REVIEWED JOURNAL® of Education Practice
[ISSN 2663-127X]
Vol. 4, Iss. 1 (2023), pp 32 – 55, June 28, 2023. www.reviewedjournals.com, ©Reviewed Journals

INSTRUCTIONAL STRATEGIES APPLIED BY MATHEMATICS TEACHERS AND THEIR INFLUENCE ON PERFORMANCE IN PROBABILITY IN SECONDARY SCHOOLS, NAIROBI CITY COUNTY, KENYA

[1] Mutua John Maundu, [2] Dr. Marguerite K. Miheso_O'connor, PhP & [3] Prof. samson Ondigi, PhD

[1] Masters in Mathematics Education Student, School of Education, Kenyatta University, Kenya
[2] Lecturer, Department of Educational Communication and Technology, Kenyatta University, Kenya
[3] Professor, Department of Educational Communication and Technology, Kenyatta University, Kenya

Accepted: June 10, 2023

ABSTRACT

This study sought to evaluate the instructional strategies applied by Mathematics teachers in teaching Probability in secondary schools in Nairobi City County. The study was guided by the four (4) objectives; to identify the types of instructional strategies used by Mathematics teachers in teaching Probability; to investigate the extent to which instructional strategies used by Mathematics teachers enhance learners' performance in Probability; to assess learners' performance in Probability by gender; and to investigate the considerations that teachers make when selecting instructional strategies for teaching Probability. The study adopted the descriptive survey research design. Purposive and simple random sampling was employed to select the sample. The sample size was 140 Form three students. Key informants were 14 Mathematics teachers and seven heads of departments. The study instruments were: questionnaires, unstructured interviews for teachers, Observation checklist and a Probability achievement test for students. A pilot study was done in a school with similar characteristics as those in the sample. The results from the pilot study were used to determine the validity and reliability of the data collection instruments. The data from the pilot study was coded and entered into the computer and reliability results with the help of the SPSS produced a coefficient of α =0.7767. The data collection was in two phases. In the first phase the researcher distributed questionnaires to the teachers. In the second phase the researcher observed the teachers in the classroom teaching Probability, conducted an interview with the Heads of Mathematics Departments and administered a test on Probability to learners. Data from the actual study was analyzed by use of both qualitative and quantitative methods. Quantitative data collected was analyzed and presented in percentages, pie charts, and frequency distribution tables. The study findings indicated that Mathematics teachers use different instructional strategies while teaching Probability. The performance outcome from the test on Probability showed that different instructional strategies used by the teachers influence the students' performance in the Probability. The study concluded that teachers' instructional strategies determine learners' performance in Probability. The findings of the study indicated that Mathematics teachers have to choose their instructional strategies carefully while preparing to teach the Probability in order to enhance performance. The results of this study would be useful to Mathematics teachers, leaders in education, and curriculum developers.

Key Words: *Mathematics, Probability, Instructional Strategies, Learners' Performance*

CITATION: Mutua, J. M., Miheso_O'connor, M. K., & Ondigi, S. R. (2023). Instructional strategies applied by mathematics teachers and their influence on performance in probability in secondary schools, Nairobi City County, Kenya. *Reviewed Journal of Education Practice*, 4 (1), 32 – 55.

INTRODUCTION

Students across the globe find Mathematics to be very valuable in their career development. The discipline contains direct attachment to several subjects, predominantly, practical and science subjects. Mathematics is a yardstick for social-economic, technological political and scientific development. The subject is the gate and key of science (Githua & Mwangi, 2003). Umameh (2011) Mathematics to be intimately connected to daily life and everyone's life-long activities. Without Mathematics, education and human life would not be able to function efficiently. In Kenya as well as other parts of the world, Mathematics is a compulsory subject from kindergarten, primary and secondary school level (Miheso, 2002).

The word strategy originates from the ancient Greek word strategia which means steps or actions taken for the purpose of winning a war. The warlike meaning of strategia is applicable in today's world of academic. Teaching Mathematics requires adequate planning for the effective learning to take place (Oxford, 1990).

Teaching-learning approaches are essential in learning of Mathematics. This is because the way in which the content is presented to the learner defines the learners' reception, retention and application of the content acquired (Linda, 2017). Strategies of teaching are categorized into two: Expository strategies, teacher-centered in which teacher dominates instructional process and heuristic strategies and learner centered where learners take a great role in their learning. Examples of teacher strategies are lecture, demonstration and direct instructions. These strategies give the teachers the authority to discharge all the knowledge and wisdom. Examples of learner –centered strategies are discussion, group work, demonstration and experiment (MoE 2006, KICD 2002)

Probability is a more practical topic and calls for the teacher to involve learners in the lesson. The syllabus guides the teachers to apply methods and strategies that encourage interaction between the learner and the teacher in order to increase practical involvement of the students in the learning process (KNEC, 2006)

Wood and Gentile (2003) points out that there are improved methods to transfer knowledge to learners that are better than the traditional strategies. Some of the improved methods discussed by Wood and Gentile are demonstration and discussion methods. Demonstration is effectual component of teaching that stimulates students' learning for their better achievement scores. (Crouch, *et al*., 2004). Application of demonstration method claims that teachers need to encounter ideas timely for production of new- fangled understanding among students for their better achievement scores (Paimin, *et al*., 2011).

At the secondary level, the curriculum has basic elements of description of Probability. The Probability taught in Kenyan secondary school Mathematics syllabus is presented as one topic that is taught in form three. At Kenyan universities, Probability is taught as a combined conceptual strand under stochastic. In this study, the focus was on the secondary school level Probability. This was guided by the Kenya National Examinations Council report of the year 2017. From this report it was discussed that among the topics tested in both paper one and paper two Probability was worst performed. The researcher collected data from the previous K.N.E.C reports and the K.C.S.E Mathematics questions papers done between the years 2013 to 2017 and recorded the Probability questions tested each year in terms of percentages as shown in table 1 below.

Table 1: Probability Content in KCSE National Examinations in both Paper 1 and paper 2 for year 2013-2017

Year	**2013**	**2014**	**2015**	**2016**	**2017**
Maximum (100%) Combination of paper1 &paper2	100	100	100	100	100
Probability Content Percentage	13%	10%	16%	12%	13%

Source: KNEC, KCSE Mathematics Question Paper one and two from 2013-2017

From the above table it is evident that Probability was mainly tested in the KCSE national examination and this guided the study to find out which strategies are applied by the Mathematics teachers to teach the topic in the Embakasi sub-county secondary schools. This was supported by study of Ma, (1999) on teaching Mathematics strategies in which there were suggestions for investigations on effective teaching instructional strategies for delivering Mathematical content in Probability to the learners.

Table 2: Analyses of the KCSE Mathematics results in Embakasi Sub County (2013-2017)

No. of Schools	Years from 2013 to 2017				
7	**2013**	**2014**	**2015**	**2016**	**2017**
Mean	**39.45**	**38.78**	**38.34**	**36.45**	**35.75**

Source: Sub County Director office Embakasi

The grading system in the Kenya National Examinations Council is given through having the total marks of the students per school divided by the number of students in the school per the given year.

Table 2 indicates that the performance in Mathematics for public schools in Embakasi Sub- County has been decreasing yearly. The mean score is below the national average mean grade of D plus (KNEC 2017). This study therefore sought to find out which instructional strategies have been applied by Mathematics teachers to enhance the performance of learners in Probability in Embakasi Sub- County, Nairobi County.

Statement of the Problem

From the background of the study, it is noted that there exists a link between the manner in which learners are taught and the outcomes of the results. The presentation of the content to the learner plays a big role in determining how a learner receives, retains and applies the content that is acquired. It is therefore clear that the teacher needs to use the appropriate teaching strategies to have a positive outcome. The results shown in the table 1 in the background of the study implies that Probability is widely and annually examined in the KCSE. The performance of Mathematics subject in Embakasi Sub-County has been deteriorating as indicated on Table 2. The performance of Mathematics is below national mean score and is with this in mind that this study sought to find out which instructional strategies have been put in place by the teachers of Mathematics so as to enhance the performance of learners in Probability in Embakasi Sub County, Nairobi County.

Purpose of the Study

This study sought to identify the instructional strategies applied by Mathematics teachers to enhance performance of learners in Probability in secondary schools in Embakasi Sub County. The following four specific objectives were used to guide the study:

- To identify types of instructional strategies used by Mathematics teachers in teaching Probability.
- To investigate to which extent teachers applied instructional strategies enhance learners' performance in Probability.
- To assess learners' performance in Probability as per gender.
- To investigate the considerations that teachers make when selecting instructional strategies for teaching Probability.

The study attempted to answer the following research questions:

- What are the types of instructional strategies used by Mathematics teachers in teaching Probability?
- To what extent does teachers applied instructional strategies enhance performance in Probability?
- What is the learners' performance in Probability per gender?
- Which considerations do teachers make when selecting instructional strategies?

