns? Assume that he did not pass by any other place. (2marks)
5. 50 cm3 of water is put into an empty graduated cylinder. A 130g stone is placed in the cylinder. Find the new cylinder reading if the density of the stone is 1.4 g/cm3. (3marks)
6. A farmer wanted to build a calf pen. If the recommended area of a calf pen is 3.5 square meters per calf, what should be the length of the side of the calf pen? What length should the calf pen be to host four calves? (4marks)
7. The recommended ratio of mixing cement, sand, and ballast to construct a simple standard structure is 1:2:4. If a mason had 25 bags of ballast, how many bags of cement and sand should he buy to create the appropriate mixture 3 marks).

APPENDIX II: MATHEMATICS ASSESSMENT TEST 2. (POST-TEST)

FORM TWO

20 Marks

Time: 30 Minutes

NAME.....CLASS.....

Attempt all questions

1. Data analysis has revealed that 55 out of 10000 new bulbs of a certain type blow off in 4 weeks. What is the chance of getting a bulb which will blow off in 4 weeks? (3marks)

2. The members of a Geography class in a particular institution decided to record data on the number of passengers in each vehicle passing along the road near their institution for 45 minutes. The recorded data is as follows:

No of the people in the vehicle	2	3	4	5	6
No. of vehicles	80	15	16	14	23

What is the likelihood that a vehicle passing along the road had? (8mrks)

a) A prime number of people

b) Less than five people

c) At least three people

d) More than four people

3. At a security checking point, the speeds in km/h of 75 cars that passed through were recorded as follows:

Speed	Number of vehicles
41-45	3
46-50	5
51-55	10
56-60	6
61-65	8

66-70	12
71-75	15
76-80	4
81-85	8

a. Determine the average speed of cars that passed through the security checking point (3mks)

b. Draw a histogram representing the information above (4mks)

c. From the histogram, determine the median speed of the cars. What can you conclude about the speed of the vehicles (2mk)?

APPENDIX III: STUDENTS QUESTIONNAIRE

This questionnaire is designed to gather information for research purposes. Your replies will be beneficial in increasing the integration of real-life circumstances in the instruction of Statistics and Mathematics. Answer all the questions honestly and correctly. The answers will be treated with the utmost discretion. (Tick in the appropriate box).

SECTION A: STUDENT'S PERSONAL INFORMATION

1. Gender

a) Male [] b) Female []

SECTION B: LEARNERS' VIEWS ON INTEGRATION OF RLS IN THE INSTRUCTION OF STATISTICS.

2. Which of the following sources of real-life connections were used during the instruction of Statistics? You may tick only one box.

Textbook examples and questions	
Authentic visual materials, e.g., videos	
Authentic listening materials e.g., radio news	
Authentic items, e.g., cards, real filled-in farm records	
Authentic printed materials, e.g., sports reports, current weather reports, farm records	

3. The following are general remarks concerning integrating RLS in Statistics instruction. Tick the relevant box to indicate your degree of agreement with each statement.

Statements	SA	A	NO	D	SD
Makes learning interesting					
Time-consuming					
Helps master formulas					
Decreases interest in Statistics					
Helps relate Statistics to real life					

Demonstrates the importance of Statistics in real-life					
Improves Grades					
Shows why learn Statistics					

4. The following are broad comments concerning the regularity with which RLS are used in Statistics instruction. Mark the relevant box to indicate your degree of agreement with each statement.

Statements	Never	Seldom	Sometime	Often	Always
Using real-life situations in teaching should be done					
Emphasise benefits of Statistics					
Emphasise why I should learn Statistics					

APPENDIX IV: MATHEMATICS TEACHERS QUESTIONNAIRE

The purpose of these conditions is in the instruction of Statistics in Tharaka Nithi County. Answering honestly will go a long way toward ensuring that the study objectives are met. The information submitted will be held in high esteem, kept with absolute secrecy, and used solely for research purposes. (Tick in the appropriate box).

SECTION A: TEACHER'S PERSONAL INFORMATION

1.What is your gender?

Male [] Female []

2.Years of service as a teacher

Less than 5 years [] 6 - 10 years [] 11 - 15 years [] 16-20 years [] Over 20 years []

3. Your current highest level of education (tick where applicable)

i). Post Graduate [] ii). Degree [] iii). Diploma []

SECTION B: TEACHERS' OPINIONS ON THE INTEGRATION OF REAL-LIFE SITUATIONS USED IN THE INSTRUCTION OF study is to determine secondary school teachers' opinions of the utilisation of actual-life

STATISTICS.

4.At what time do you use RLS when teaching Statistics

Commencing []

Finishing []

All the time []

5.What are your suggestions about the amount of RLS that should be used in teaching Statistics at the high school level?

