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Teacher and Student Based Instructions on Probability Achievement Outcomes and Attitudes of Secondary School Students in Bungoma North, Kenya

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Abstract
Teacher based is the usual instructional method used by most teachers in high school. Traditionally, teachers direct the learning and students work individually and assume a receptive role in their education.Student based learning approach is an instructional use of small groups of students working together to accomplish shared goals to increase everyone's and their own achievement. With the advert of progressive education in the 19th century and the influence of psychologists, educators have largely replaced teacher based curriculum approaches with "hands-on" activities and group work where the child determines on his own what he/ she wants to do in class.The current study investigated the effect of "teacher" and "student based" instructions on probability achievement outcomes and attitudes of secondary school students in Bungoma North district, Kenya. It tries to explore the possibilities of exposing students to pedagogical practice which will actively engage them into the learning process and improve their performance in probability. The study will also inspire mathematics teachers to use appropriate teaching approaches that incorporates constructivist teaching characteristics that can enhance active participation of students and at the same time offer insight into patterns of student thought (understanding of mathematical concepts and processes) as well as their perception of, and attitudes towards solving and mathematics in general.Seymour Paper's theory of constructionist provides the frame work for this study. The study utilized the matching only pretest – posttest control group design. The experimental group (N=100) used student based learning approach, while the control group (N=100) used teacher based approach. The study targeted 660 Form three students.Attitude and probability scores were collected from (N=200) students in five secondary schools. It was analyzed by descriptive and inferential statistics with the use of SPSS (Statistical Package for Social Sciences) guide and hypothesis tested by one- way analysis of variance (ANOVA). The analysis revealed that "student based" method of instruction enhanced students' attitudes toward probability and probability achievement.
Keywords: Teacher based instruction, student based instruction, probability attitude survey, probability achievement test, attitude scores, probability scores.

Introduction

A usual trend with the teachers is that they direct the learning process and students assume a passive role in their education. With the advert of progressive education in the 19th century, and the influence of psychologists, educators have largely replaced teacher based curriculum approaches with "hands on" activities and group work where the child determines on his own what he wants to do in class. Key amongst these changes is the premise that students actively construct their own learning.

Theorists like John Dewey (1952) and Jean Piaget (1975) whose collective work focused on how students learn is primarily responsible for the move to student based learning.

Carl Rogers' ideas about the formation of the individual also contributed to cooperative learning which is student based. "Student based" learning means reversing the guided teacher based understanding of the learning process and putting students at the centre of the learning process.

Student based learning approach is an instructional use of small groups of students. The groups consist of two to four members working together with characteristics of being supportive, encouraging, helpful and assisting each other in progressive academically (Johnson, 1994). The techniques are dependent upon interactions in which individuals experience the same outcome; an individual can attain his or her goal only if other members of the group attain theirs. This is in contrast to "teacher based" method where students work individually hence are not supportive, encouraging, helpful and assisting each information and strategies among the students and with the teacher.

Competition results in individuals achieving varying outcomes; when one person is successful in attaining a goal, others are prevented from doing so. Under these conditions, each person's outcome is independent of others (Deutsch, 1949).

Learners therefore play a passive role in the learning process thus affecting their attitude towards probability and its achievement. The positive impact of "student based" methods has not been limited to academic achievement. Student based strategies have consistently shown beneficial effects on affective variables such as liking of school subjects (Aronson, Sikes, Blaney, Stephen & Rosenfield, 1977; Humphreys, Johnson & Johnson 1982; Slavin, Leavey and Madden, 1984) and have generally been found to be more effective than teacher based method in improving self- esteem (Madden & Slavin, 1983; Leavey and Slavin, 1984).

Stipek et al (1998) observe that teachers who scored high on the learning orientation subscale conveyed to students that effort and persistence that would pay off. In whole class setting this orientation was demonstrated by the teacher staying with one student for a substantial length of time in an effort to get a clearer explanation, to provide alternative suggestions or in general to make sure that the student understood the concept or problem.

During student- work —time this orientation was observed when the teacher encouraged students to keep working or thinking about a problem, gave them instrumental help that facilitated their progress, allowed plenty of time for students to complete their work, required students to go back and try again when they had reached inadequate solutions or encouraged them to come up with multiple strategies. Teachers who scored high on this subscale neither embarrassed students nor ignored wrong answers in whole-class instruction. Rather, they used students' inadequate solutions and mistakes to enhance the instruction. They commented on the problem solving process or the strategies students were employing, often making reference to the particular mathematical concepts that students were learning and they held students to high standards, asking them to explain their thinking in writing as well as verbally (Stipek et al, 1998).

They showed an interest in what students had to say and listened to their ideas and contributions by calling on students having difficulties and pointing out what could be learned from mistakes. The value that is given to students' thinking and theft contributions influences the way in which students view their relationship with mathematics.

Kazemi, E. and Franke, M.L (2004) document how a teacher communicated the value of student effort and knowledge generated in individual, paired or whole- class activity. By validating contributions and asking further questions with the intent of allowing other students to access knowledge, the teacher used students' ideas to shape instruction and to occasion particular mathematical understanding in the classroom.

