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Teachers' Classroom Discourse and Academic Achievement Prediction in Mathematics among Secondary School Students in Kakamega County, Kenya

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Abstract: ***Good education environment as well as Teachers application of suitable classroom discourse is key for the success of students in a mathematics classroom in secondary schools in Kakamega County, Kenya. Specific objective of the study was to establish the level at which Mathematics teachers' classroom discourse could predict students' academic achievement in mathematics. The study was guided by the Technological Pedagogical Content Knowledge (TPACK) theory, and was implemented using the descriptive survey research design via mixed methods approach that combined elements of both qualitative and quantitative methods. The target population was 801 Mathematics teachers in public secondary schools in Kakamega County. A sample of 80 teachers was selected using multistage sampling procedures. Research instruments included questionnaire, observation Schedule, and document analysis guide. Data collected were analyzed using descriptive statistics and Simple Linear Regression. Results revealed that teachers' classroom discourse is a significant predictor of students' academic achievement in Mathematics. These findings have important implications in Mathematics education and provide useful facts and figures that may be used to formulate policy on how Mathematics classroom discourse should be implemented in the current curriculum, with a view of improving the current students' low academic achievement in the subject in Kenya.***

Keywords: Classroom Discourse, Academic Achievement, Prediction, Mathematics, School Students

1. Introduction

Mathematics plays several core roles in the society. According to Hughes (2005), Mathematics forms an essential prerequisite for joining tertiary colleges, universities and for self-employment. Friendland (1985) affirms that many professionals such as engineers and accountants use it. Besides the aforementioned roles of Mathematics, many countries in all continents have complained about the shortcomings of the modes of teaching mathematics and how the subject is learned (European Mathematical Society, 2012). There exists numerous research evidences in this study with regard to the teachers' way of teaching mathematics and how it affects learning. There is therefore need for people to involve themselves in changing classroom discourse and improving it. Need has consequently arisen for research in mathematics classroom discourse to be carried out.

In Kenya, students achieve low scores in mathematics as shown in table1. Even though, the Ministry of Education (MOE) has put in place several initiatives aimed at making students realize good academic achievement in mathematics. For instance, through Strengthening Mathematics and Science Education (SMASE) workshops, teachers are encouraged to embrace 'hands on' approach to teaching Mathematics. This approach encourages classroom discourse that sees learners involved actively in the process of learning. However, the Kenyan national examinations help teachers to define the important content and therefore have a role to play to influence teacher's classroom teaching (Wanjala et al., 2016; Pedulla et al., 2003). The Kenya National Examinations Council (KNEC) examines secondary school learners' Mathematics content recall, comprehension, application as well as general reasoning. According to 2021 Kenya Certificate of Secondary Education **(**KCSE) KNEC report, performance in Mathematics for the last 5 years were as summarized in Table 1.

Table 1: Candidates National Performance in KCSEMathematics Alternative A from 2016 to 2020

Year	Candidature	Mean Scores (%)	Std Deviation
2016	570, 398	20.79	21.165
2017	609, 525	25.48	22.215
2018	658, 904	26.445	21.005
2019	694, 445	27.54	22.47
2020	742, 796	18.36	17.19

Source: KNEC, 2021

Table 1 shows percentage mean scores ranging between 18% and 26% depicting poor performance in mathematics with the worst performance being the most recent in the year 2020. Kakamega County, where the study was carried out is one of the most affected in this regard, with KCSE county 5 year mean score of below 3.18 (D). This poses a very worrying scenario. If this poor performance in Mathematics persists, Kakamega County and the Country at large may face a shortage of professionals such as engineers, doctors, accountants, architects, scientists and better teachers of Mathematics among many others. This threatens the realization of Kenya's vision 2030 whose main aims are to transform Kenya into an industrializing and middle-income country by providing high quality of life to all its citizensby 2030.

