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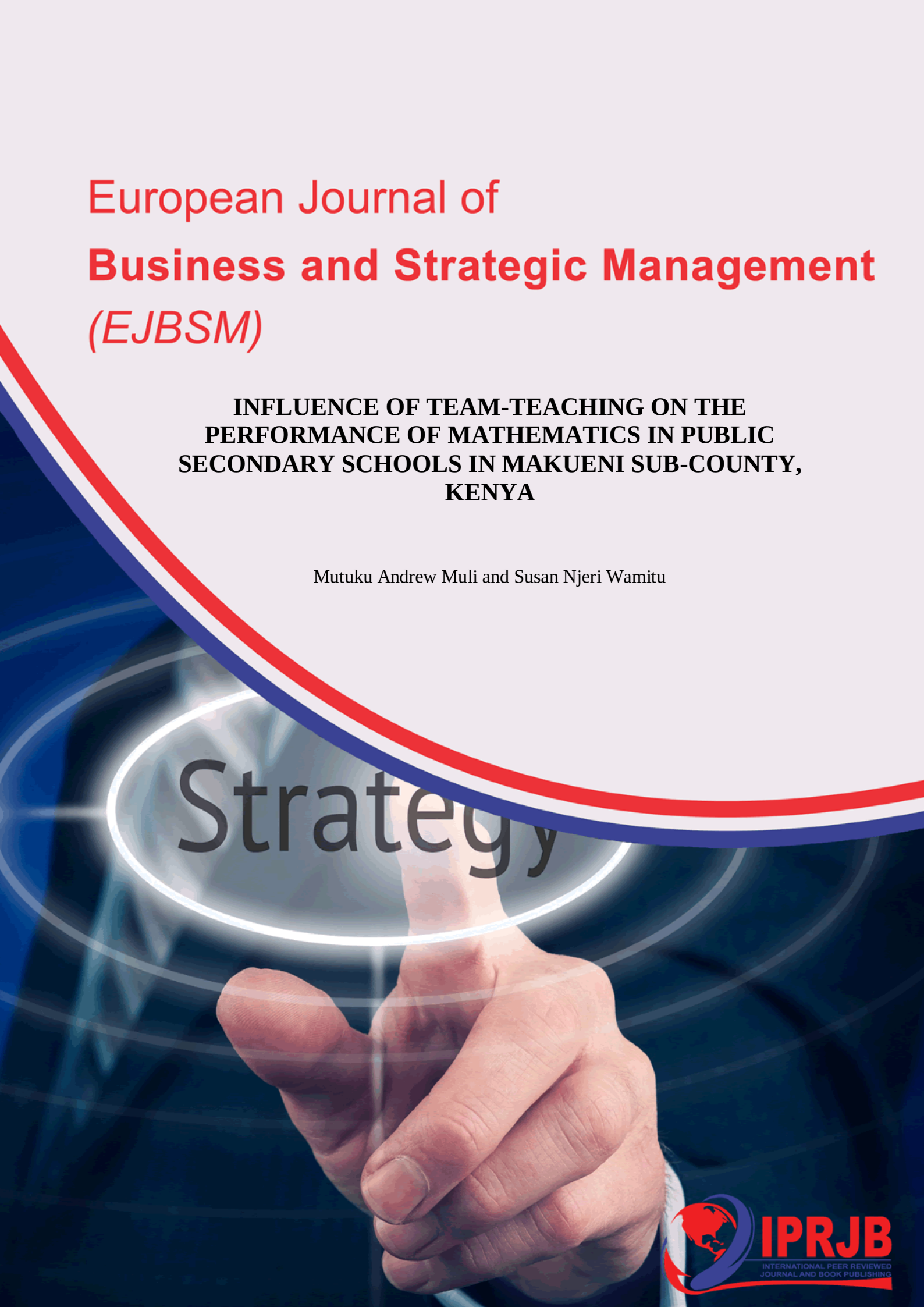

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INFLUENCE OF TEAM-TEACHING ON THE PERFORMANCE OF MATHEMATICS IN PUBLIC SECONDARY SCHOOLS IN MAKUENI SUB-COUNTY, KENYA

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Abstract

Purpose: Strategic management is a concept that is concerned with making decisions and taking corrective actions to achieve long term targets, objectives and goals of an organization. The main purpose of this study was to determine the influence of team-teaching on the students' performance in Mathematics in public secondary schools in Makueni Sub-County.