Quality teaching facilitates students' growing awareness of themselves as legitimate creators of mathematical knowledge. Yackel and Cobb (1998) make the important observation from their research that the daily practice and rituals of the classroom play an important part in how students perceive and learn mathematics. Students create 'insider' knowledge of mathematical behaviour and discourse from the norms associated with those daily practices. Establishing participation processes and responsibilities for class discussion is an important pedagogical strategy. These ensured that students shared their thinking and listened attentively to each other.

Students who are actively involved in the discussion, on the whole, saw an advantage in solving challenging problems, explaining personal solutions to their peers, as well listening to and trying to make sense of someone else's explanations. Honouring students' contributions is an important inclusive strategy. Yackel and Cobb (1998) found that classroom teachers who facilitate student participation and elicit student contributions and who invite students to listen to one another, respect one another and themselves accept different viewpoints and engage in an exchange of thinking and perspectives are teachers who exempli& the hall marks of sound pedagogical practice.

A pedagogical practice that does not attempt to synthesize students' individual contributions (Mercer, 1995) does not advance mathematical thinking. Peers serve as an important resource for developing mathematical thinking and for finding out about the nature of task demands and how those demands could be met (Kazemi E and Frake M.L, 2004). Quality teaching pays attention to the important fact that students' willingness to contribute in the public arena of the classroom is influenced not only by the nature of the community established; it is also affected by a student's ability to function in social situations and interpret the flow of events in a discussion.

Helme and Clark (2001) found in their secondary school classroom study that peer interactions, rather than teacher-student interactions, provide opportunity for students to engage in high- level cognitive activity. These researchers stress the impact role the teacher plays in establishing social rules governing participation.

Working groups: Research has shown that gifted students, as well as low attainers, benefit from collaboration with peers. Johnson, L.C (1985) provides evidence that small homogenous group collaboration significantly enhanced knowledge construction. In particular, collaborative work that was focused on solving challenging tasks produced a higher level of cognitive engagement than that produced by independent work.

Atton-Lee (2003) in a study by Webb (1992) reports that teachers who set aside time to instruct students about the intricacies of effective group processes variably enhanced students' outcomes. Students who learned to help each other learned that, communication and feedback within the group needed to be centred on mathematical explanations and justifications rather than on single answers to problems. A number of studies provided evidence of the benefits for some students of independent learning approaches (Anthony, G., 1999). Students need sometime alone to think and work quietly away from the demands of a group. What effective teachers do is to create a space for both the individual and the collective. They use a range of organizational processes to enhance students' thinking and to engage them more fully in the creating of mathematical knowledge. More significantly over and above establishing structures for participation, the effective teacher constantly monitors, reflects upon and makes necessary changes to those arrangements on the basis of their inclusiveness and effectiveness for the classroom community.

Effective teachers share with their students the conventions and meanings associated with mathematical discourse, representation and forms of argument (Wood, 2002).

A fruitful approach, aimed at clarifying descriptions and explanations, is for the teacher to purposefully provide information or ask questions. This aspect of teacher telling (Lobato, Clarke and Ellis (2005)) is one that facilities learning by initiating student reflection on the concept and on the process. The approach is directed at developing students' conceptual knowledge rather than their memory skills — the purpose is not aimed at showing procedural steps, rather, its intent is to shape ideas and make connections between ideas in a coherent and sensible fashion.

There is now a large body of empirical and theoretical evidence that demonstrate the beneficial effect of students articulating their mathematical thinking (Murphy and Fuson, 1999). Hiebert and Colleagues (1997) have found that relevant and meaningful teacher talk involves drawing out the specific mathematical ideas encased within students' methods, sharing other methods and advancing students' understanding of appropriate mathematical conventions. Reframing student talk in mathematically acceptable language provides teachers with the opportunity to enhance connections between language and conceptual understanding. Quality teaching involves socializing students into a larger mathematical world that honours standards of reasoning and rules of practice (Martin, T.S, ed, 2007).

According to O'Connor and Michaels (2001), the teacher must give each child an opportunity to work through the problem under discussion while simultaneously encouraging each of them to listen and attend to the solution paths of others, building on each others' thinking. They highlight the importance of shaping students' higher — level thinking by fostering students' involvement in taking and defending a particular position against the claims of other students. This instructional process depends upon the skilful orchestration of classroom discussion by the teacher.

Stigler (1999) compared the pedagogical approaches of Japanese and American teachers and found that Japanese teachers spend more time than American teachers in encouraging their students to produce comprehensive verbal explanations of mathematical concepts and algorithms. Expanding on this aspect, Cobb, Wood and Yackel (1993) in their research report that effective teachers initiated and guided a genuine mathematical dialogue between students. These teachers made it possible for students to share their interpretations of tasks and their solutions. In addition, the teachers influenced the course of the dialogue by picking up on students' contributions. They did this by framing students' interpretations and solutions as topics for discussion. The benefits of providing regular opportunities for students to explain and justify their solutions are well documented. Many researchers have found that pedagogical practices that make provision for the development and evaluation of mathematical argument and proof contribute to the development of students' mathematical thinking (Walshow, M., 2007).