This low academic achievement in mathematics was the basis of this study. Classroom discourse, whether communication with peers or a teacher, is essential to students as they learn effectively, and also is a critical assessment tool for teachers (Small, 2013). Classroom discourse that is not well orchestrated by the teacher makes the teacher unable to immediately hear and see the students' current abilities and understandings so that immediate feedback and immediate intervention can be provided to guide the students in the correct direction (Bishop, 2012). Poor classroom discourse causes students' poor academic achievement (Bishop, 2012. This study was therefore conducted in classrooms to assess the level at which teachers' classroom discourse predicts academic achievement in Mathematics among secondary school students in Kakamega County, Kenya. This was done with a view of improving on performance in Mathematics at secondary schools in the Country as a whole. No Similar study in Kakamega County has been documented, which makes policy action a tall order. It is on these premises that the present study was carried out.

1.1 Objective of the Study

The specific objective of this study was to establish the level at which Mathematics teachers' classroom discourse could predict students' academic achievement in mathematics.

1.2 Research Hypothesis

The following null research hypothesis was formulated from the objective of this study and tested at 0.05% significance level.

H_{01}: *Mathematics teachers' classroom discourse does not significantly predict students' academic achievement in Mathematics.*

1.3 Significance of the Study

The findings of this study are envisaged to contribute to both the improvement of practice and the growth of the body of Mathematics education knowledge in a number of ways:

1) The findings may assist the teachers as well as the board of management of secondary schools to solve the problem of low academic achievement in mathematics and predict future performance in this subject. This could improve Mathematics teachers' style of teaching to arouse students' interest to effectively learn and pass mathematics, so as to form a formidable team of professionals in future, fit to propel industrialization in the country and in the world at large.
2) The findings may also step up awareness to colleges and universities about the fitness of the teachers they produce with regards to their classroom discourse and hence improve on their pre-service training. This could lead to production of teachers with desirable competencies to work with learners to produce good results.
3) It is hoped that the findings will enable the ministry of education, authors of course books, and developers of the curriculum in Kenya such as Kenya Institute of Curriculum Development (KICD) to tune the curriculum that would enhance effective classroom discourse. This could bring about bright future to the learners after passing Mathematics examinations.
4) The findings are hoped to be a source of new knowledge and possibly add to the stock of literature while at the same time encourage further research in the cycles of classroom discourse of teachers'. This could see Mathematics instruction delivery in schools improve.

2. Literature Survey

The literature reviewed comprises: theoretical framework, Mathematics classroom discourse and learners' academic achievement in the subject; and finally the gap in the literature

2.1 Theoretical Framework

This study based its research on the TPACK theory which was developed by Mishra and Koehler (2006) which stated that a teacher needs to blend sets of knowledge he/she posses so as to come up with an amalgamated knowledge that effectively serve to teach. The sets of knowledge Mishra and Koehler referred to were Technological, Pedagogical, and Content Knowledge (TPACK). The blend of the knowledge domains is illustrated in a venn diagram in figure 1.

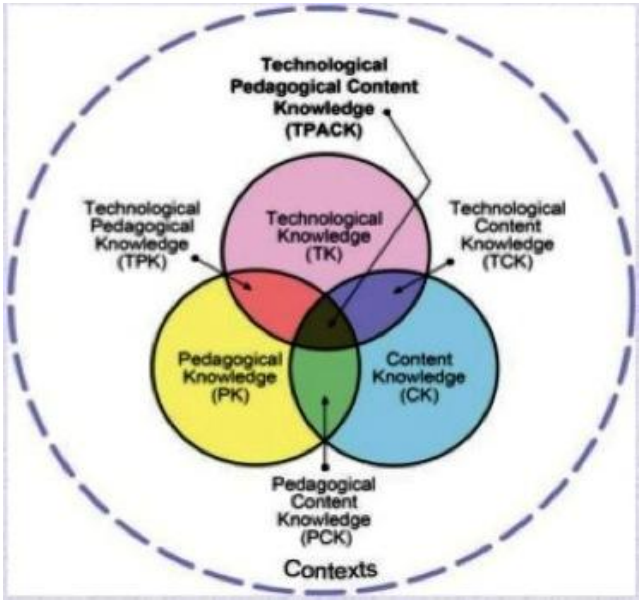

Figure1: TPACK Model of Mathematics Instruction
Source Harris et al., 2009; Koehler & Mishra, 2009