Methodology: This study adopted a descriptive survey research design and the study targeted the 46 registered public secondary schools in Makueni Sub-County. Two sampling techniques were used; census on the school principals and systematic random sampling of 30% of the Mathematics teachers from every school to obtain a sample size of 118 study participants. Data collection was carried out through administration of questionnaires. Data was analyzed using descriptive and inferential statistics with the help of statistical package for social scientists (SPSS) version 21, discussed and presented in tables.

Findings: Descriptive statistics and regression analysis indicated that there was a positive relationship between team-teaching and performance in Mathematics. The findings of this study were in agreement with those of the previous studies reviewed. The study concluded that team-teaching is a major predictor of the students' performance in Mathematics.

Unique Contribution to Theory, Practice and Policy: The study recommended that the school administrators and other stakeholders in secondary schools in Makueni Sub-County should embrace team work as teachers for students' optimum performance in their respective secondary schools.

Keywords: *Team-teaching, Academic performance, Mathematics, Secondary School.*

1.0. BACKGROUND OF THE STUDY

In relation to a school set up, management practices refer to the ways in which the school leadership, under the leadership of the school principal, uses the resources available; human and material, to promote the best value as well as the way in which the school works with its governing body. These management practices also refer to the use of the most effective and practical techniques to achieve the school objectives while making the optimum use of its firm's resources (Holmes, 2014). This study intended to answer the question "to what extent does team-teaching influence the student's academic achievement in Mathematics?" The traditions about the leadership styles in schools are not different from those regarding leadership in other institutions. The school principal, being the leader of the other managers of other departments within the school, he/she is considered very important in ensuring successful functioning of the various component areas of a school (Ndinza, 2015).

According to Karen (2014) the school heads are believed to perform, among other key functions, in shaping the vision of academic success for all students, creating a climate friendly to education, refining leadership in others, improving instruction, managing people and data processes to further school improvement. Today, improving school management ranks high on the list of priorities for school reforms. According to another survey carried out by Wallace foundation in 2010 found that principal's leadership is among the most imperative matters on a list of issues in public school education. Although there exists a range of leadership patterns in any school, among principals, assistant principals, teachers and parents, the principal remains the central source of leadership influence in a school (Andrew, 2012).

While writing on leadership, Andrew (2012) noted that successful principals are responsible for establishing a school wide vision of assurance to high standards and success of all students. For many years, public school principals have been seen as school managers and as recently as two decades ago, high standards were thought to be the province of the college bound-success. He further revealed that in a school that begins with the principal's spelling out high standards and meticulous learning goals, high prospects for all including clear public standards is one key to closing the gap between the advantaged and less advantaged learners and for raising the overall achievement of all students (Andrew, 2012).

Anderson (2014) further argued that an effective principal makes sure that the concept of academic success for all gets picked up by the faculty and underpins a school wide learning development agenda that focuses on goals for students' progress. The most successful principals aim at building a sense of a school community with attendant characteristics which include value for every member of school community; welcoming, solution-oriented, no blame, professional environment; and effort to involve staff and students in a variety of activities, many of them school wide (Anderson, 2014).

According to another study from the university of Minesota and university of Toronto by Seashore (2010), efficient leadership styles from all sources; principals, influential teachers, staff teams and others, is associated with better student performance in Mathematics and other reading tests. The study concluded that the principals are the most influential on decisions in all schools (Seashore, 2010). However, the school heads do not lose influence as others gain as available literature suggests that higher

performing schools awarded greater influence to stakeholders. The school principals themselves agreed almost unanimously on the importance of several specific practices including keeping track of teachers professional development needs and monitoring teachers work in the classroom; team work, observing and communicating on what is or not working well (Mlozi, 2013). Moreover, they shift the pattern of the annual appraisal cycle to one of on-going and informal interactions with teachers (Michael, 2011).

Michael (2011) explained five key responsibilities of the school principals; firstly, shaping a vision of academic success for all students, one based on high Academic standards, secondly, creating an environment hospitable to education in order that a cooperative spirit, safety, and other foundations of fruitful interaction prevail, thirdly, improving instruction to enable teachers to teach at their best and students to learn their utmost and fifthly, managing people, data and processes to foster school improvement, fourthly, cultivating leadership in others so that teachers and other adults assume their part in realizing the school vision (Michael, 2011).