Woodward, T. (2002) report on opportunities for students to explain and justify solutions where the teacher made a significant contribution to students' mathematical development. She did this by listening attentively to her students' queries and explanations, asking them to justify their answers and holding back with explanations until she deemed them crucial. The effective teacher is one who is able to set up an environment in which conventional mathematical language migrated from the teacher to the students. Constructive feedback as one form of exchange of ideas has a powerful influence on student achievement. Feedback that engages learners in further purposeful knowledge construction will contribute to the development of their mathematical identities. William (2000) assets, feedback that is constructive has the effect of occasioning certain mathematical capabilities in students and assists in the development of their perception of the mathematical world.

In the mathematics classroom, it is through tasks, more than any other way, that opportunities to learn are made available to students. Hennengsen, M. (1997) defines tasks as the products that students are expected to use to generate those products and the resources available to students while they are generating the products.

When students engage in tasks in which they are motivated intrinsically they tend to exhibit a number of pedagogically desirable behaviours including increased time on task, persistence in the face of failure, more elaborative processing, the monitoring of comprehension, selection of more difficult performance and learning strategies

Fennema and others (1996) in a longitudinal study of 18 teachers from the cognitively guided instruction project found achievement in concepts and problem solving was higher when instruction was designed around students' existing proficiencies and concept images. This approach replaced the more traditional approach where teachers focused on filling gaps in students' knowledge or remediating weaknesses.

Research centering on students' attitude towards mathematics study and its performance has received increasing attention. Studies have shown that factors such as motivation and attitude have impacted on student achievement (Cote and Levine, 2000).

Moreover, instructional strategies may also support student needs in order to increase student achievement. For example, Bottge (2001) found that when mathematics problems were interesting and engaging, students with learning disabilities were able to solve problems that emphasized higher level thinking skills. Tymms

(2001) investigated 21000 students' attitudes towards mathematics and suggested that the most important factors were the teacher and students' academic level, while age, gender and language were weekly associated with attitudes.

Data from the first and the second journal of Negro Education on black and Hispanik students examined the differential impact of reform and traditional types of instruction on the mathematics performance and attitude. Findings from this sampled group showed that students receiving reform instruction had a significantly higher achievement score than students receiving traditional instruction. Also students with better attitudes towards mathematics had a significantly higher achievement score than those with poorer attitudes towards mathematics.

Numerous studies have examined the teaching and learning in mathematics. Studies related to classroom instruction, for example, have focused on the amounts of allocated and engaged time devoted to instruction, individual differences and instruction (Bloom, B.S 1974), teacher behaviour, planning and decision making, instruction in small and cooperative groups (Slavin, 1995); and the quality of teachers' instructional messages (Mayer, D.P 1999).

Studies related to instructional practices and academic achievement have suggested that the quality of teachers' instructional messages affect children's task involvement and subsequent learning in mathematics (Cornell, 1999; Mullis & Chambers, 1988). Researchers also found that, at the high school level, much mathematics instruction remains teacher centred, with teachers placing greater emphasis on lectures and textbooks than on the desire to help their students think critically across subject areas and apply their knowledge to real-world situations (Cohen, McLaughlin, & Talbert, 1993; U.S Department of Education, 2000).

Gregg (1995) described the evolution of two forms of instruction in the mathematics classroom: teacher-centred and inquiry — based mathematics traditions. Cuban, (1984) delineated the features of teacher-centred instruction as favouring "teacher talk" over "student talk" and including situations in which the teacher directs instruction to the whole class rather than working with small groups of students or with individual students. Typically, students are seated in rows of desks that face the teacher, who authoritatively determines the use of class time.

The attitude of students could therefore be influenced by the attitude of the teacher and his method of teaching. Studies carried on have shown that the teachers' methods of mathematics teaching and his personality greatly accounted for their students' positive or negative attitude towards mathematics and that without interest and personal effort in learning mathematics by the students, they can hardly perform well in the subject.

Rodger and Johnson (1999) have advocated the issue of structure by focusing on student grouping implemented with positive foundation to influence positive interdependence and social skills. Student based learning is based on positive interdependence, individual and group accountability, face — to — face promotive interaction, interpersonal and small group skills and group processing (Johnson and Johnson, 1994).

Students who interact in groups are required by necessity to work together to achieve said goals. Regardless of whether the grouping is heterogeneous or homogenous, the members are obligated to work together in order to exchange information and strategies among themselves and with the teacher. Students gain far more in knowledge, interaction, achievement and social skills when in a group setting than when not in a group setting (Johnson and Johnson, 1994). Kagan (1990) promotes the utilization of several different goals in cooperative learning to equip the teacher with many ways to reach learning objectives. Through cooperative grouping the roles of the teachers and students enhance the learning process.

The fundamental assumption of the developmental perspective on student learning is that interaction among children around appropriate tasks increases their mastery of critical concepts.

There is a great deal of empirical support for the idea that peer interaction can help non-conservers become conservers. Many studies have shown that when conservers and non conservers of about the same age work collaboratively on tasks requiring conservation, the non conservers generally develop and maintain conservation concepts (Bell, Grossen and Perret — Clermont, 1985). Infact, a few studies (Ames and Murray, 1982) have found that pairs of disagreeing non conservers who had to come to conservers on conservation problems both gained in conservation.