The model in Figure 1 illustrates TPACK thus an intersection or blend of teachers' knowledge in technology, pedagogy and content domains which is required for teaching learners a subject and teaching it effectively. The TPACK model simply explains why a much known teacher in the world may not be the best teacher in the subject for a simple justification that makes the subject easily taught (Harris, Hofer *et al*, 2010). They reiterate that to be a wonderful teacher, you should blend the three domains of knowledge to realize a masterful 21st century classroom focused on essential learning, applying good learning theory supported by technology. The current study therefore

assesses the mathematics teachers' classroom discourse and its ability to predict students' future academic achievement in secondary schools in Kakamega County, with a view of encouraging effective teaching that would improve student performance in Mathematics.

2.2 Mathematics Teachers' Classroom Discourse and Academic achievement

Mathematics classroom discourse refers to a formal interaction between learners as well as between learners and their teacher during a Mathematics lesson (Good & Grouws, 2003). Student-centered Mathematics classroom discourse involves attending to students' knowledge and building on these ideas in a meaningful way that promotes learning about concepts and procedures (Donovan & Bransford, 2005). The teacher in the student-centered classroom plays the role of learning facilitator and guider during Mathematics classroom discourse (Franke et al., 2007). Students discuss Mathematics, make conjectures, and construct mathematical arguments and proofs in student-centered classrooms (Lampert, 1990). Generally it [student-centered Mathematics classroom discourse] implies an approach in which learners are given opportunities to offer their own ideas and to become actively involved in their learning (Boaler, 2008).

According to Ezrailson et al. (2006), teaching is an activity that presumes some form of communication. Ezrailson and the other researchers went on to state that students will only retain 20% of what they hear, 30% of what they see and 50% of what they see and hear. However, when teachers focus on interaction and communication in the classroom, students will retain 90% of what they say and do as they engage in discussions. It is therefore clear in this research that discourse is an important factor in enhancing the quality of students' learning and understanding in the Mathematics subject area. When students are able to effectively engage in discussions about Mathematics, they will be better able to build confidence and see themselves as mathematicians (Bishop, 2012). Discourse is the process of expressing mathematical ideas and understanding orally, visually, and in writing, using numbers, symbols, pictures, graphs, diagrams, and words" (Ontario Ministry of Education, 2005). In her research on the effects of communication on the participation of seventh graders in their Mathematics classrooms, Janneke et al. (2017) found that "a classroom discourse with a focus on correct answers may be more threatening than one that emphasizes understandings". Yackel (2001) stated that, discourse provides students with opportunities to discuss, explain, and justify their thoughts, pose questions to resulting answers that they do not understand, and simply make an attempt to answer problems. In a study on the different contexts and forms of communication that may take place between students and teachers, and students and their peers,

Nuhrenborger and Steinbring (2009) found out that the quality of discourse will differ given the context in which the discourse is taking place. In this respect, the quality of discourse that will emerge in the Mathematics classroom will largely depend on the classroom environment and the relationships between peers and between students and teachers. Nuhrenborger and Steinbring further assert that when discussion and interaction in the classroom is not given a high degree of importance, and the social environment is not a positive one, often students will sense this negativity towards hearing opinions and the lack of interpersonal relations and, therefore, will not wish to participate in class discussion or activities. Staples, (2007), a researcher from the University of California, and Stein (2007), an employee of the Goleta Union School District, state that discourse in and about Mathematics helps to enhance understanding, establish some shared understandings, empower students as learners, promote a comfortable learning environment, and assist the teacher in gaining insight into the students' thinking so as to guide the direction of instruction. Monitoring student talk enables one to identify who participates and how, who does not participate and why, and what kinds of Mathematics identities students are enacting (Bishop, 2012). Bishop further aver that discourse, both verbal and written, allows teachers to immediately hear and see the students' current abilities and understandings so that immediate feedback and, if necessary, immediate intervention can be provided to guide the students in the correct direction.