LITERATURE REVIEW

Theoretical Framework of the Study

The study adopted constructivism theory by Jerome Bruner (1966). Constructivism as defined by Bruner (1966) is an educational theory whereby learners construct their own knowledge by a natural ability to think, by learning from environment, or by combination of both natural ability and environmental influences. Moreover, constructivism transforms the instructor's responsibility to one of assisting students in the creation of rather than creating a list of details. The instructor should have problem solving and inquiry-based learning exercises according to constructivism, so that learners can devise besides analyzing their view points, draw conclusions and assumptions and transmit their information in a cooperative learning environment (Ultanir, 2012).

Constructivist's principles emphasize inquiry, decision making, problem solving, critical thinking and reflection. Mathematics teacher of Probability is guided by these constructivist's principles in choosing an effective teaching strategy that will trigger the learner to develop his/her own knowledge for learning.

The constructivist theory supports the use of instructional strategies that will motivate the learner to be independent and create knowledge through discovery. The theory proposes that use of interactive strategies in teaching Probability will create a learning environment that allows learners to construct knowledge rather than wait for the teacher to transfer the knowledge to them (Masata, 2020). Based on theory, the study contended that for the instructional strategies to have meaningful impact on teaching Probability, their use must go beyond the mere presentation of information. They should be used to endorse learners' ability to analyse, evaluate and construct information.

Conceptual Framework

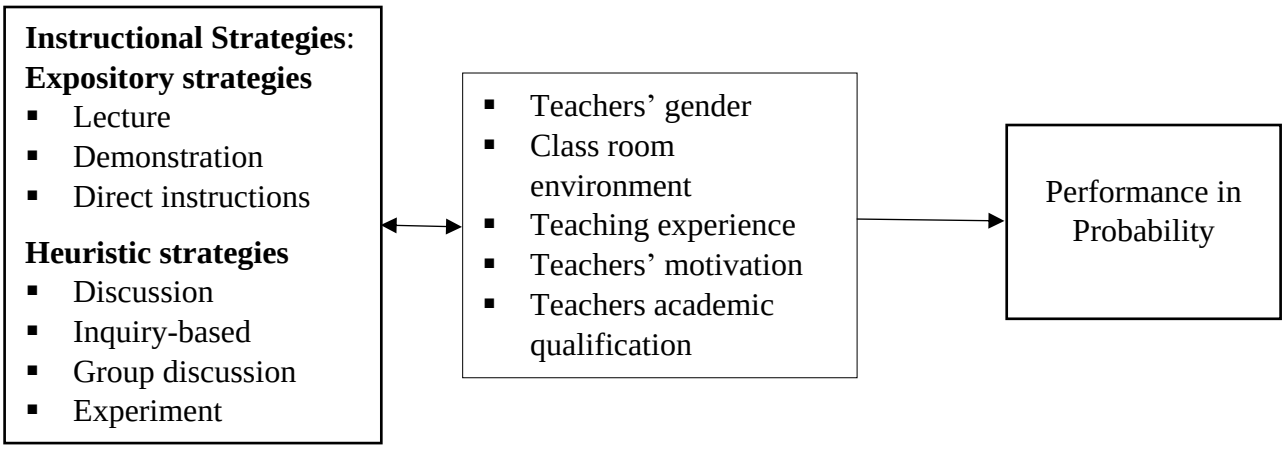

Figure 1: Conceptual framework of Instructional Strategies applied by Mathematics teachers in enhancing Learners' performance in Probability

Review of Related Literature

Types of instructional Strategies used by Mathematics teachers in teaching Probability

Several past studies have evaluated the role of teachers' instructional strategies in determining learners' performance. Vasquez and Alsina (2021) state that teaching school curriculum subjects needs a well-grounded knowledge at every level that ranges from understanding of the content to be disseminated and strategies of teaching. Atandi, Gisore and Ntabo (2019) pinpoint that to achieve the ultimate benefit of instructional process, the choices of a teachers' instructional strategy is paramount. In addition, the effectiveness of any instructional method is mirrored in the outcome of the process in terms of grades, mean scores and grades Whalen III (2012).

Teaching approaches form the integral part in any curriculum presentation and knowing instructional strategies help in planning and implementing the curriculum of Probability. The range and frequency of strategy use, the nature of the strategies or the combination of the strategies is the key to successful learning of Probability as noted by researchers (Werderich, 2008; Adams & Bushman, 2006; Barton & Smith, 2000; Smith & Johnson, 1993).

There are two broad types of strategies: Learner-centered and teacher centered. The effective use of each strategy will lead to a good connection between the way learners are taught and the learning outcomes. This is basically achieved by the preparation that the teacher will do prior to teaching and use of the selected appropriate strategy to post the positive outcomes.

According to Kisirikoi, Malusu and Wachira (2008) learner centered trains learners to think and solve problems by themselves and making them active in learning. This makes the learner centered strategies the preferred ones to be used in teaching Probability topic compared to the teacher centered where the teacher does everything and the learner is passive.

Barton and Smith, 2000; Cook & Martinello,1994 in their study found out that students who were allowed to utilize a self-directed approach to making connections with the actual topic they studied reported an increase in confidence with the material. Goddard (1972) concurs by pointing out that effective teaching –learning depends on the teaching methods and techniques applied by the teacher.

Marsi (2011) in the research on the effect of using response-based strategy for teaching poetry in English in the Jordanian University students' achievement, found out that learning strategy has an effect on performance. The research found out that response-based strategy which is a learner centered has a strong impact on performance as the experimental group scored a higher mean score than the control group (those who used the traditional strategy-teacher centered), which ended in affecting the students' proficiency in poetry.

Existing literature has revealed that most discussed instructional strategies for Probability teachings were inquiry-based learning and metacognition. The two strategies really influence leaners' academic performance in Probability.

Cook, Kennedy and McGuire (2013) states that, "metacognition falls under the constructive perspective teaching style which holds that students must remain actively engaged in the learning process, and that students shall not be reduced to the terms of passive, receivers of information. While adjusting teaching practices in order to better fit the needs of students can improve student performance in a particular class, the metacognitive perspective suggests students benefit more from being taught how to better learn the material themselves so that they can apply these strategies to every class." (p. 963).

Learners should be given the proper tools that are needed for significant learning according to the metacognitive perspective. This will enable them develop meaningful skills such as: retaining information, applying information, and creatively solving problems. The perception of metacognitive is also viewed as a reflective cognitive process guiding students' learning process. Metacognitive approach can be applied in teaching of Probability. This is because it has potential to improve learners' ability in handling compound and difficult problem-solving techniques hence improving academic performance in Mathematics.

The significance of metacognition approach was analyzed by Rickey and Stacy (2000) with regards to teaching and learning Chemistry and states that, "There are four principle facets of metacognition: descriptive and declarative knowledge of one's own mental processes, the ability to monitor one's own thinking and understanding, and the ability to regulate that thinking as well as the flexibility and inclination to apply those practices to solving problems." (p. 917).

Rickey and Stacy (2000) further argued that metacognition is fundamental in aiding learners' in developing learning skills. This is because it equips them with more dynamic and transferrable content knowledge.

Successful integration of metacognition approach by Mathematics teachers will automatically improve students' performance in Probability. Mathematics as a subject has been reported to having good results because of using peer instruction strategies (Topping, 2002). When 800 schools were surveyed, 32 percent of them were described of utilizing peer instruction as a strategy to increase the achievement of learners' (Hallam, Ireson & Davis, 2004). Walker (2007), Mesler (2009) and Spencer (2006) made observations on dissimilar kinds of learners. Even though they considered learners who were not the same, they concluded that when learners are paired with their peer instructors, they increase their performance.

Khan *et al.,* (2011) sought to establish how an inquiry-based learning influence learner's academic performance among students taking Chemistry. The study found that the learners who were taught using inquiry-based instruction had significantly higher academic achievement than learners who were instructed through traditional approach. This led to the conclusion that inquiry-based instruction improves learners' learning in the domain of chemistry.

Therefore, Mathematics teachers should view inquiry-based instruction beneficial in regards teaching Probability and improvement of learners' performance in Mathematics. In his research on teaching strategies (Macaro, 2005) concluded that instructional strategies are paramount when it comes to classroom teaching and learning. The way they are applied by the instructor determines if the learning takes place or not.

Teachers' must know and understand Mathematics; student's thinking level and pedagogical strategies to use when teaching Mathematics (NCTM, 2000). This study sought to find out the instructional strategies used by the Mathematics teachers of the Embakasi Sub County to teach Probability and if they use teacher-centered or learner-centered strategies.

To investigate extent to which teachers apply instructional strategies in teaching Probability.

Having the strategy for teaching is one thing but the way you present the strategy while teaching is as well another thing. Teachers need to be well prepared to teach Probability concept. One of the teachers' preparations is choosing the right teaching methods in teaching Probability. Several researchers have carried out studies on teaching methods. Each strategy for teaching Mathematics has different ways or methods to present the content to learners. Musyoka (2018) argued that teaching methods are main contributors for the low performance of the Mathematics in Kenya.