On the basis of these and other findings, many Piagetians (Murray, 1982, Damon and Wadsworth, 1984) have called for an increased use of cooperative activities in schools. They argue that interaction among students on learning tasks will lead in itself to improved student achievement. Students will learn from one another because in their discussions of the content, cognitive conflicts will arise, inadequate reasoning will be exposed, disequilibration will occur and higher quality understandings will emerge. From the developmental perspective, the effects of student based learning on student achievement would be largely or entirely due to the use of cooperative tasks. In this view, the opportunity for students to discuss, to argue, to present and hear one another's' viewpoints is the critical element of student based learning with respect to student achievement. It is against this background that this study seeks to explore the effect of student and teacher based methods of instructions on probability achievement outcomes and attitude of secondary school students in Bungoma North, Kenya.

Statement of the Problem

In Kenya, mathematics is a compulsory subject up to the secondary school level. During the last couple of years, achievement in sciences and mathematics in particular has been persistently low (KNEC, 1995). Despite the persistently low achievement in mathematics, it is regarded as one of the important subjects in the secondary schools curriculum. Although efforts have been made by research to improve the secondary school curriculum, nothing substantial so far has been achieved. Recent findings indicate that the level of mathematics has remained persistently low (M.O.E, 1995).

The Kenya National Examination Council reports have continued to raise concern over the poor performance in secondary mathematics examinations, including items testing the understanding of probability.

According to the study carried out on the reform of mathematics education in Kenyan secondary schools by the government of Kenya with assistance of Japan International Corporation Agency (JICA), it was observed that students' poor performance in mathematics could be attributed to the teaching methods used in which students worked less by themselves and the teacher served as the sole source of information (Reform of mathematics education in Kenyan secondary schools – SMASSE Project July 1998-June 2003).

The Kenyan government therefore launched the SMASSE (Strengthening of Mathematics and Science in Secondary Education) project to enhance mathematics and science education by in-serving secondary school teachers in the country with assistance of (JICA). The overall outcome of these initiatives was expected to empower teachers in the use of more active inquiry approach to the teaching of mathematics that may improve students' performance in all the aspects of mathematics syllabus including probability.

Inspite of these initiatives, teaching a conceptual grasp of probability still appears to be a very difficult task, fraught with ambiguity and illusion. The problem therefore warranted for the present study which was designed to investigate the effects of "student and teacher based" learning strategies on probability achievement outcomes and attitudes of secondary school students in Bungoma North, Kenya. The findings of the study will hopefully shade some light and explore other areas apart from SMASSE that can help improve the teaching and learning of probability concepts and its achievement by secondary school students.

Theoretical Background

The study based on constructivist learning theory developed from the work of Seymour Papert and Jean Piaget among others which has had wide ranging impact on learning and teaching methods in education.

According to social constructivists, the process of sharing individual perspectives- called collaborative elaboration (Michael R, Mathews, 2000) results in learners constructing understanding together that wouldn't be possible alone. Social constructivist scholars view learning as an active process where learners should learn to discover principles, concepts and facts for themselves (Brown and others, 1993).

Most constructivist models, such as that proposed by Daffy and Jonassen (1992), also stress the need for collaboration among learners, in direct contradiction to teacher centred competitive approaches. The theory has influenced the replacement of teacher based approach where the responsibility rested with the instructor to teach and learners played a passive role with hands – on activities and group work.