Kenya, like any other country values education because of its extrinsic and intrinsic gains. Education is an important component in the society because it helps the individual learners to overcome their restrictions and transcends in order to have their aspirations achieved. The government of Kenya has an obligation to ensure that its citizens are educated to enable them to fully participate in the development of their country. Education is important in Kenya because the kind of job one acquires generally depends on his/her level of education. Normally, the higher the level of education, the more likely that one gets a more prestigious job with greater higher income (Mlozi, 2013).

Muya (2015), there is a high competition among Kenyan schools as each is trying to produce good results every year. There is much emphasis on good performance in examinations and acquisition of good academic certificates that would enable school leavers to gain further education or employment. There has been increasing pressure from parents, taxpayers and stakeholders in schools' performance in national examinations (Muya, 2015). According to Ocham (2013) management practices can vary extremely at times independent of school official goals and that head teachers employ a variety of means in supervising and motivating teachers to improve their practices.

In another study by Wekesa (2003) instructional processes are affected directly or indirectly by various management practices exercised by the school heads. The head teachers are charged with the task of managing human resources in their schools. The school principal's managerial behavior has great impact either negatively or positively (Wekesa, 2003). Effective school heads (effective strategic managers) usually concentrate on planning, coordinating and facilitating the work without neglecting interpersonal relationships with the staff, support staff and the student body. Studies conducted by (Andrew, 2012; Wekesa, 2003) all concurred that, the strong leadership of the school heads was the greatest predictor of students' achievement in national examinations. Since the success of teaching and learning takes place in the school, the quality of education is greatly determined by the managerial practices of the head teacher.

These practices play a major role in determining the schools performance in the national examinations. Public Secondary Schools are part of the public sector and they have adopted the new style of management. There are challenges facing their performance in Mathematics which include lack of teacher motivation, inadequate human resource particularly in Mathematics, poor academic implementation, poor school governance, inadequate funding and mismanagement of school funds (Hill, 2015). School principals are often confronted by issues of drugs and social problems which requires a concerted effort with all school stakeholders (Mlozi, 2013). This raises questions on the effectiveness of strategic management the school purports to practice. Moreover it is not clear on how the practices have impacted on the performance of Mathematics in PSS in Makueni Sub-County.

Statement of the Problem

The members of public and Educators acknowledge that different schools achieve different degrees of success. This is so even when the schools have similar learning facilities. There is enormous competition today among the schools as all are trying to produce better results in national examinations. Some schools have maintained better results while others have dropped a situation that has been associated with different management practices of principals and Mathematics teachers in the schools. Success in producing good results in national examinations is largely determined by the school head teacher and the different types of management practices he/she adopts. When an analysis of the KCSE results was done by the researcher on how the schools had performed for the last five years, it was observed that there has been a declining trend in Mathematics performance. This is a phenomenon has been observed in all the schools that presented candidates for the KCSE national examinations from 2013 to 2017.

Table 1: KCSE Performance for all PSS in Makueni Sub-County, 2013-2017

Year	Number of Public Secondary Schools (N)	KCSE Targeted Mean Score in Math.	KCSE Actual Score in Math.	Deviation	KCSE Overall Performance Mean Score in the Sub-County
2013	36	8.50	5.07	-3.43	5.896
2014	39	7.00	6.05	-0.95	5.846
2015	40	7.50	4.35	-3.15	5.580
2016	44	5.50	2.59	-2.91	4.650
2017	46	5.80	2.32	-3.48	4.217

Source: Makueni County Director of Education, 2018

In the year 2013, only 36 PSS presented form four candidates for KCSE in the sub-county. The targeted Mathematics mean score was 8.50 but managed an actual Mathematics mean score of 5.07 reflecting a deviation of -3.43 and finally posting an overall KCSE mean score of 5.896. What the researcher checked for in the year 2013 was also checked for in the subsequent four years as shown in table 1. Based on the literature reviewed in the background information, the researcher has associated this phenomenon with poor strategic management practices by the school leadership in PSS. This study investigate to find out if the strategic management practices are the

ones associated with the undesirable performance in Mathematics or not and provide recommendations which may reverse the clinch to produce an improved performance in the said subject as well as overall (Makueni_County_Director_of_Education, 2017).

Objectives of the Study

The main objective of this study was to determine the influence of strategic management practices on the performance in Mathematics in public secondary schools in Makueni Sub-County.

2.0. LITERATURE REVIEW

This study was guided by two theories; contingency theory and diffusion of information theory.

Contingency Theory

Contingency is a theory profound by Fieldler (1958) on leader attitudes and group effectiveness. This theory centers on the notion that there is no single best approach to manage organizations, people or work best in every situation. In other words, organizations should not be managed by one-size-fit all approach but should work out unique managerial strategies depending on the particular condition of situation they are facing. This perspective encourages managers to study individual and situational differences before deciding on a course of action.