The observation made by the Hardman and Dawson (2008) in their research on impact of federal public policy on curriculum and instruction for students with disabilities in the general classroom; stated that, several African countries use teaching methods that have been in use for over forty years.

Use of games

Teaching Mathematics using games is one of the teaching strategies commended by Lach (2007). Lach, argued that when games are applied effectively in the Mathematics classroom, learners are encouraged to be more involved in the lesson participation.

In the United States of America (USA), investigation on how games motivate students in learning Probability in grade seven found out that learners understood Probability better and retained the Probability knowledge for a long period as compared when the teachers do not use games in teaching Probability (Nesbit & Williams, 2009).

"Psychological mind of the learner is positively influenced by games" (Ke & Grabowski, 2007, p. 249). When teachers use games in teaching Mathematics; it improves learner's self-esteem towards Mathematics generally. It as well creates a wealthy classroom environment for students to get more involved in the Mathematics classroom hence improving Mathematics ability in Probability.

Real-life application

The abstract nature of Probability concepts confuses many students during learning since they find it difficult to visualize and relate to Probability ideology to real life

Experiences. Mathematics educators need to consider employing diverse instructional strategies. This will aid learners in gaining meaningful insight and develop an enthusiastic life experience that transforms their perception on the Probability field.

When Mathematics teachers use real life application in teaching Probability, it becomes an effective teaching method. It is true to say that the world is made in Mathematics language and all what is done by human being let it be cooking, carpentry or construction Mathematics is involved. According to Farren (2008) study on application of Mathematics in real-life situations, concluded that it is very boring and difficult for learners to understand Mathematics without connecting it with their day-to-day application.

Modern technologies

Integrating technology throughout curriculum in all subjects allows students to be more engaged in the classroom, and have more confidence in the technology, which may lead toward a greater confidence in the subject (Allsop, McHatton, & Farmer, 2010). In another study by Stephen J. Hegedus, Sara Dalton, and John R. Tapper (2015) in the article *The impact of the Technology-Enhanced Curriculum on learning advanced Algebra in Us High school classrooms,* discovered that, the implementation of the technology in a high school Mathematics classroom is beneficial not only student engagement, but also to student learning.

In another research article done by Liu, *et al*., (2006), wireless technology was hypothesized to assist student's teacher interaction. Meagher, (2012) stated that, integrating technology early in education may allow the students to become more aware of not only how to use the technology, but may also give the students more confidence in the Mathematics subject.

Integration of modern technologies in instruction of Mathematics is considered as one of modern ways of teaching Mathematics. When Mathematics teachers use computers and projectors to teach on Mathematics concepts in Probability, it becomes very easy for the learners to understand the concepts. If Mathematics teachers integrate technology well in the Mathematics lesson it will be motivating to the learners and the retaining of the formulas and concepts will last longer than when technology has not been used to teach concepts in Probability.

Use of experiments

Putra, Widodo and Sopand (2017) suggested that teaching and learning through experiment is one of the best strategies for teaching for the Science teachers. In their study involving six elementary teachers who taught in third grade concluded that teacher representation of the content as a part of learning to the students is paramount.

National Council of Teachers of Mathematics Principles (NCTMP, 2000) argues that, learners learn Mathematics through the experience teachers provided. However, for better understanding of content in Mathematics and ability to apply it in solving problems is acquired through good teaching approaches and effective teaching done in the classroom by the teacher.

To assess learners' performance in Probability as per gender with respect to instructional strategies used by the teacher.

Researchers in Education have conducted many studies with aim of establishing whether student's academic performance can be associated with their gender. Brunner, Krauss and Kunter's (2007) studied achievement on Mathematics items of learners in Germany. The main aim of the study was comparing gender differences in overall Mathematics ability. According to the study's findings female students outperformed male students on ability to reason. On several specific Mathematics ability, they found male students had a significant advantage over female students (Brunner *et al.,* 2007). In another study carried out in England by Cooper and Dunne (2000) on the influence of the social-cultural background on interpretation of 'realistic' mathematical problems on the national curriculum by learners. The study established that the mean of male learners was higher than that of female learners.

This study sought to assess learners' performance in Probability as per gender.

To investigate the considerations that teachers make in the selection of instructional strategies.

Teaching Probability to the students requires the teacher to prepare well in order to achieve the objectives during the lesson. There are several considerations the teacher has to make as he selects the method to use in teaching Probability content.

Teachers' Mathematical knowledge for Teaching

Miheso (2009) argues that the challenges faced in Mathematics education are complex because the school Mathematics provides provisional knowledge only hence leading to Mathematics construct. She further described that teachers' knowledge for teaching is incorporated intensely with how teachers respond to learner's difficulties and providing substitute solutions for all students. Ball *et.al., (*2003) explained that teachers have a specialized Mathematics content knowledge for teaching. This knowledge is utilized in teaching process, representation of phenomena in Mathematics and methods of finding solution in a flexible manner. Ball and Bass (2003) pinpoints that for an instructor to teach Mathematics in a school syllabus, they require to have more than the capability of teaching the subject. An extra effort and special knowledge of teaching Mathematics is needed (Shulman, 1989).

Education depends on how much teacher knows in terms of content to be able to teach effectively (Hill, Rowan & Ball, 2005). The research done by Smith *et al.*, (2005) confirmed that teachers with enough Mathematics content knowledge perform very well in classroom teaching than the ones who have no knowledge in Mathematics content.

This line of investigation was initiated by Shulman *et al.*, (1987) in their work trying to discover what makes a teachers' knowledge. Shulman discussed three sets of teachers' subject matter knowledge. This includes curriculum knowledge, content knowledge and pedagogical content knowledge.

Content Knowledge involves how a teacher organizes knowledge in the mind for teaching. Shulman went further to explain that this knowledge is a specific one in an exact area one is trained to teach. Bruner (1960) and Schwab (1986) argues that this is how knowledge is initiated and arranged in a particular subject.

The next type of knowledge, pedagogical content knowledge as discussed by

Shulman *et al.*, (1987) involved the pedagogy of teaching with conjunction with content knowledge. The knowledge involves representations of precise content ideas in addition to an understanding of what constitutes the teaching and learning of a particular subject matter complex or simple for students (Shulman, 1986).

Additionally, Shulman (1986) highlighted on the third area of teachers' knowledge as curriculum knowledge. This is how topics are arranged in the school syllabus. For the teachers to be effective in teaching Mathematics they have to know very well how topics link to each other.

The three types of knowledge discussed by Shulman (1986) and colleagues are very paramount. Mathematics teachers are supposed to know that for effective teaching of Probability should put more weight on the understanding of concepts and formulas used in delivering of Probability. Learners will project different outcomes on issues concerning real life situations and handle different tasks in day-to-day life settings.

Moore (1997) illustrated that for a good teaching and learning to be said to have occurred is when there is a clear balance between pedagogy and the content taught in the classroom by the teacher. In contrary Ball et al. (2008) in their research pointed out that the knowledge needed to teach Mathematics is very complex and it goes beyond just knowing the content of the subject one is teaching. Knowing of the formulas by the learners is not enough for the learning of the Mathematics to take place but having conceptual learning makes understanding of the Mathematics successful.

By having a good content knowledge in Probability and use the correct teaching methods in teaching the content, Mathematics teachers will have an impact on learners learning. (Fennema & Franke, 1992)

Teachers' Teaching experience, Age and Academic Qualification

The ability of the teacher to impact knowledge contributes extensively on learners' academic performance (Alufohai & Ibhafidon, 2015). Research has proved that teacher related factors like age and teaching experience and age has a significant impact on instructional effectiveness (Brunner, Krauss & Kunter, 2007). Zafar and Aslihan (2012) found older teachers between forty-one years are good in management of classroom learning environment than those who are below. Their teaching methods and skills are more effective and efficient than young teachers in in secondary schools. Aloka and Bojuwoye (2013) concurs with Zafar and Aslihan (2012) wrote, "*younger teachers often end up making more risky decisions."* However, the scholars did not analyze the context of the learners' disciplinary issues due to inadequate experienced and immaturity in contrast to the old teachers.

Bunt analyses of Teaching and Learning International Survey (TALIS) data indicated higher scores for experienced teacher's verses beginner ones. This gave impression that early beginner teachers are less efficient and effective (Organization for Economic Co-operation and Development, 2019).

University Initial Teacher (ITE) has been criticized for being too theoretical. Their training for Mathematics teachers has been termed insufficient in preparing Mathematics teachers for the practical realities of the classroom teaching and delivery (Teacher Education Ministerial Advisory Group, 2014). This criticism is more on behavioral management (Joseph, 2017; O'Neil & Stephenson, 2012). This criticism has been termed as "ideological" (Bolton, 2019) without any rigorous investigation of what is being taught in ITE, whether this is really where the problem lies, or whether the beginning teachers are any less effective at behavior management than more experienced teachers. The effect of coupling ITE and 'teacher quality" however is, it views graduate beginner teacher as "the problem." This consequently barriers the process of finding solutions (Mockler, 2018).