Measuring knowledge is hard because of its invisibility; therefore we can only measure its effects on our behaviors and actions (Hunt, 2003). Teachers' classroom discourse measurement tools should be valid to evaluate the reflections of this knowledge on teachers' action (instruction design, lesson plans, classroom activities, assessment tasks) and correlate such knowledge with teaching effectiveness. The design of teachers' classroom discourse evaluation tool and the interpretation of its data should respond to the definition of teachers' classroom discourse and its objectives and be consistent (Koehler et al., 2012). Multiple ways of measuring such knowledge will provide a rich foundation for our decision about whether teachers have acquired the teachers' classroom discourse and which forms the basis of this study. Teaching artifacts are good sources of information about teacher effectiveness since they present more valid information about their pedagogy and instructional activities (Lyublinskaya and Tournaki, 2012). Analyzing randomly selected teaching materials like lesson plans, student homework, classroom activities work sheets and assessment tasks and then measuring their relationship to student learning or academic achievement trajectories are examples for such evaluation measurer (Little et al., 2009). Analyzing artifacts of teaching is a practical and cost-efficient measure to conduct both summative and formative evaluation for teacher effectiveness, and its accuracy and consistency of data quality is comparable to those obtained from classroom observations (Strong, 2011). Lyublinskaya and Tournaki (2012) examined how professional development of content authoring influences Mathematics teachers TPA teachers' classroom discourse CK development and in turn affects their students' algebra academic achievement scores. After a one-year professional training spent creating curriculum that integrates TI-Nspire technology, four Algebra teachers from a New York City public high school were evaluated for their classroom discourse developmental levels. Researchers utilized their developed classroom discourse Levels to measure teachers' artifacts and their teaching practices. Their results indicated

the importance of lesson plan preparation in teacher effectiveness and the impact of teachers' classroom discourse levels on student academic achievement. They also found that the growth of classroom discourse levels is not linearly or consistently developed. Lyublinskaya and Tournaki (2012) recommended that professional development program designers provide Mathematics teachers with the time, feedback, and collaboration support needed to improve their lesson plan designing.

2.3 Gap in the Literature

Classroom discourse, whether communication with peers or a teacher, is essential to students as they learn effectively, and also is a critical assessment tool for teachers (Small, 2013). Classroom discourse that is not well orchestrated by the teacher makes the teacher unable to immediately hear and see the students' current abilities and understandings so that immediate feedback and immediate intervention can be provided to guide the students in the correct direction (Bishop, 2012). Poor classroom discourse causes students' poor academic achievement (Bishop, 2012; Bostic & Jacobbe, 2010; Staples, 2007; Stein, 2007). To reverse this current trend of students' poor performance in mathematics in Kenya, classroom discourse as well as policy on the implementation of Mathematics classroom discourse needs to be revisited with a view of improving the prevailing poor academic achievement in mathematics in secondary schools in Kenya. In this regard, current research on assessment of teachers' classroom discourse and its prediction of learners' academic achievement in Mathematics in Kakamega County was necessary. No researches on this topic have been documented in Kakamega County, which makes policy action a tall order. It is on these premises that the present study was carried out.

3. Approach

This study used descriptive survey research design which allowed for the combination of both elements of qualitative and quantitative methods in data analysis. Descriptive survey research design allows the use of mixed research methodology that combines elements of qualitative and quantitative methods (Creswell, 2003). The study was conducted in Kakamega County, Kenya. Kakamega County is located in western part of Kenya with its headquarters in Kakamega town. Out of 47 counties in Kenya, Kakamega County is the Kenya's most populous rural County and among the counties trailing in mathematics performance. According to statistics from Kakamega County Director of Education (2019), the county has 429 secondary schools, 407 of which are public and the remaining 22 are private schools. The county has over 3,620 teachers. Enrolment in secondary schools in Kakamega County is 154960 students.