More []

Less []

None of the above []

6. The remarks below express opinions on integrating real-life scenarios in Statistics instruction. Click in the relevant box to indicate your degree of agreement with the statements. Use the key provided below.

1 – Strongly Agree, 2 – Agree, 3 – No Opinion, 4 – Disagree, 5 – Strongly Disagree

Statements	SD	D	NO	A	SA
Boosts Students' motivation and enthusiasm in learning Statistics					
Enhances intellectual, meaningful, and lifelong learning of Statistics					
Create a good attitude about Statistics among students					
Allows for the generalisation statistical ideas					
Is constrained by the breadth of the curriculum					
Becomes a constraint if the example provided is unrealistic and unrelated to the students' experiences					
It is possible that it will make students believe that Statistics is only applicable in real life					
Because certain subtopics remain abstract, it makes statistical reasoning harder					
Is suitable for any student group and always effective					
Is better suited to a group of students who are uninterested in Statistics					
Is not required for a particularly capable set of students					

5. The phrases below express views regarding high school teachers' readiness to use real-life links in the instruction of Statistics. By clicking on the relevant box, you may indicate your level of agreement with the statements. Use the key below.

SA – Strongly Agree, A – Agree, NO – No Opinion, D – Disagree, SD – Strongly Disagree

	SD	D	NO	A
I can successfully employ real-life connections in the teaching of Statistics				
I require further assistance in the use of real-life circumstances in the teaching of Statistics				
My in-service teacher training includes the use of real-life scenarios in teaching Statistics.				

APPENDIX VI: STUDY BUDGET

S/NO	Activity	Item	Estimated Cost
1	Typing		15000
2	Study piloting	Study data collection tools	25000
3	Data collection	Study data collection tools	140000
		Transportation	25000
		Information Conveyance	15000
3	Data analysis	SPSS package and seminars	40000
4	Thesis	Copies reproduction and binding	40000
5	Miscellaneous		35000
	Total		**335000**

APPENDIX VII: TEACHING RESOURCES USED IN THE STUDY

Teaching Video: https://youtube.be/-HfvfkkKyjc

Milk Production Records for August 2020

AUGUST 2020								
Name of Cow	3rd Mon	4th Tue	5th Wed	6th Thru	7th Fri	8th Sat	9th Sun	Total Weekly production
Kithunguri 3	25.5	26	26.5	16	28	27	25.5	
Kithunguri	26	25.5	26	25.5	28	28	26	
Dinnah	27	23	23	22	23	26	23	
Mbogori 2	23	25.5	24	24	22	25	23	
Mbogori 3	24	23	24	24	23	23	24	
Kanini	24	23	23	23.5	24	24	24	
Mercy	7	6.5	6	5.5	8	9	7	
Juju	13	13.5	13	14	16.5	16	13	
Mutwiri	14	14	15.5	15	15	15.5	14	
Mucugu	12	12	12	12	7	0	12	
Karew	23	20.5	22.5	24	22.5	21	23	
Peter	14	15.5	11	11	17	18	14	
Meky	7	7	7	6	7.5	7.5	7	
Mukiri	20.5	22	18.5	19	20	20	20.5	
TOTAL								
	10th Mon	11th Tue	12th Wed	13th Thu	14th Fri	15th Sat	16th Sun	
Kithunguri	26.5	23	28	26	28	28.5	26	
Dinnah	27	27	27.5	27	27	28	26	

Mbogori 2	23	25	26	24	25	25	23	
Mbogori 3	24	24	23.5	18.5	24	21	23	
Kanini 2	24	23	24	25	24	26	20	
Mercy	23.5	24	23.5	26	23.5	25.5	23.5	
Juju	7	5	4	2.5	2.5	2.5	5	
Mutwiri	8	14	7	7.5	11.5	13	16	
Muugu	15.5	13	15	14.5	13	14	10	
Karew	12	12	11	10.5	10	9	22	
Peter	22.5	24	24	21	23	25	23	
Meky	13	12	12	16	16.5	18	15	
Mukiri	7	6.5	8	6.5	6.5	6.5	6	
TOTAL	19.5	20	21	24	18	18	20	

	17th Mon	18th Tue	19th Wed	20th Thu	21st Fri	22nd Sat	23rd Sun	
Kithunguri	26	23	25	24.5	25.5	25	26	
Dinnah	26	25	25	25	25.5	23	25	
Mbogori 2	22	24.5	21	20.5	21.5	23	24	
Mbogori 3	18	22	16.5	15	18	19	18.5	
Kanini 2	23	21	21	22	22	24	24.5	
Mercy	22.5	23	22.5	22	22	24.5	25	
Juju								
Mutwiri	11	10	12	12	10	11	10.5	
Muugu	13	13	14	14.5	12	16	14	
Karew	10	10.5	9	10	8.5	10.5	10	