The academic mastery of the subject to be taught is very key if the students are to achieve high academic performance in Probability. Monk (1994) states that undergraduates' coursework in Mathematics is positively related to students' improvement in Mathematics. Alexander and Fuller, (2005) stated that learners' achievement in academic is greater when instructed by qualified teachers than inexperienced and less qualified teachers.

METHODOLOGY

The study adopted cross-sectional descriptive survey as the research design. The research design was instrumental in allowing the researcher to gather data at one point in one time using surveys about the research phenomena. The methods of data collection were interview schedules, lesson observation, questionnaire administration to Mathematics teachers and students' Probability test and questionnaire. In addition, the cross-sectional descriptive survey research design allowed the researcher to utilize both qualitative and quantitative approaches to gather data and analysis was done by use of SPSS. The research was based in Embakasi sub-County in Nairobi County. The researcher selected Embakasi Sub County as the location of the study since it had been characterized by poor Mathematics performance in KCSE compared to other Sub Counties in Nairobi.

Embakasi Sub-county had a total of 32 Secondary schools. This consisted of 25 private and 7 public secondary schools. The study targeted public secondary schools in Embakasi Sub-County. Six schools were mixed day secondary schools while one is a girl boarding secondary school. The target population was 803 respondents.

The descriptive design was suitable for studying classroom conditions because it is non-experimental and it would allow the researcher to observe instructional strategies used in the teaching of Probability in actual Mathematics classroom without externally manipulating the subjects. The Embakasi Sub County was purposively selected because of the dismal performance among the other Nairobi Sub Counties. For the three consecutive years, 2015, 2016 and 2017 the Embakasi Sub County had performed worse than all the other eleven Sub Counties in Nairobi County.

The sample population was made up of respondents from public secondary schools in Embakasi Sub County. The study applied two sampling techniques: Purposive or selective technique and simple random sampling technique.

Mathematics teacher's questionnaire was administered so as capture both the general information of the teachers and the ability of the Mathematics teacher to identify instructional strategies, interpret student's misconception and errors they make while tackling questions on Probability. The researcher also used direct observation; the researcher was not a participant rather the researcher strived to be unconstructive as much as possible so that he does not bias the observation. Form three students participated through a Probability test so as to get performance scores for every school and compare the gender performance of the students.

Mathematics heads of the departments participated through a questionnaire so as to get the information on the teachers' instructional strategies use to teach Probability. The questionnaires adopted open questions design. The questionnaire was structured to collect data on instructional strategies that Mathematics teachers adopted in teaching Probability among form three students.

Statistical package for social sciences (SPSS) IBM version 21 premium was used to analyze the collected data. This was first done by cleaning, coding, entering in the computer and then generating required analysis as per every objective. The data was examined to distinguish Mathematics teachers' views on knowledge of teaching Probability as well as instructional strategies.

FINDINGS

The number of completed questionnaires were 140 hence the study attained a 100 percent response rate from the possible targeted 140 respondents. Therefore, the data gathered was considered suitable for analysis. Data analysis and presentation was according to the following research objectives:

- To identify types of the instructional strategies used by Mathematics teachers in teaching Probability.
- To investigate to which extent does teachers' applied instructional strategies enhance performance in Probability
- To assess learners' performance in Probability as per gender.
- To investigate the considerations that teachers make when selecting instructional strategies for teaching Probability.

Types of the Instructional Strategies used by Mathematics Teachers in Teaching Probability

The first objective for this study was to identify types of the instructional strategies used by the Mathematics teachers in teaching Probability. Table 3 showed the study respondents' responses on types of the instructional strategies used by Mathematics teacher to teach Probability.

Table 3: Teachers' Classroom Observation and Students Responses on Instructional Strategies used by Mathematics Teachers to Teach Probability

Instructional Strategy	Frequency (f)	Percentage (%)
Direct instruction	37	26.4
Inquiry-based learning	32	22.9
Discussion	23	16.4
Group work	20	14.3
Demonstration	12	8.6
Field work	9	6.4
Game-based learning	7	5
Total	**140**	**100**

According to teachers' classroom observation and the student's findings, 37 respondents representing 26.4 percent stated that Mathematics teachers use direct instruction to teach Probability content. The direct instruction is a teacher-centered teaching strategies. Thus, Mathematics teachers utilized classroom lectures to teach Probability. 32% respondents representing 22.9 percent stated that the teachers used inquiry-based learning in dissemination knowledge on Probability. The inquiry-based teaching entails teacher posing questions to the students on Probability and students would provide answers.

Furthermore, 23 respondents representing 16.4% stated the method used to disseminate Probability was classroom discussion. Twenty, twelve and nine respondents representing 16.4%, 14.3% and 8.6% respectively stated that the instructional methods utilized by Mathematics teachers to teach Probability were discussion, group work and demonstration respectively.

Additionally, nine respondents, representing 6.4 % highlighted that Probability was disseminated using fieldwork. In the fieldwork, the teachers took the students to outdoor exploration and used outdoor instructional resources to make them comprehend Probability. Finally, seven respondents representing 5 % pointed out that Mathematics teachers used game-based learning to teach Probability. Game based learning is a strategy that implements game-like elements into non-gaming activities to enhance motivation. In other words, game-based learning is instrumental in allowing students to use imagination to understand a phenomenon or a learning topic. Thus, in teaching Probability, Mathematics create an imaginary situation such as a shop for students to understand Probability in a business environment.

The study also aimed to determine instructional strategies used to teach Probability from the Mathematics teachers who were key informants. The Mathematics teachers were as well supposed to be gauged on their college training in preparation to teach Probability from the teachers' questionnaire Appendix (A) part two item 2(a). Likert scale of very good, good, fair, poor and very poor was used. The results were: very good (2), good (3), Fair (10), Poor (4) and very Poor (2). In order to classify college training, the researcher grouped the data as: proper training (sum of Very good and good), adequate training (fair) and inadequate training (sum of poor and very poor). The findings were presented in Table 4.

Table 4: Mathematics Teachers' Perspectives on College Training In Preparation to Teaching of Probability

Training	Frequency (f)	Percentage (%)
Adequate training	7	48
Inadequate Training	4	28
Proper Training	3	24
Total	**14**	**100**

Adequate teacher training means that the teachers were only conversant with basics of teaching the Probability, while inadequate training means that the training offered to teachers in terms of skills and knowledge in teaching Probability was not enough. On the other hand, proper training denotes the means of providing holistic training to teachers as far as teaching Probability is concerned. In this light the study findings shows that 7 Mathematics teachers representing 48% stated that were moderately trained to teach Probability. Additionally, 4 and 3 Mathematics teacher representing 28% and 24% respectively stated that were inadequately and properly trained respectively to disseminate knowledge on Probability.

After assessing the teachers' perspectives on college training they received to teach Probability content, the next step was to assess the instructional strategies they utilized in teach the Probability. The teachers were also required to give the instructional strategies they use to teach Probability in appendix (A) part 2 (i). Table 4 below shows the Mathematics teachers' responses on instructional strategies they used to teach students on Probability.

Table 5: Mathematics teachers Preferred Instructional Strategies to teach Probability and Learners' Average Score in Probability as per school.

School	Preferred Instructional Strategy to teach Probability
A	Experimentation, discussion question and answer
B	Discussion, group work and fieldwork
C	Discussion, games-based learning and demonstration
D	Experimentation, direct instruction and inquiry-based
E	Lecture, group work and demonstration
F	Questions and Answer, group work and discussion
G	Lecture, group work and games-based learning

From table 5 it was clear that secondary schools in Embakasi Sub County use different teaching instructional strategies to deliver Probability. Mathematics teachers adopted learner centered strategies more than the teacher cantered as it is indicated in the table 5. Only 5 out of 21 (24%) instructional strategies mentioned by the teachers are teacher centered, 76% apply learner centered to teach Probability.

This study finding agree with the Putra, Widodo and Sopandi (2017) who argued that experiment method of instruction is one of the best strategies for teaching for the Science teachers. Macaro (2005) in his study on teachers teaching strategies in

Mathematics concluded that strategies are paramount when it comes to effective and efficient instruction in a classroom. The way they are applied by the instructor determines if the learning takes place or not.

To investigate extent to which teachers applied instructional strategies enhance teaching Probability.

The second objective of the study was to investigate extent to which teachers applied instructional strategies to enhance teaching Probability. To meet this objective, the researcher looked at the frequency of ways used by the teachers under the instructional strategies by requesting the Mathematics teachers to indicate agreement level when adopting a given way (method) by use of the scale (Very Frequent (VF), Frequently (F), Occasionally (O), Rarely(R) and Never (N)) in Mathematics lessons. The data was collected by use of the teacher's questionnaire appendix (A) Part 2 (b) and classroom observation carried out during the Probability lessons. The responses were presented on Table 6 for Probability.