The target population of this study was the 801 Mathematics teachers and 32012 form One students in public secondary schools within Kakamega County. The study sample comprised of 80 teachers of Form One Mathematics who were selected from the target population of 801 as earlier mentioned. It also included 3320 Form One students. The 3320 students who participated in this study were the total number of students who attended classes taught by the sampled 80 teachers. Therefore all students (3320) in the sampled classes were allowed to participate in the study. This sample size (80 teachers) formed 10% of the targeted respondents, which was deemed sufficient to represent the entire population for educational researches (Mugenda & Mugenda, 2003).This sample was arrived at by use of multi-stage sampling technique that involved purposive and simple random sampling techniques.

Related literature was reviewed and the researcher developed three instruments for data collection as guided by the one specific research objective of this study. The instruments developed were; document analysis guide, teacher questionnaire, and teacher Observation Schedule. Descriptive data are obtained through the use of questionnaires, interview and observation methods (Okoth, 2012). Information on Mathematics Students' academic achievement in Mathematics was collected by use of the document analyses of mark books where students' scores are recorded after marking tests or examinations. In this study, tests were administered after the lesson. The questions were drawn from KNEC past papers and covered current lesson topic and recently covered topics by the same teacher. The tests were marked and scores recorded in the mark books. The scores together with the recent test scores were then extracted for the purpose of gauging the students' academic achievement in mathematics. Bryman (2004) also asserts that secondary data analysis allows for examination of existing data yet can produce new and more detailed information. The researcher used questionnaires to collect background information of the respondents whereas the mathematics teacher classroom discourse observation schedule was therefore used to collect data during the actual teaching and learning process in the classroom.

A pilot study was carried out prior to the actual study in two Sub County secondary schools in ten sub counties within Kakamega County. The teachers and students who participated in the pilot study did not participate in the actual study, so as to avoid redundancy and *halo* effect in the actual study (Long-Crowell, 2015). Data collected from the pilot study was used to reliability of the research instruments. When the data collection exercise was complete, the raw data was sorted, classified and tabulated ready for analysis. Data analysis involved the use of descriptive and inferential statistics computed by aid of SPSS version 23. Descriptive statistics involved computation of frequencies, means, percentages and standard deviations to analyze data of the demographic information of respondents. Inferential statistics used involved Simple Linear Regression analysis which was used to test the null hypothesis that sought to determine whether Mathematics teachers' observed classroom discourse scores could predict their students' academic achievement in Mathematics.

4. Results

The demographic data was collected on school type, age of participants and gender distributions. Of the 276 sampled schools, 216 were co-educational, 24 boys' schools, and 36 girls' schools. Of the 80 teachers sampled in the study, 49 were male while 31 were female. Of the sampled 3320 students, 1552 were male while 1768 were female. Simple

Linear Regression (SLR) was used to test the the null hypothesis of this study. Data for this hypothesis were checked to assess if the statistical assumptions were met for linearity, outliers, normality, homoscedasticity, and independence. The assumption of linearity was assessed by visual inspection of a scatter plot. The plot indicated positive linear relationship between the predictor variable and the outcome variable which revealed dots on an almost straight line, hence no violation was committed (Masinde, 2019; Aurah, 2013). The remaining assumptions were assessed after running simple linear regression analysis with Mathematics academic achievement scores as dependent variable and drawing residual plots.

Several descriptive measures were computed on data that were collected by the research instruments, with the intention of establishing trends and patterns that would give explanations to some of the observations made in the analysis of quantitative data. Teachers' classroom discourse data was analyzed descriptively to generate Means and Standard Deviations (S.D) and the outcome was as presented in Table 2 thus:

Table 2: Statistics of TPACK, Classroom Discourse and Achievement

Variable	Mean (%)	Standard Deviation
Teachers' Classroom Discourse Scores	67.75	7.38
Students' Mathematics Academic achievement Scores	56.85	5.75

Source: Researcher, (2022)

It can be observed from Table 2 that the selected Teachers' Classroom Discourse mean Score was 67.75% and a standard deviation of 7.38 units. Additionally, it can be observed from the Table that the selected Teachers' Students' Mathematics Academic achievement mean Score was 56.85% and a standard deviation of 5.75 units. The selected students' Mathematics academic achievement mean score was 56.85% and a standard deviation of 5.75 units. The study's null hypothesis was tested inferentially using parametric test at the 0.05 alpha level of statistical significance. The subsequent subsection presents the results. The objective of this study was to establish the extent to which Mathematics teachers' level of classroom discourse could predict students' academic achievement in Mathematics.