Conceptual Framework

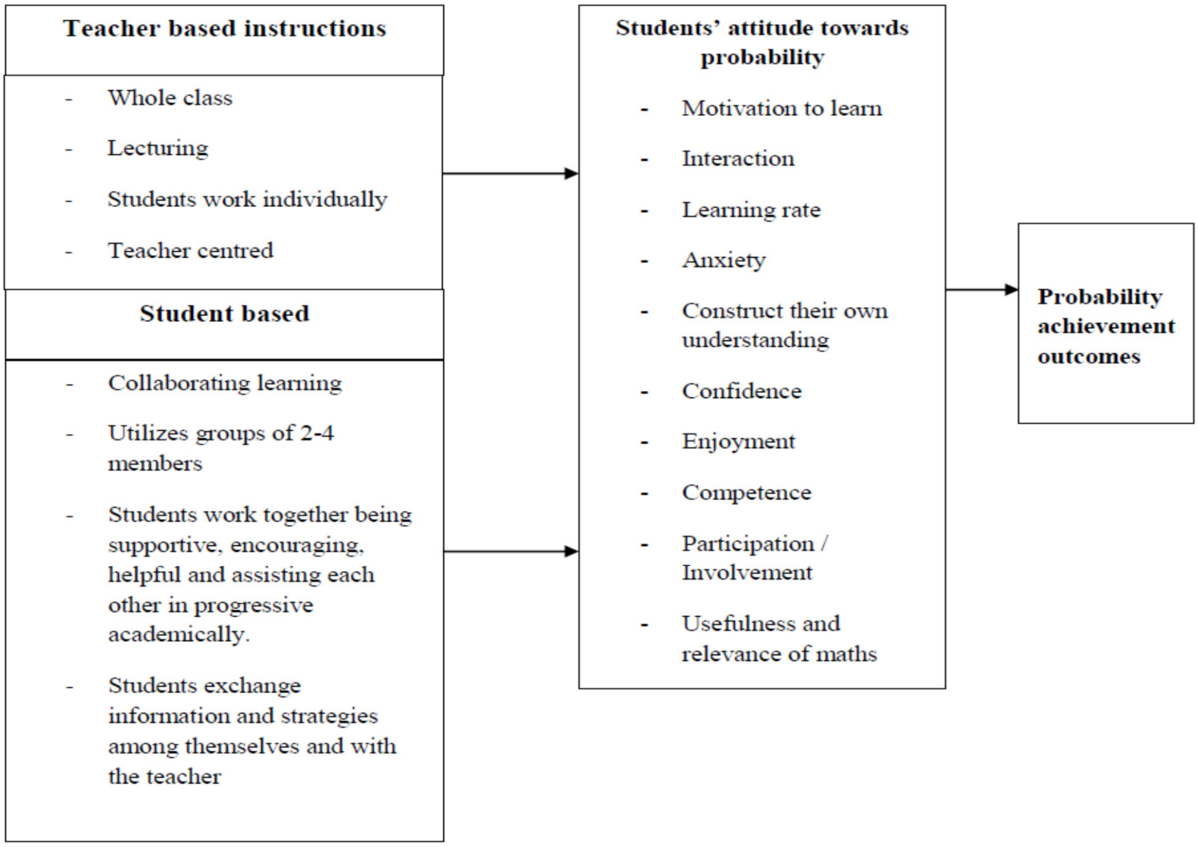

Figure 1: Conceptual framework relating instructional methods, students' attitude and probability achievement.

Research Hypothesis
The current study investigated the effects of "student and teacher based" learning approaches on probability achievement outcomes and attitudes of secondary school students.
The study was guided by the following hypotheses:

1. There is no difference in attitude towards probability of the students who are taught using "Student based learning approach and those taught with "teachers based" method.
2. There is no difference in the achievement of probability scores of the students who are taught with student based learning method and those who are taught using teacher based method.

Methodology
The study investigates the effects of teacher and student based instructions on probability achievement outcome and attitudes of secondary school students in Bungoma North District, Kenya. The study is a true experimental design utilizing the matching only pretest – posttest control group design. The researcher preferred its use- the pretest- posttest design because it controls for history, maturation and regression. By randomization subjects across experimental and control conditions, both selection and mortality are controlled. The design therefore controls many threats to validity or sources of bias.

Sample and Sampling
There are 18 secondary schools in Bungoma North district with an enrolment of approximately 660 Form three students attending school. The sample constituted Form three students (N=200) from 5 secondary schools.

Data Collection Instruments
The present study utilized the following measuring instruments; probability attitude survey which measures the attitude of students towards probability and probability achievement test that measures probability scores. For data to be reliable, the data collection tools must be reliable. This means that the tools must have the ability to consistently yield the same results when repeated measurements are taken under the same conditions (Sharma et al, 1989, Koull, 1993). The instrument was administered to 30 students in 3 different schools who were not part

of the study population. Cronbach's alpha was used to determine the internal consistency of items in the questionnaire as 0.81 which showed that the instrument was reliable and can be used for the study.

Validity is the degree or success of an instrument in measuring what or set out to measure. It defines whether an instrument has achieved its intended purpose (Moser and Alton 1971-355).

Measuring Scales

The information on students' attitude was solicited using twenty items (10 positive items and 10 negative) of Likert type scale containing 6 response alternatives.

Strongly agree to strongly disagree (SA, A, TA, TD, D and SD).

The positively worded items were scored starting from strongly agree as 6, to strongly disagree as 1, and negatively worded items were reversed to positive direction for scoring purposes.

Probability achievement test was development by the researcher to determine students' achievement in probability. The content of probability achievement test included experimental probability tree diagram, probability space, mutually exclusive and independent events. The test and course content were developed from Form III secondary school curriculum syllabus of the Ministry of Education, Kenya.

The control group received instruction using "teacher based" method while the experimental group received "student based" instructions. In "teacher based" the teacher taught concepts and skills directly to the whole class. The only interaction between students and the teacher was when students asked questions.

Student based strategy used groups of two to four members. Students then worked together being supportive, encouraging and exchanging information and strategies among themselves and with the teacher. Both the control and experimental groups received two hours instruction during six weeks.

At the end of the treatment, the probability Attitude Survey (PAS) forms were administered to the two groups of students for scoring.