Table 6: Frequency of ways (methods) teachers use Instructional Strategies to teach Probability Frequency Utilization in a Term

Way(method)used	VF	F	O	R	N
Lecture	7(50%)	3(22%)	2(14%)	1(7%)	1(7%)
Question and answer	5(36%)	7(50%)	1(7%)	1(7%)	0(0%)
Demonstrations	6(43%)	4(28%)	2(14%)	1(7%)	1(7%)
Group work/discussions	2(14%)	4(29%)	5(36%)	2(14%)	1(7%)
Practical experiments	1(7%)	2(14%)	3(22%)	5(36%)	3(22%)
Computer games	0(0%)	1(7%)	2(14%)	2(14%)	9(65%)
Textbooks	3(22%)	7(50%)	4(28%)	0(0%)	0(0%)
Internet	1(7%)	2(14%)	1(7%)	2(14%)	8(58%)
Visualize (videos, photos, field trips	1(7%)	1(7%)	2(14%)	3(22%)	7(50%)
Inquiry-based instructions	3(22%)	3(22%)	2(14%)	4(28%)	2(14%)
Differentiation (grouping class tasks based on students ability	2(14%)	2(14%)	3(22%)	4(28%)	3(22%)
Practical approach (demonstrating e.g., tossing a coin	2(14%)	2(14%)	3(22%)	4(28%)	3(22%)
Technology in the classroom e.g., computers	1(7%)	2(14%)	2(14%)	3(22%)	6(43%)

The data from table 6 was interpreted by adding the VF and F column percentages 50% and above to mean high adopted ways that teachers use instructional strategies to teach Probability, below 50% to mean least ways applied by teachers to teach Probability. The results showed that majority (86%) of teachers always use question and answer method, lecture, demonstrations and textbook centered learning (71%) or above, inquiry-based (44%) group discussions/co-operative learning (43%), Practical approach (28%), differentiation (28%), internet and other technologies (21%), visualization (14%) and computer games (7%) as their instructional strategies of teaching Probability. From the data presented it was clear that the highest number of the teachers in the Embakasi Sub County used more teacher centered approaches than learner centered and modern technologies to present Probability to the learners. This teacher centered approaches instructional strategies could be the main cause of dismal learner performance in Mathematics especially Probability content areas in Embakasi Sub County.

The study also aimed to assess whether metacognition and inquiry played a role in determining learners' performance in Probability when different instructional strategies were used. The study tested the findings from the 14 Mathematics teachers on whether metacognition and inquiry-based learning improves learners' performance in Probability. Results showed, 79 percent of the Mathematics teachers with a frequency of 11 stated that metacognition and inquiry-based learning determine learners' performance in Probability when different instructional strategies are utilized. Conversely 21 percent Mathematics teachers with a frequency of three pointed out that metacognition and inquiry-based learning does not affect leaners' performance in Probability. Abdelrahman (2020) define metacognition as the capability of students to undertake several necessary steps that are ideal in solving challenges they encounter, evaluate consequences and modify and design new approaches using prior knowledge.

Zulkiply (2009) states that metacognition is simply defined as the "thinking about thinking". Thus, metacognition assists students to successfully attain a personal goal of selecting effective learning strategies to comprehend a content. On the other hand, inquiry refers to a systematic or in-depth investigation or examination of information. Thus, effective models' inquiry and metacognition have a significant influence in learners' comprehension of Probability. Learners with effective inquiry strategies are able to acquire in-depth answers on complex Probability and contribute to their understanding and vice versa. On the other hand, learners with effective metacognition are able to have effective learning strategies and provide suitable solutions to Probability thus achieving a higher mastery and high performance in the content and vice versa.

During oral interviews with Mathematics heads of department, who were key informants, six of them representing 86% noted that Mathematics teachers mostly adopt teacher-centered which consecutively led to poor performance in Probability among learners. Most of the key-informants stated that adopting teacher centered approaches to teach Probability was high due to strict timelines to cover the syllabus. Teacher-centered approaches provide a platform for the Mathematics teachers to dominate classroom activities rather than give learners a chance to contribute in knowledge making. Thus, utilizing teacher-centered approaches in teaching Probability creates boredom among the students since they are not involved in the learning processes leading to low performance in Probability.

To assess learners' performance in Probability as per gender

The third objective was to assess learners' performance in Probability as per gender. To obtain and describe variation of Probability performance scores by gender, descriptive statistics was done on students' scores in Probability test. The findings were as shown on Table 7.

Table 7: students' average scores performance on Probability as per their gender from seven public schools in Embakasi Sub County.

School Code	Sample Size	Gender	Average Score
A	20	M	63
B	20	F	55
C	20	F	50
D	20	M	48
E	20	M	43
F	20	F	36
G	20	M	32

Study findings indicated that, only one male secondary school scored above 50% and only two girls' schools scored 50% and above. The other secondary schools scored below 50%. This implies that there is no significant difference in learners' performance in Probability test when taught using different instructional strategies. The average scores per gender of students were as shown in Table 8.

Table 8: students' performance scores in Probability by Gender

Students Gender	Number Students	Average Score	Standard Deviation
Male	80	46.5	11.15
Female	60	47	8.04

Table 8 showed that female learners scored slightly higher average scores in Probability test than male counterpart with average scores of 47 % and 46.5 % and standard deviations of 8.04 and 11.15, respectively. This establishes that both female and male learners had similar scores when taught using different instructional strategies.

Table 9: Independent t-test for students' Achievement in Probability

Gender	N	Mean	Standard deviation	t-value	df	Sig. (2-taile d)
M	80	46.5	11.15	0.294	138	1.960
F	60	47	8.04			

Table 9 showed the analysis of t-test. It reveals that the difference between male and female learners score in Probability test, female (mean = 47, SD=8.04) and male (mean= 46.5, SD =11.15) was not significant since $t(140) = 0.294, < p = 1.960$ with $\alpha = 0.05$. Hence the null hypothesis which stated that there was no statically significant difference in performance in Probability test between male and female students when taught with use of the different instructional strategies was accepted. This means there is no significant difference among students by gender when taught Probability using different instructional strategies. The findings agree with Brunner, Krauss and Kunter's (2007) study performance on Mathematics items of students in Germany where they found out that girls slightly out performed boys on reasoning ability performance. These was a bit difference with the study done in England by Cooper and Dunne (2000) on their influence of the social – cultural background on students' interpretation of 'realistic' Mathematical problems on the national curriculum where they found out that the means of boys were higher than of girls.

To investigate the considerations that teachers make when selecting the instructional strategies for teaching Probability.

The fourth objective was to investigate the considerations that teachers make when selecting instructional strategies to teach Probability. These considerations formed the intervening variables that participated in

performance of the learners in Probability apart from teachers teaching instructional strategies. The considerations apart from instructional strategies were; teaching knowledge, teachers experience, teachers' gender, teachers' age, and teachers' academic level.

Mathematical Knowledge that Exists for Teaching Probability

The Mathematical knowledge for teaching that exists for teaching Probability consists of several types of knowledge (subject content knowledge, PCK, curriculum knowledge, student knowledge) as discussed by (Aminah & wahyuni, 2018). Pedagogic content knowledge has three components namely (1) content, (2) knowledge and (3) pedagogy (Turnukly, 2007).

Teachers' pedagogical content knowledge in teaching Probability in secondary school was a consideration in this study. To be able to attain this objective Mathematics teachers were requested to answer written tasks based on pedagogical content knowledge used to teach Probability in Appendix A part 111 item 1, 2 and 3. The pedagogic content was consolidated in three Mathematics questions requiring different levels of knowledge to answer them. The same questions were part of questions done by the students. The questions sought to establish teachers' knowledge to teach Probability. The teachers' knowledge was measured in the ability of the teacher to explain and interpret student's mistakes and misconception made by the learners in the three Items. The normal class teaching observation carried out by the researcher helped to gauge the teachers' ability in teaching. The marking scheme helped as well to gauge the teachers' ability to teach.

Table 10: Teachers Knowledge in Teaching Probability

Number of teachers	Percentage % (content knowledge)	Teachers' explanation on learners' misconception
14	100	It was an *excellent* performance. Teachers were able to get right the misconceptions and errors done by the students in their calculations.

From the table above, which was obtained from the three items the teachers tackled in their questionnaire, it was clear that teachers' knowledge was adequate for teaching Probability in public secondary schools. The teachers' performance in the Probability questions indicated that the teachers have the three types of knowledge discussed by Shulman, (1987) in his work trying to discover what makes a teachers' knowledge. Shulman discussed three categories of teachers' subject matter knowledge. These included pedagogical content knowledge, curriculum knowledge and content knowledge.

In the content knowledge, it was about how a teacher organizes knowledge in mind for teaching. Shulman went further to explain that this knowledge is a specific one in an exact area one is trained to teach. Bruner (1960) and Schwab (1986) note that this is how knowledge is initiated and arranged in a particular subject.