The null hypothesis of this study was formulated from this objective as follows;

H01: Mathematics teachers' level of classroom discourse cannot significantly predict students' academic achievement in Mathematics

Data concerning teachers' level of classroom discourse and their students' academic achievement in Mathematics were collected by the teacher observations and the students' marks document analysis respectively. This hypothesis was tested inferentially using Simple Linear Regression (SLR), which was performed on data collected with respect to the specific objective to determine whether Mathematics teachers' observed classroom discourse scores could predict their students' academic achievement in Mathematics. The ANOVA test of the fitness of the regression model yielded affirmative results *[F=65.28, p=.003 at α=.05]*. The researcher therefore proceeded with regression analysis on the data in question. The model summary for the regression was displayed in table 3.

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.185	.342	.341	.69519

A. Predictors: (Constant), classroom discourse Score
Source: Researcher, (2022)

The model summary for the regression as displayed in table 3 revealed that the selected Mathematics teachers' classroom discourse scores explained 18.5% of the variance in their students' Mathematics academic achievement scores. The "enter" method, which was used to undertake this analysis revealed the classroom discourse scores explained a significant amount of variance in the values of the Mathematics academic achievement scores [F = 43.83, p < .001, R^2=.233, $R^2_{Adjusted}$ = .154]. The eventual analysis results for the regression coefficients were as presented in Table 4, in which students' Mathematics academic achievement score was the dependent variable while their teachers' classroom discourse scores was the predictor variable.

Table 4: Simple Linear Regression Analysis

Model	β	t	p	Descriptive	
				Mean	S.D
Constant	24.52	9.054	0.002	-	-
Classroom Discourse Score	0.186	5.853	0.028	67.75	7.38

Source: Researcher, (2022)

Table 4 reveals that teachers classroom discourse scores significantly predicted their students Mathematics academic achievement scores [t =5.853, β=0.186, p=.028]. A regression equation was formulated from the simple linear regression analysis as shown in Figure 2 thus;

Academic achievement score = 24.52 + (0.186 × Classroom Discourse score)

Figure 2: Regression equation

To exemplify the applicability of this equation, we can predict with 23.3% accuracy, students' mathematics academic achievement mean score if given their Mathematics teachers' classroom discourse score. For example, the Mathematics academic achievement mean score of a class taught by a teacher with a low classroom discourse score of say 30% can be predicted by substituting his value in the equation as follows:

Mathematics Academic achievement Score = 24.52 + (0.186 × 30) = 30.1

It can be seen from this working that a low academic achievement score of 30.1% is obtained as a result. Let us now consider another example whereby a Mathematics teacher has a higher classroom discourse score of say 95%. His or her students' Mathematics academic achievements mean score can be predicted using the same equation in

Figure 2, also by substituting 95 in the regression equation as follows;

Mathematics Academic achievement Score = 24.52 + (0.186 × 95) = 42.19

This working proves that a higher Mathematics academic achievement score is obtained for the students who are taught Mathematics by a teacher with higher classroom discourse score. It is now apparent from all workings displayed in this section with respect to the linear regression equation in Figure 4, that there is enough evidence to a new assertion that Mathematics teachers' classroom discourse scores can significantly predict their students' academic achievement in the subject. This new assertion is inconsistent with what is posited in the null hypothesis of this study. For this reason, the null hypothesis was rejected**.** It can now be alternately asserted that '*Mathematics teachers' classroom discourse can significantly predict students' academic achievement in Mathematics.*