Table 1: Attitudinal results for teacher based group

	Statement	Mean	Std. Deviation	Variance
	Probability is interesting	2.0	1.791	3.208
	I am not good at probability	4.20	1.876	3.521
	I prefer other topics in mathematics than probability	4.36	1.634	2.671
	Probability is my best topic	2.25	1.594	2.540
	The topic i hate most is probability	3.76	2.011	4.046
	Probability is useful in life	3.39	1.977	3.907
	Exam questions from probability should be optional	4.74	1.629	2.655
	The probability i am taught is a waste	3.34	1.913	3.661
	Probability is the easiest topic so far	2.45	1.741	3.032
	Probability is more difficult to understand than other topics in mathematics	4.07	1.896	3.595
	I like solving problems in probability	2.58	1.714	2.936
	Probability questions terrify me	3.94	1.714	2.939
	I understand most of the concepts in probability	2.38	1.702	2.898
	I think everyone should learn probability	3.05	1.965	3.860
	I enjoy learning probability	2.73	1.753	3.074
	Probability is boring	3.53	2.016	4.066
	When i do not understand a new concept in probability initially, i know that i will never really understand it	3.84	1.941	3.768
	I think its important to do well in probability in school	3.55	1.813	3.286
	After all you can never apply probability after school to solve your everyday life situations.	2.97	1.822	3.321
	We learn probability in order to get a job	2.40	1.765	3.116

Table 2: Attitudinal results for student based group

	Statement	Mean	Std. Deviation	Variance
	Probability is interesting	4.26	1.722	2.964
	I am not good at probability	4.08	1.619	2.621
	I prefer other topics in mathematics than probability	3.62	1.839	3.381
	Probability is my best topic	3.04	1.695	2.874
	The topic i hate most is probability	2.59	1.697	2.879
	Probability is useful in life	4.07	1.896	3.596
	Exam questions from probability should be optional	3.76	1.904	3.625
	The probability i am taught is a waste	2.46	1.515	2.296
	Probability is the easiest topic so far	2.98	1.742	3.033
	Probability is more difficult to understand than other topics in mathematics	3.45	1.695	2.873
	I like solving problems in probability	3.53	1.846	3.408
	Probability questions terrify me	3.03	1.758	3.091
	I understand most of the concepts in probability	3.00	1.713	2.933
	I think everyone should learn probability	4.19	1.917	3.675
	I enjoy learning probability	3.54	1.870	3.496
	Probability is boring	2.75	1.901	3.613
	When i do not understand a new concept in probability initially, i know that i will never really understand it	3.04	1.892	3.581
	I think its important to do well in probability in school	4.72	1.679	2.820
	After all you can never apply probability after school to solve your everyday life situations.	3.14	1.953	3.815
	We learn probability in order to get a job	2.96	2.032	4.130

The attitudinal data collected from the students provided a measure of the students' attitude towards probability. Data were then coded and analyzed using SPSS guide.

Part of the attitudinal results from teacher and student based on probability attitude survey are reproduced in table 3.

Table 3: Sample statement from the probability attitude survey

PAS	Statement	Teacher Based	Student Based
Negative items	2	4.20 (70%)	4.08 (68%)
	3	4.36 (72.67%)	3.62 (60.3%)
	5	3.76 (62.67%)	2.59 (43.1%)
	10	4.07 (67.83%)	3.45 (57.50%)
	12	3.94 (65.66%)	3.05 (50.50%)
Positive items			
	4	2.25 (37.50%)	3.04 (50.66%)
	6	3.39 (56.50%)	4.08 (68%)
	9	2.45 (40.83%)	2.98 (49.66%)
	11	2.58 (43%)	3.53 (58.83%)
	15	2.73 (45.50%)	3.54 (59%)

Hypothesis 1

The table shows both negative and positive items with their respective statements to be scored by the students. It shows the mean and percentage of students in each of the two groups that scored against that particular statement. From table 3, it was found out that the percentage of students who agreed with the negative items from "student based" learning method was much smaller as compared to the percentage of those who agreed with the same items from the "teacher based" method. This meant a greater percentage of students from student based learning approach disagreed with the negative items that were sampled while a higher percentage of students from the teacher based method of instruction indicated that the items (negative) they scored showed that probability as a topic in mathematics was difficult for them thus a smaller percentage from the "teacher based" instruction disagreed with the negative items. This therefore showed that a greater number of students who were taught using student based learning approach had positive attitude towards probability than those who were taught using teacher based method. Student based method of learning therefore enhanced students' attitude towards probability as compared to teacher based method of instruction.

When the two methods were pegged against positive items, it was found out a greater percentage of students that used student based learning liked probability as compared to those students from teacher based method whose percentage of liking probability was smaller.

In addition to scoring of the questionnaire items in the probability attitude survey, students were asked to state their views in written on the teaching and learning of probability and mathematics in general. The items from which the data was derived focused on aspects of the: importance of probability, the desire to use probability in a career and perseverance in learning probability and solving problems. The data on the attitudes are important to understand as teachers work to encourage students to achieve at the levels expected.

Results from the selected items are discussed here.

It is important for people to learn probability (82 90) 90 students in the student based class (45%) agreed that probability is important as compared to 82 (41%) of teacher based group.

Probability is harder for me than for most people (54 41) in general less than half of the students (47.5%) in the five schools agreed with the statement; slightly more than half (52%) disagreed.

I will work along time in order to understand a new concept in probability (53 45)

This item and the following one address perseverance. Across schools, the percentage of students who indicated a willingness to work from 22.5% for student based and 26.5% for teacher based.

I will work along time in order to get a solution to the probability problem (56 54). Many probability problems cannot be solved quickly but require sustained time to solve. 55% of the students of the schools agreed that they would work along time to obtain the solution to probability problem.