The next type of knowledge, pedagogical content knowledge as discussed by Shulman et al. (1987) involved the pedagogy of teaching in conjunction with content knowledge. It involves representations of precise content idea, proper understanding of what makes the teaching and learning of a particular subject matter easy or compiles for students Shulman (1986). Shulman further talked on the third area of teachers' knowledge as curriculum knowledge. This is how topics are arranged in school syllabus. For the teacher to be effective in teaching Mathematics, has to know very well how topics link to each other. However, the findings disagree with those of Ball, Hill and Bass (2005). Ball et al asserted that slight enhancement is achieved with no direct attention teaching process. Also, several research supports the contention Mathematics teachers have inadequate confidence and content knowledge when teaching Probability and Mathematics in general (Ambrose, 2004;

Evans, 2011; Hill et al., 2008; Kajander, 2005; Norton, 2010; Tsao, 2005). Askew (2008) echoed this assertion by quoting "several potential and practicing secondary teachers' expresses, a lack of confidence in their mathematical knowledge." (p. 25)

Teachers' Gender and Learners' Performance in Probability

The study sought to ascertain whether Mathematics teachers' gender plays part in learners' academic performance in Probability. The study tested on whether teachers' gender impacts learners' performance in Probability. According to the analysis, 64 percent of the respondents sated that Mathematics teachers' gender role in their mastery and academic performance in Probability is paramount. In contrast, a total of 36 percent of the respondents stated Mathematics teachers' gender does not affect their performance in Probability. The findings corroborate with UNESCO report (2016) which state that teachers' gender has an impact on learning and achievement in Mathematics. However, the findings disagree with those of Mutai (2011) who results revealed that regardless of Mathematics teachers' gender, learners learn Mathematics well.

Teachers Academic Qualification

Academic qualification of teachers determines the professional development of a person.

Mathematics teachers were required to indicate their highest academic qualification.

The findings were as shown on Table 11 below

Table 11: Mathematics teachers' academic qualification

	Frequency (f)	**Percentage (%)**
Diploma (Education)	2	14.3
Degree (B.E.D)	10	71.4
Masters (M.E.D)	2	14.3
PhD	0	0.0
Total	**14**	**100.0**

Table 11 showed there were more teachers representing 71.4 percent with bachelor's degrees in education. However, none of the teachers had a PhD. The results show that all the teachers were qualified to teach in secondary school. For quality and effective teaching of the Mathematics in the secondary school, a teacher is required to have a minimum of a diploma in education. This was observed in the way teachers explained on how to handle the Probability questions in the teachers' questionnaire. All teachers had adequate subject content knowledge on Probability items presented to them in the questionnaire. This matched the teachers' academic qualifications. This was supported by the findings done by Monk (1994) who quoted that, "undergraduates' coursework in Mathematics is positively related to students' improvement in Mathematics." (p. 125)

Alexander and Fuller (2005) also affirmed that high qualified Mathematics teachers make students achieve better grades than those of lower qualification. This indicates that academic qualification of teacher impacts performance of the students. The exposure of Mathematics teachers to degree training enables them to acquire effective teaching and learn more strategies of learning and teaching complex topics like Probability.

Mathematics Teachers Teaching Experience

Mathematics teachers were also required to indicate their experiences in teaching Mathematics. Their responses were presented in Table 12.

Table 12: Mathematics Teachers' Teaching Experience

Years of Experience	**Frequency (f)**	**Percent (%)**
Below 5	2	14.3
5 -10	6	42.9
11- 15	5	35.7
Above 15	1	7.1
Total	**14**	**100**

Table 12 showed (42.9%) of the Mathematics teachers had been teaching for 5 – 10 years followed by 35.7 % who had taught for 11-15 years, 14.3% had teaching experience of less than 5 years and 7.1% had Mathematics teaching experience of above 15 years. Therefore, these findings indicate that all the teachers had enough experience as required for this study. During lesson observations, the researcher observed that the teachers who have told Probability for many years, delivered Probability content better and simpler to learners as compared to the one who have taught for few years. Teaching experience seemed to be swaying the way Probability was taught to the students. These findings incline to Zafer and Aslihan (2012) whose findings quoted "older teachers of age 41years old and above are more effective in teaching and good in classroom management skills than young teachers in high school." (p. 1310)

Summary and Discussion on considerations related to the Mathematics Teacher

To summarize and analyze on the teachers related factors the teachers were requested to indicate their opinion concerning the statements in Table 13 using a 5- point Likert scale using SD-strongly disagree, D-disagree, N-neutral, and A-agree and SA-strongly agree. The findings were as shown in Table 13.

Table 13: Mathematics teachers' considerations on instructional strategies in teaching Probability content.

Strategy	SD	D	N/S	A	SA	Total
Teachers academic level influence teaching of Probability.	1(7%)	2(14%)	1(7%)	7(50%)	3(22%)	14(100%)
Teachers gender influence performance in Probability.	7(50%)	1(7.1%)	2(14.3%)	2(14.3%)	2(14.3%)	14(100%)
Teachers age influence performance in Probability.	1(7%)	7(50.0%)	1(7%)	3(22%)	2(14%)	14(100%)
Experienced teachers teach better	1(7%)	3(22%)	2(14%)	7(50%)	1(7%)	14(100%)
Administration support influences performance	(28.5%)	1(7%)	3(22%)	4(28.5%)	2(14%)	14(100%)
Schools with enough teaching and learning resources are better	1(7%)	2(14%)	1(7%)	7(50%)	3(22%)	21(100%)

Table 13 above showed that (52.4%) of the Mathematics teachers indicated that teachers academic attainment influences the way they teach Probability. This was followed by 47.6% who strongly disagreed that teachers' gender influenced the performance in Probability. Many respondents (47.6%) believed that the experienced teachers teach better. More over 47.6% of the respondent agree that schools with enough teaching and learning resources do better but 52.4% of the participants disagreed with the age of the teachers' affects performance in Probability. The support from the administration to performance the respondents gave mixed reaction 28.5% strongly disagree and 28.5% strongly agree with it.

The Head of Mathematics Department Response during Interview.

The following findings are based on the responses given by the head of the Mathematics department during interviews. Interviews were carried out on participating heads of Mathematics departments. The interview sought administrative perspective on teachers' instructional strategies they use to teach Probability, Mathematics knowledge for teaching and teacher professional development efforts. The interview helped the researcher to confirm and strengthen on what was observed during teachers' lesson. Table 14 below shows summary of some of the responses by the head of department.

Table 14: Responses by Head of Mathematics Department

Question	Responses
1-1 What do you think is the biggest challenge for Mathematics teachers?	Completing syllabus, class size and students' attitude (72%)
1-2 How do you deal with these problems?	Teaching as per the time table to cover syllabus in time (79%)
1-4 What is the administrative support on teaching Probability to the Mathematics department?	They provide the required teaching aids such as dice (88%)
1-5 What is the main concern about teaching Mathematics that has been brought to your attention?	It is hard to cover the syllabus due to the big number of the students and negative attitude towards the subject (66%)
1-6 How can you describe the availability of Mathematics teaching and learning resource situation?	Text books are available for every student from government but the other resources are not easily available (69%)
1-7 What challenges if any do the teachers face in the teaching of the Probability topics in your school	Negative attitude from the students and difficulties in doing pedagogy on the two topics (60%)
1-8 What solutions have you offered as the Head of Mathematics Department?	Teachers to cover syllabus in time to have sufficient time to do remedial on the two topics (65%)
Teaching 2-1 Which teaching-learning strategies and do teachers of Mathematics use? learning strategies	Demonstration, discussion, group work (90%)
2-1 How do you feel about use of activities in Mathematics lessons?	Not fully utilized by Mathematics teachers (70%)
2-3 How often do you check on teachers teaching methods?	Very rare. Teachers are expected to deliver by their own (76%)
2-4 In what way does the Principal support your department to ensure effective implementation of the Mathematics Curriculum	Partially gives support to us. Supports workshops such as SMASSE (78%)

The teachers stated that, most schools were more concerned with the completion of the syllabus rather than how the Probability is to be taught to the students in the classroom. During lesson observation, many Mathematics teachers did not take more time in taking care of the slow learners who never understood the subject matter of the content. It was noted that majority of teachers were using teacher centered method in teaching Probability. This data helped the researcher to get more information on teachers teaching strategies and the knowledge teachers have in terms of the teaching the subject matter. Furthermore, the data helped the research to compare and contrast the data had collected from the classroom lesson observation and by the use of the teachers' questionnaire.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of the study was to assess instructional strategies applied by Mathematics teachers to enhance performance of learners in Probability in secondary schools in Embakasi Sub County. The first objective aimed at identifying the instructional strategies used by Mathematics teachers in delivering Probability to learners.

Instructional strategies that the study respondents identified were used in teaching Probability were direct instruction, inquiry-based learning, discussion, group work, demonstration, fieldwork and question and answer. In most cases, the identified instructional strategies were used as a combination but the most common was the direct instruction that involved teacher-centered classroom lectures. The teacher-centered classroom discussion did not involve students in creating Probability knowledge leading them to have negative attitudes, poor mastery and low academic performance.