5. Discussion of Findings

It was established that Mathematics teachers' classroom discourse is a significant predictor of students' academic achievement in Mathematics. These findings are consistent with those of a study by Smart and Marshall, (2018) whose study examined the relationship between classroom discourse and students' academic achievement during science instruction. Results of these observations indicated a significant positive relationship between students' cognitive engagement and various aspects of classroom discourse like questioning level, complexity of questions, questioning ecology, communication patterns and classroom interactions. Findings of this study are also supported by those of Kiemer, et al, (2015), whose German study investigated whether a video-based teacher professional development (TPD) intervention on productive classroom discourse improved students' learning motivation and interest development over the course of a school year. In their study, the teachers' intervention group was compared with a control group who participated in a traditional TPD programme on classroom discourse. The teachers showed a statistically significant increase in constructive feedback and decrease in simple feedback as a function of the treatment. Pre and post-tests revealed that students in the intervention group significantly increased their perceived autonomy, competence and intrinsic learning motivation as compared with those in the control group. They also showed significantly greater interest changes in the subjects compared with their peers in the control group.

6. Conclusion

On the basis of empirical evidence arising from data that were collected by the study's research instruments and the subsequent statistical data analysis, a major conclusion was arrived at:

> Students' Mathematics academic achievement score can be predicted by teacher's classroom discourse score. Thus, if a given Mathematics teacher's classroom discourse score is known, it is possible to predict his or her students' Mathematics academic achievement mean score, using the linear regression equation that this study has come up with in figure 4. This new development calls for amalgamation of efforts that would ensure and maintain high classroom discourse scores, as this is the main contributory factor to high students' mathematics academic achievement as the study found out.

7. Recommendations

As it has been found out in this study that teachers' classroom discourse significantly affect students' academic achievement. Several recommendations are hereby made to key stakeholders in the education sector, for purposes of policy action. This is especially so because their implications directly concern the problem of low academic achievement in Mathematics at secondary school, an issue that necessitated this study.

Recommendations for Teachers of STEM

Teachers of Science, Technology, Engineering and Mathematics (STEM) should do self-monitoring and evaluation of their Classroom Discourse for the sake of using the feedback to improve their students' academic achievement in the subject.

Recommendations for Secondary School Principals

Limitations aside, results of this study emphasize the importance of teachers' Classroom Discourse. Persistent monitoring and evaluation of the same is therefore very important measure, because these variables positively affect students' academic achievement in mathematics. Principals of all secondary schools in the country need to send all their teachers of Mathematics for any in-service training opportunity that arises, in order to boost their classroom discourse. This should guarantee high academic achievement in Mathematics, which is a core subject in all secondary schools in Kenya.

Recommendations to Ministry of Education

Findings from this study have implications for the MoE, specifically the Kenya Institute of Curriculum Development (KICD). Curriculum planners need to develop a greater awareness and understanding of the various variables that significantly predict Mathematics academic achievement among secondary school students, like teachers' classroom discourse as it was found in this study, and thus integrate them into the existing curriculum. To design a secondary school curriculum that aims to churn out high achievers in the subject of Mathematics, the MoE should therefore closely monitor and evaluate all Mathematics teachers' classroom discourse level and pass over their feedback to KICD, who should in turn use the feedback to improve the current Mathematics curriculum.

8. Future Scope

It was not possible to investigate all issues surrounding students' academic achievement in mathematics, due to a number of limitations such as limited time, insufficient funds and unique programs of various potential participant schools in the study. However, with regard to research on the influence of mathematics teachers' classroom discourse

on students' academic achievement in mathematics, many gaps will still exist, even after adoption of all recommendations of the present study. For this reason, the following suggestions are hereby made for further research, with the hope of bridging some, if not all the gaps that this study leaves behind;

1) For technical reasons, this study was done in secondary schools within Kakamega County only. Generalizing the findings of this study to the whole country may therefore be a farfetched idea. It is therefore suggested that a similar study be replicated in other counties within the republic of Kenya apart from Kakamega County, so as to ascertain if findings of this study are universal.
2) This study used teachers who have taught Mathematics up to form four though currently teaching Form One. However, there are many other teachers who are new on the job and therefore do not have the experience of handling candidate classes. Since there is an acute shortage of teachers in the country, the current 100% transition in the country that pupils from primary schools join secondary schools has only compounded the problem, which means that even the inexperienced teachers will soon be handling candidate classes. The study should therefore be replicated but this time using the not so experienced teachers, to establish their classroom discourse.

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