Peter	23	22.5	22.5	23	22	23	25	
Meky	19	18.5	17.5	13	14	15	16	
Mukiri	6	5.5	5.5	5	6	5.5	5.5	
TOTAL	18	23	17	16	19	20.5	22	
	24th Mon	25th Tue	26th Wed	27th Thu	28th Fri	29th Sat	30th Sun	
Kithunguri	26	26	26.5	26	26.5	25	26.5	
Dinnah	26.5	28	29	28	27.5	28	25.5	
Mbogori 2	24	25	26	25	25	24.5	24	
Mbogori 3	16.5	15.5	18	18	18	16	16.5	
Kanini 2	24	23	24	23	23	23	24	
Mercy	26	24	24	22.5	22	24	26	
Juju						9		
Mutwiri	12	11.5	9	9	11	9	9.5	
Muugu	13.5	13	14	13	12.5	13	13.5	
Karew	9.5	11	12.5	12.5	13	13	12	
Peter	22.5	22	23	24	23	22	22.5	
Meky	16	16	16.5	17	18	16	21	
Mukiri	5	5.5	5	6	5.5	6	5	
TOTAL	23	20.5	23	24	23	23		
	31stMon	1st Tue	2nd Wed	3rd Thu	4th Fri	5th Sat	6thSun	
Kithunguri	25.5	26						

	26	25.5						
Mbogori 2	27	23						
Mbogori 3	23	25.5						
	24	23						
Mercy	24	23						
Juju	7	6.5						
Mutwiri	13	13.5						
Muugu	14	14						
Karew	12	12						
Peter	23	20.5						
Meky	14	15.5						
Mukiri	7	7						
TOTAL	20.5	22						
June 2021								
Kithunguri 3	7th Mon	8th Tue	9th Wed	10th Thu	11th Fri	12th Sat	14th Sun	
Kithunguri								
Kithunguri 2	36.5							
Dinnah	36							
Mbogori 2	27.5							
Mbogori 3								
Mbogori 1								
Mrefu	27.5							
Albino	24.5							

Kabeshty	24.5							
Kanini 2.2	24.5							
Mercy	14.5							
Mutwiri	21							
Juju	5.5							
Mucugu								
Karew								
Peter								
Meky								
Mukiri								
TOTAL	21.5							

Teaching Guide

Measures of Central Tendency for Single Data

1. Pick 1 cow's weekly record.

Use the record to determine

I. Mean

II. Mode

III. Median

Ask students to determine on their own

a) The weekly mean milk production per cow. *(Record this information on a table for reference thereafter).*

b) The mean daily milk production for all cows.

c) If the milk is sold for sh.50, how much money does the farmer make from milk sales in

i) A week

ii) A month

d) If the farmer pays his 3 workers sh. 8000 per month and around sh. 50000 is used to run his farm per month, is this farmer running a profitable or loss-making venture?

e) Can the farmer who did not have records tell whether he is making profits or losses

Measures of Central Tendency for Grouped Data

2. The data below has been derived from the milk records.

22.5	26	26.5	16	28	27	25.5
26	25.5	26	25.5	28	28	26
7	6.5	6	5.5	8	9	7
13	13.5	13	14	16.5	16	13
12	12	12	12	13	0	12
14	15.5	11	11	17	18	14
22	23	25	24	22	21	20
7	7	6	8	9	7	5

Use the table to group the data on a frequency distribution table. Hence calculate the measures of central tendency for grouped data.

3. Use the table recorded in 1 (a). ***(Table of weekly mean milk production per cow).***

Compare the data in this table with that in table dated June 2021.

Ask learners to explain why some of the cows are missing from the recent data table

(The cows with decreased milk production were serviced and left to calve)

Using the table from activity 1, introduce the treatment concepts by projecting

a) Which cow is likely to be serviced next?

b) How many cows are likely?

i) To be serviced and withdrawn from the milking herd next

ii) To remain in the milking herd

c) How many cows are likely to produce?

i. Even the number of litres of milk

ii. Odd number of litres of milk

4. Can these projections be made by the farmer who does not keep records?
5. Are records important in farming?
6. Is Mathematics applicable in real life? Is there a need to continue pursuing it?

APPENDIX VIII: RESEARCH PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 845869

Date of Issue: 15/October/2021

RESEARCH LICENSE

This is to Certify that Ms.. Irene Mwende Mutegi of Kenyatta University, has been licensed to conduct research in Tharaka-Nithi on the topic: Effect of Real-life Situations on Secondary School Students' Performance in Probability and Statistics in Tharaka-Nithi County Kenya for the period ending : 15/October/2022.

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