The second objective was to investigate to which extent teachers applied instructional strategies enhance learners' performance in Probability. The results showed that majority of teachers at 86% always use question and answer strategy, lecture, demonstrations and textbook centered learning (71%) or above, inquiry-based (44%) group discussions/co-operative learning (43%), Practical approach (28%), differentiation (28%), internet and other technologies (21%), visualization (14%) and computer games (7%). as their instructional strategies of teaching Probability. From the data presented it was clear that the highest number of the teachers in the Embakasi Sub County used more teacher centered approaches rather than learner centered and modern technologies to present Probability to the learners. This teacher centered approaches instructional strategies can be the main cause of dismal learner achievement in Mathematics especially Probability in Embakasi Sub County. For more information from the teachers on objective two, the researcher found out that the teachers use of metacognition and inquiry strategies enhance on learners' performance in Probability. 79% of the 14 Mathematics teachers who were key informants stated metacognition and inquiry plays a key role in determining how students comprehend Probability concepts when different instructional strategies are used. On the other hand, 21% of the teachers stated that the two concepts do not have any influences in understanding of Probability concept.

The Mathematics head of departments explained that teacher-centered strategies may cause students to have poor performance as they are not given a chance to participate in the knowledge creation process. Therefore, secondary schools in the study area that adopt teacher-centered approaches performed poorly in the Mathematic subject and especially in the Probability. This therefore confirms that instructional strategies influence learners' achievement in Probability. The learners instructed through learner centered strategies scoring more than learners instructed through teacher centered instructional strategies.

The third objective focused on assessing learners' performance in Probability as per gender. From the discussions done in chapter four of this study it was found out that, the students' gender did not impact the learner's performance as per the study analysis done using mean, standard deviation and t-test. The study analysis revealed that the difference between male and female learners score in Probability test, female

(Mean= 47, SD=8.04) and male (m*ean= 46.5, SD=11.15)* was not significant difference among students by gender when taught Probability content using different instructional strategies. The t-test confirmed that, $t(140) = 0.294$, $< p = 1.960$ with $\alpha = 0.05$. Hence the null hypothesis which stated there was no statically significant difference in performance in Probability test between male and female students when taught Probability.

The fourth objective aimed to investigate the considerations that teachers make when selecting instructional strategies for teaching Probability. The study investigated existing Mathematical knowledge as one of the considerations that teachers require to teach Probability to learners. Mathematical knowledge comprises of pedagogy knowledge, content knowledge and how a teacher is supposed to unite the two types of knowledge for better teaching of Probability.

Another consideration that the study found out that enhanced teaching of Probability is gender of the teachers. 64% of the study respondents stated that teacher's gender determines their concentration in class hence enhances the mastery of Probability and performance. Conversely, 36% of respondents stated that teachers' gender does not affect their mastery and academic performance in Probability. From the discussions obtained from the teachers' questionnaire, teacher academic qualification also plays a significant role in determining the

dissemination of Probability. The study findings indicate that 7.4 % of the teachers in the study area had bachelor degree qualification. The exposure of Mathematics teachers to degree training enables them to acquire effective teaching and learn more strategies of learning and teaching complex topics like Probability. Most of Mathematics teachers at 42.9 % within the study area had five years of experience, while 37.5 percent had 11-15 years, 14.3 percent had less than five years of experience and 7.1 percent had above 15 years of experience. Thus, despite most the teachers in the study area having credible academic qualifications, they lacked an in-depth experience in dissemination of Probability.

Conclusions

This study evaluated the types of instructional strategies applied by the Mathematics teachers to teach Probability. The study found out that the instructional strategies utilized to teach Probability in the study area were; direct instruction, inquiry-based learning, discussion, group work, demonstration and questions and answer. From the results it is clear that secondary schools in Embakasi Sub County use different teaching instructional strategies to teach Probability. Mathematics teachers adopted learner centered strategies more than the teacher cantered as it is indicated in the results. Only 5 out of 21 (24%) instructional strategies mentioned by the teachers are teacher centered, 76% applied learner centered to teach Probability. Therefore, the study concludes that the teachers applied both learner centered and teacher centered strategies in teaching Probability. The study concludes that the learner centered strategies are more favored to the lecture strategies.

The study evaluated the extent by which instructional strategies applied by the teachers enhance learning in Probability. The results showed that majority (86%) of teachers always use question and answer method, lecture, demonstrations and textbook centered learning (71%) or above, inquiry-based (44%) group discussions/co-operative learning (43%), Practical approach (28%), differentiation (28%), internet and other technologies (21%), visualization (14%) and computer games (7%) as their instructional strategies of teaching Probability. The study concludes that the teacher centered methods were commonly employed strategies although the teachers occasionally use group discussions, technologies and practical approaches. This study concludes that the lecture method is favored to the other strategies because it is easier to implement and does not require much experience or sophisticated teaching skills.

Regarding learner's performance and their gender, the study concludes that student's performance was the same for both genders of the students. The t-test done on the results reveals that the difference between male and female learners scores in Probability test, female (mean = 47, SD=8.04) and male (mean= 46.5, SD =11.15) was not significant since $t(140) = 0.294$, $< p = 1.960$ with $\alpha = 0.05$. Hence the null hypothesis which stated that there was no statically significant difference in performance in Probability test between male and female students when taught with different instructional strategies was accepted. Therefore, the study concludes that there is no significant difference among students by gender when taught Probability content using different instructional strategies.

On the other considerations that teachers make when choosing the instructional strategies, the study concludes that the considerations such as teaching experiences, teaching knowledge and teachers' gender are paramount when choosing the strategy to apply in teaching Probability. From classroom observation it was clear that, teachers who have taught Probability for many years utilized their strategies better compared to those haven't taught for many years. Therefore, from the findings this study concludes that; teachers need to do considerations of knowledge they have on instructional strategies, their academic level of learning and on their teaching experience as they choose instructional strategies to teach Probability.

Recommendations

The factors listed below include recommendations based on the study's interpretation, outcomes and conclusions.

- The study concludes that the teachers applied both learner centered and teacher centered strategies to teach Probability. Utilizing several approaches to teacher Probability will play crucial role to eliminate the shortcoming of each method. In addition, secondary schools in the study can benchmark in other sub counties on instructional strategies utilized and replicate them in their institution.
- Teacher centered methods were commonly employed strategies although teachers occasionally used group work discussions and practical approaches. The study revealed that the Mathematics teachers have a challenge in applying a balanced instructional strategies in teaching Probability. Regarding this problem the study recommends that the schools should increase in-service trainings in schools and regionally as well as team teaching so as to help teachers to know how to use a mix of teacher-centered, learner-centered and self-directed learning approaches.
- The study concludes that there is no significant difference in Probability performance between male and female students. The teachers need to select their teaching strategies to teach all the students Probability irrespective of their gender.
- The study established that the teachers with little experience in teaching Probability that is less than ten years had much difficult in applying the instructional strategies compared to more experienced Mathematics teachers. To solve this challenge the study also recommends that an internship program for teachers of Mathematics to be developed to form part of professional development for secondary school teachers after training in University. This will strengthen their teaching experience which promotes positively the teaching and performance of the students.

Suggestions for Further Studies

The study suggested the following areas for further research:

- Similar research should be carried out in other Sub Counties so that the results can be extended to a broader region.
- The research was based on strategies used to teach Probability. Further investigation in the similar scope could look at the variables that were not studied in the depth in this report, such as teachers experience and strategies, teachers' knowledge on strategies and teachers' training on strategies.

REFERENCES

Abdelrahman, R. M. (2020). Metacognitive awareness and academic motivation and their impact on academic achievement of Ajman University students. Heliyon, 6(9), e04192.

Alexander, C., & Fuller, E. (2005). 1. Effects Teacher Qualifications on student

Allsopp, D. H., McHatton, P., & Farmer, (2010). Technology, Mathematics Ps/rti,

Aloka, P., & Bojuwoye. (2013). 1.Gender, age and teaching experience differences in decision making behaviors of members of selected Kenyan secondary school disciplinary panels. Asian social sciences, 9(10). Doi:10.5539/ass.

Alufohai, P., & Ibhafidon, H. (2015). (2015). Influence of teachers age, marital status and gender on students 'academicachievement. Asian Journal of Educational Research,3(4).60-66.

Ambrose, R et al., (2004). Initiating change in prospective elementary school teachers' orientations to Mathematics teaching by. Building on beliefs. *Journal of Mathematics Teacher Education* 7(2), 91-119. http://dx.doi.org/10.1023/B:JMTE.0000021879.74957.63

Aminah, N., & wahyuni, I. (2018). Design of capability measurement instruments pedagogic content knowledge (PCK) for prospective Mathematics teachers. *Journal of Physics: Conference Series (Vol. 1013, No. 1, p. 012112). IOP Publishing.*

Askew, M. (2008). Mathematical discipline knowledge requirements for prospective primary teachers, and the structure and teaching approaches of programs designed to develop that knowledge. In P. Sullivan and W.