I would like to have a job that lets me use the probability (33 34)

Overall a third of the students were interested in a job that used probability. Two thirds of the students disagreed.

I think probability is interesting (50 51)

Overall close to half of the students agreed with the statement, with the agreement percentage ranging from 50% to 51%. The responses provide another perspective on students' views of probability and provide contrast to views about the importance of probability.

Students may view probability as important but may not be as likely to view probability as interesting. These results indicate that even when students overwhelmingly view probability as important, only about half of them were willing to work along time in order to understand a new idea in probability or to get a solution to a probability problem.

Teachers need to engage students in non-routine problem solving experiences in which they need to reason their way to a solution. The result reported here have implications for all mathematics education. Encouraging students to view mathematics as important is not enough. These students already recognized the importance of mathematics, yet they still did not want a job that used mathematics. Perhaps this is a reflection on how probability and mathematics in general is taught in our secondary schools. Approximately 58% of students viewed learning mathematics as mostly memorizing formulas and rules less than half of them viewed mathematics as interesting.

Mathematics educators must do a better job of instilling a love of mathematics in their students. Teachers must provide students with learning opportunities in which they experience the excitement that comes from making sense of mathematics instead of memorizing formulas and rules. This focus on making sense of mathematics is an essential component of the reform movement in mathematics education.

It is also important for teachers to help students understand the role mathematics plays in fields that they might find interesting and challenging, such as engineering science and technology.

Helping students realize these types of connection between the mathematics they are learning in school and its applications in the outside world is strongly encouraged by the reform movement. The majority of these students who participated in this study said probability was important. However, slightly over half of these students reported that they lacked the perseverance to stick with probability in order to understand a new concept or solve a problem. Perseverance is a critical element of inquiry–based classrooms as students work together to understand mathematics.

These results suggest that teachers must help their students understand and value the need for perseverance in solving mathematics problem. They must help students realize the connections between the mathematics they learn in school and the mathematics related fields that might interest them. Instead of focusing on formulas and rules, mathematics teachers should help their students make sense of the mathematics they are learning.

Hypothesis 2

The probability achievement test was administered to the two groups of students and used as a posttest. There were 20 items in PAT which were scored over 100. Each item was scored five points.

Results

The student based and teacher based learning scores were then compared. The students who used teacher based instruction achieved a mean of 38.15 in probability achievement test while those who used student based learning strategy achieved a mean 55.45 in a similar test. The F ratio was then computed and the result shown in table 4.

Table 4: Summary for ANOVA

Variation	Ss	df	ms	F
SSB	14964.50	2-1=1	14964.50	137.90
SSW	21487.58	200-2=198	108.52	

Total 36452.04 N-1=199

At alpha = 0.05, the hypothesis was rejected. This showed there was a significant difference in scores between teacher based and student based instructions with student based group having far better attitude towards probability than the teacher based group.

Limitations of the Study and Implication for further research

This study was conducted in five secondary schools in Bungoma North district of western part of Kenya. It may not therefore be possible to generalize the results to a larger population. The study also did not consider changes in incentives and task structure brought about by certain forms of student based learning. Further more teacher quality as a factor of how mathematics achievement was not taken into consideration.

Additional research could be undertaken to investigate the conditions under which student based learning strategy can affect achievement.

Conclusion

This study investigated the effect of "teacher" and "student based" instructions on probability achievement outcomes and attitudes of secondary school students.

The findings generated from the study indicated that 120 (60%) of the students find probability very difficult, 54 (27%) agreed with the idea that probability was fairly difficult. Only 26 (13%) said that probability was easy. Students also gave varied reasons as to why they find probability difficult. Most of them 170 (85%) cited difficulties related to the concepts that are being learned. They are unable to grasp the fundamental concepts of probability. Others said their teachers rush to cover the syllabus when in real sense they don't understand while some attributed their weakness in probability to the teachers' methods of teaching. A small proportion of students 30 (15%) attributed their problems to pressure and discouragement from the peers which was attitudinal. However, a greater number of students who used "student based" method had positive attitude towards probability than those who were taught using teacher based method. "Student based" method of learning therefore enhanced students' attitude as compared to "teacher based" method of instruction.

Dansereau and his colleagues found in a series of studies that while both the recaller and the listener learned more than did students working alone, the recaller learned more (O'Donnel & Dansereau, 1992).

These mirrors both the peer tutoring findings and the findings of Noreen Webb (1992), who discovered that the students who gained the most from cooperative activities were those who provided elaborated explanations to others. In the present study as well as in Dansereau's, students who received elaborated explanations learned more than those who worked alone, but not as much as those who served as explainers.

Student based learning has also been found helpful in writing process models (Graves 1983), in which students work in peer response groups to help one another draft, revise and edit compositions. Such models have been found to be effective in improving creative writing (Hillocks, 1984).

The findings in this study are in line with many Piagetians (e.g. Damon 1984, Murray 1982, Wadsworth, 1984) who have called for an increased used of student based learning in schools. They argue that interaction among students on learning tasks will lead in itself to improved student achievement.