Terry (s.), Knowledge and Beliefs in Mathematics Teaching and Teacher Development (pp. 13-36). Rotterdam: Sense

Atandi, B. C., Gisore, B., & Ntabo, A. J. (2019). Influence of Teaching Methods on

Ball, D. L., & Bass, H. (2003). Toward a practice-based theory of mathematical knowledge for teaching. *Proceedings of the 2002 Annual Meeting of the Canadian Education Study Group, CMESG/GCEDM*, (PP3-14).

Ball, D. L., Hill, H.C., & Bass, H. (2005). Knowing Mathematics for teaching: Who knows Mathematics well enough to teach third grade, and how can we decide? American Educator 29 (1), 14-17.

Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59(5), 389-407*.

Ball, D., Thames, M., & Phelps, G. (2008). Content knowledge for teaching: What makes it special. Journal of teacher education, 59(5), 389-407.

Barton, K., & Smith, L. (2000). Themes or motifs? Aiming for coherence through interdisciplinary outlines. Reading Teacher, 54 (1), 54-63.

Bolton. (2019). Ideology cruses teachers' ability to control classes.

Cook, E., Kennedy, E., & McGuire, S. (2013). The Effect of Teaching Metacognitive Learning Strategies on Performance in General Chemistry Courses. Journal of Chemical Education, 90, 961- 967.

Crouch, C., Fagen, A.P., Callan, J.P, & Mazur,E. (2004).Classroom demonstrations:

curriculum on learning advanced Algebra in US high school classrooms. *Education Technology Research and Development* 63(2), 203-228.

Development, O. f.-o. (2019). Organization for economic co-operation and development September 10). Review education policies; Learning time and disciplinary climate.

Farren, V. (2008). A reflection on my teaching practices using students' Math moments. *College Quarterly, 11(4), 74-81*.

Fennema, E., & Franke, M. L. (1992). Teachers Knowledge and its impact. *In Grouws, D.A (Ed), Handbook of research in Mathematics Teaching and Learning2003,4thEdition, NCTM: Reston, VA*, (pp147-163).

Githua, B. N., & Mwangi, J. G. (2003). Students' Mathematics self-concept and motivation to learn Mathematics: relationship and gender differences among Kenya's secondary school students in Nairobi and Rift Valley Provinces. *International Journal of Educational development, 6(23), 487- 499.*

Goddard, N.L. (1972). Literacy, language experience approaches. London:

Hallam, S., Ireson, J., & Davis. (2004). Grouping practices in the primary school:

Hardman, M. L., & Dawson, S. (2008). The impact of federal public policy on curriculum and instruction for students with disabilities in the general classroom. Preventing School Failure: Alternative Education for Children and Youth, 52(2), 5-11.

Hegedus, S. J., Dalton, S., & Tapper, J.R. (2015). The impact of technology-enhanced

Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' Mathematical knowledge for teaching on student achievement.*American Educational Research Journal 42,371-406*.

Joseph. (2017). Getting the most out of Gonski2.o: The evidence base for school investments.

Ke, F., & Grabowski, B. (2007). Game playing for Mathematics learning: Cooperative or not? *British Journal of Education Technology, 38(2), 249259*.

Kenya Institute of Curriculum Development. (2002). *Kenya Certificate of Secondary Education Syllabus. Nairobi: Government Printers*.

Kenya National Examination Council (KNEC) (2017). The year 2017 KCPE

Khan, S. M., Hussain, S., Ali, R., Majoka, I. M., & Ramzan, M. (2011). Effect of Inquiry Method on Achievement of Students in Chemistry at Secondary Level. International Journal of Academic Research, 3, 955-959.

kisiriko, F., Wachira, L., & Malusu. (2008). Distinction education for primary teacher education. Nairobi.

Kisirikoi, F., Wachira, L. & Malusu, J. (2008). Distinction education for primary

Kisirikoi, F., Wachira, L., & Malusu, J. (2008). Distinction education for primary teacher education. Nairobi.

Liu, C.-C., Chou, C.-C., Liu, B.-J., & Yang, J.-W. (2006). Improving Mathematics

Ma, L. (1999). Knowing and teaching elementary Mathematics. *Teachers' understanding of Mathematics in China and the United States. Mahwah, N.J Lawrence Erlbaum Associates*.

Macaro, E. (2005). Strategies for language learning and for language use: Revising theoretical framework. *The Modern Language Journal, 89 (1), 37-53.*

Marsi, A.(2011).The effect of using response – strategy for teaching English poetry

Masata, M. (2020), challenges of ICT based constructivist approach in teaching

Meagher, M. (2012). Students' relationship to technology and conceptions of

Mesler, L. (2009). Making Retention Count: The Power of Becoming a Peer Tutor. Teachers College Record, 11(8), 1894-1915.

Ministry of Education (2006) secondary Mathematics teachers' guide Nairobi: Kenya

Mockler. (2018). Early career teachers in Australia: A critical policy historiography Journal of Education policy,33(2) (2018), pp 262-278.

Monk, D. (1994). Subject Area Preparation of Secondary School Mathematics and Science Teachers and student Achievement. Economics of Education Review ,1 (2), 125-145.

Moore, D. S. (1997). New pedagogy and new content: the case of statistics (with discussion). *International Statistical Review, 65, 123- 137.*

Moore, D. S. (1997). New pedagogy and new content: The case of statistics. International statistical review, 65(2), 123-137.

Musyoka, J. (2018). School based factors influencing students' performance in Kenya certificate of secondary examination in public Secondary schools in Kathiani Sub-county (Doctoral dissertation).

Mutai, C.C (2011). Gender Differences in Mathematics Performance Among Secondary School Students in Bureti Sub-County, Kericho County

National Council of Teachers of Mathematics. (2000). *Professional Standards of Teaching Mathematics. Reston, WA: Author.*

Nisbet, S., & Williams, A. (2009). Improving students' attitudes to chance with games and activities. *Australian Mathematics Teacher, 65(3), 25-37.*

O'Neil, & Stephenson. (2012). Does classroom management coursework influences pre-service teachersperceive preparedness or confidence?

Organization for Economic Co-operation and Development (2019). Organization for economic co-operation and development September 10). Review education policies; Learning time and disciplinary climate. (2010).

Oxford, R.L. (1990). Language learning strategies: what every teacher should know.

Paimin, A. N., Hadgraft, R., Prpic, K., & Alias,M. (2011,January).*Learning strategy,*

Putra, M. A., Widodo, A., & Sopandi, W. (2017). Science teachers' pedagogical content knowledge and integrated approach. *In Journal of Physics: Conference Series (Vol. 895, No. 1, p. 012144). IOP Publishing*.

Putra, M., Widodo, A., & Sopandi, W. (2017). Science teachers' pedagogical content knowledge and integrated approach. In Journal of Physics: Conference Series (Vol. 895, No. 1, p. 012144). IOP Publishing.

Rickey, D., & Stacey, A. (2000). The Role of Metacognition in Learning Chemistry. Journal of Chemical Education, 77, 7, 915-920.

Shulman, L. M. (1986). Those who understand knowledge growth in teaching. Educational Research.15 (2),4-14.

Shulman. (1987). Knowledge and teaching foundations of the new reform. Harvard Educational Review. 57 (1)., 1-22.

Smith, J. & Johnson, H. (1993). Bringing it together: Literature in an integrated

Spencer, V. (2006). Peer Tutoring and Students with Emotional or behavioral Disorder. A Review of the Literature. Behavioral Disorders, 31(2), 204 -222.

Topping, K. (2002). Peer and parent assisted learning in Math, Science and ICT, spotlight 8. Glasgow, Scottish center for research in Educational.

Turnukly. (2007). The pedagogical content knowledge in Mathematics. Pre-service primary Mathematics Teachers' perspective in Turkey IUMPST: The Journal 11-13.

Ultanir, E. (2012). An epistemological glance at the constructivist approach: Constructivist learning in Dewey, Piaget, and Montessori.Intenational Journal of Instruction,5(2), 195-212.

Umameh, M. A. (2011). A Survey of Factors Responsible for Students' poor users.math.umd.edu/~dac/650/bowespaper.html

Vásquez, C., & Alsina, Á. (2021). Analyzing Probability Teaching Practices in Primary Education: What Tasks Do Teachers Implement? Mathematics, 9(19), 2493.

Walker, E. (n.d.). The Structure and Culture of Developing a Mathematics Tutoring Collaborative in an Urban High School. The High School Journal, .

Werderich, D. (2008). Bringing family and community into the writing curriculum

Widodo, A. (2017). Teacher pedagogical content knowledge (PCK) and students' reasoning and wellbeing. In journal of physics: Conference series (Vol. 812, No. 1, p. 012119). IOP Publishing.

Wood, W., & Gentile, J. M. (n.d.). Teaching in a Research Context Science 302: 1510.

Zafer, U., & Aslihan, U. (2012). The impact of the years of teaching experience on the classroom management approaches of elementary school teachers. International Journal of instruction,5(2),e-ISSN;1308-1470.www.e-iji.net p. ISSN;1694-609x.

Zulkiply, N. (2009). Metacognition and its relationship with students' academic performance. The International Journal of Learning, 15(11), 97-106.