Students will learn from one another because in their discussions of the content, cognitive conflicts will arise, inadequate reasoning will be exposed, disquilibration will occur and higher quality understanding will emerge. Education now requires teaching strategies that emphasize student involvement. According to Johnson and Johnson (1990) to achieve success in learning mathematics, students should be given the opportunity to communicate mathematically, reasoning mathematically, develop self confidence to solve mathematics problems. One of the ways this can be done is through student based learning. Many studies show that student based learning can improve performance, long-term memory and positive attitudes towards mathematics, self concept and social skills. More opportunities should be given to discussion, problem solving, creating solutions and working with peers.

Several educators in the field of mathematics education conducted studies using student based learning and find increase in students' mathematics achievement (Brush, 1997, Nicholas and Miller, 1994, Tarim 2009) provides several benefits on the use of student based learning approach: it promotes deep learning of materials, students achieve better grades in student based learning, students learn higher –order critical thinking skills and develop positive attitudes towards learning. Apart from mathematics achievement, attitude is also a major focus in student based learning.

In the result of this study, it can be concluded that the "student based" learning method is more effective than "teacher based" instructions on probability achievement outcomes and attitude of students. Therefore, teachers who teach mathematics need to be aware of the benefits and importance of student based learning and thus change the practice of teacher- based teaching methods to student based teaching methods. The implication of the result is that teachers' method of instruction in classroom is important in changing classroom achievement outcomes and attitude of students towards mathematics.

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REFERENCES

Alton — LEE (2003). *Quality Teaching for Diverse Students in Schooling*: Best Evidence Synthesis. Wellington: Ministry of Education.
Bottge, B.A. (2001). *Using intriguing problem to improve math skills*. Educational Leadership, 5 8(6), 68-72.
Clarke, D. (2001). *Understanding, Assessing and Developing Young children mathematical thinking*. Research as a Powerful tool for professional growth. Numeracy and beyond Proceeds of the 24th annual conference of the
mathematics education research of Australasia. Vol. 1PP9-26, Sydney.
Cobb, P.E, Yackel, E & McClain, K. (Eds) (2000). *Symbolizing and Communicating in Mathematics Classrooms*.
Damon, W. (1984). *Peer Education: The untapped potential*. Journal of Applied Developmental Psychology, 5, 331-343.
Deutsch, M. (1949). *A theory of cooperation and competition*. Human Relations, 2,129-152
Graves, N. B., & Graves, T. D. (1984). *Creating a cooperative learning environment: An Ecological Approach.*
Henningsen, M. (1997). *Mathematical Tasks and Student Cognition*: Classroom based
Factors that Support and Inhibit high level mathematical thinking and Reasoning. Journal for Research in Mathematics Education, vol. 28, no. 5, pp 5 24-549.
Humphreys, B., Johnson, R. T., & Johnson, D. W. (1982). *Effects of cooperative, competitive and individualistic learning on students' learning on students' achievement in science class*.
Johnson, D.W., & Johnson, R.T. (1994). *Learning together and alone: Cooperative, competitive and individualistic learning* (4th ed) Boston: Allyn & Bacon.
Johnson, L.C (1985). *The Effects of the groups of our cooperative learning model on student problem-solving achievement in mathematics*. Unpublished doctoral dissertation, University of Houston.
Kazemi, E. et al (2004). *Teacher Learning in Mathematics: Using student work to promote collective inquiry*. Journal of mathematics teacher education, 7, 203-235.
Lobato, J. et al (2005). *Initiating and Eliciting in Teaching: A reformulation of telling*. Journal for Research in Mathematics Education, Vol 36, no 2, pp 101-136.
Madden, N. A., & Slavin, R. E (1983). *Effects of cooperative learning on the social acceptance of mainstreamed academically handicapped students*. The Journal of special Education, 17 (2), 171-184.
Martin, T.S-ed (2007). *Mathematics teaching today*: Improving Practice, Improving Student Learning, 2 ed. Reston. VA: National Council of Teachers of Mathematics.
Mercer (1995). *The Guided Construction of Knowledge:* Talk Amongst Teachers and Learners, Clevedon, Philadelphia, Multilingual matters.
Michael, R. and Mathews (2000). *Constructivism in Science and Mathematics Education*.
Murphy, L. et al (1999). *Advancing Children's Mathematical Thinking in Everyday Mathematics Classroom*. Journal for Research in Mathematics Education, Vol. 30, no 2, pp 148-170.
Murray, F.B. (1982). *Teaching through social conflict. Contemporary Educational Psychology*, 7,257 – 271.
Slavin, R. (2013). *Cooperative learning and achievement: Theory and Research*. In Reynolds W. Miller G. and Weiner I. (eds). Handbook of Psychology Vol. 7 (Zild ed).
Stigler, J.W (1999). *The Teaching gap: Best Ideas from the world's teachers for improving education in the classroom.* New York: The Free Press. Study guide for the pre-professional skills (PPST). (2003).
Stipek & Colleagues (1998). *Promoting students' cognitive and emotional development*.
Webb, N. M (1992). *Testing a theoretical model of student interaction and learning in small groups.*
Woodward, T. (2002). *What does it mean to teach mathematics differently*? In: Barton, B. et al, eds. Mathematics Education in the South pacific (Proceedings of the 25th annual conference of the mathematics education research group of Australasia, pp 61-67).