This is due to the differing environmental and organizational needs and structures that affect an organization, coupled with differing resources and capabilities pertaining to individual organization. Similarly, for the students to perform well in all the subjects and specifically in Mathematics there is need for the teachers to employ a combination of a number of ways which include team-teaching in teaching Mathematics for better results in the national examinations.

Diffusion of Innovation Theory

Diffusion of innovation is a theory whose proponent was Everett Rogers and it seeks to explain how, why, and at what rate new ideas and technology spread. In this theory, Rogers argues that diffusion is the process by which an innovation is communicated over time among the participants in a social system. According to Rogers (2003), adoption is a decision of "full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation". In this theory, Rogers defines diffusion as "the process in which an innovation is communicated thorough certain channels over time among the members of a social system." As expressed in this definition, communication channels, innovation, social system, and time are the four key components of the diffusion of innovations.

Similarly, the speed at which the teachers in the public secondary schools learn the new and effective ways of teaching Mathematics is more likely to positively influence the way they teach and the way the students in such schools perform in the national examinations. Therefore, the school management should put in place the necessary measures and resources to ensure a smooth and fast adoption of new teaching methods that enhance understanding and hence better performance in the national examinations. Such measures that encourage sharing or diffusion of ideas would

include frequent training and team-teaching in the teaching Mathematics, which are the four main independent variables to be studied in this study.

Team-Teaching and Students' Performance in Mathematics

Jang (2011) conducted a study in Taiwan on the effects of team-teaching upon two secondary school teachers. The research findings revealed that the average final examination scores of students receiving team-teaching were higher than those of students receiving traditional teaching. The two teaching methods showed a significant difference in respect to students' performance. More than half of the experimental students preferred team-teaching to traditional teaching. The discrepancy between team teachers' expectations of team-teaching and its implementation was noticeable.

The differences in the teaching strategy also exposed team teachers to the challenge and being compared with each other by students in class. Besides, the team-teachers had been unprepared for this comparison, especially in relation to class management. The implementation of team-teaching, however, did not win the support of the school administration, which impeded teachers in holding team-meetings and caused students' doubts regarding team-teaching. Collaboration is increasingly identified as a key aspect in teachers' professional growth (Jang, 2011). Educational reformers have recommended placing more consideration on the relations of teachers for the purposes of professional growth (Lieberman, 2015; Little, 2013). Efficient professional growth must be collaborative, involving the sharing of knowledge among teacher communities of practice rather than concerning individual teachers (Darling-Hammond, 2009; Firestone, 2009; Roth, 2015).

Researchers report that regular opportunities for interaction with colleagues are essential in creating professional school cultures (Lieberman, 2015). A community of peers is important not only in terms of support, but also as a crucial source of generating ideas and criticism Roth et al, (2014). Little (2013) examined prominent forms of collegial relations-assistance, sharing and joint work. Joint work is a strong version of collegiality that shifts teaching from the individualistic to the collective, breaking down the barriers of privacy and leading towards new kinds of teaching (Abell, 2010). Professional development activities must provide regular and frequent opportunities for both individual and collegial reflection on classroom and institutional practice (Porter, 2002).

However, it needs to be investigated why collaboration has been largely ignored in schools. First, in many schools, opportunities for collaboration among teachers are limited and communication tends to be informal and infrequent, even though teachers believe their teaching could be improved by working with colleagues (Corcoran, 2008). Second, the dominant school structure continues to emphasize teacher autonomy rather than collaboration; for many years, schools have expected teachers to teach students independently without assistance from others (Lortie, 2005).

The practice of this pattern has hindered attempts to create collaborative environments where teachers regularly talk with each other, and observe one another. Third, collaboration is not necessarily easy in the form of team-teaching: it takes time and energy for teachers to work together in planning, teaching and evaluating. A related approach to increased collaboration among teachers exists in team-teaching. Team-teaching is, in fact, a typical element of primary school level education (Golner, 2012)

but has less frequently been implemented at the secondary school level. Perhaps this is due to traditional departmental barriers (McKenna, 2009) that have often made collaborative teaching difficult, or even impossible.

Cook (2006) stated that collaboration is, indeed, a problematic relationship, which is also about collegiality and professional sharing. Similarly, (Bennett, 2008) observed that collaborative cultures take time to develop, require trust and mutual understanding, and are derived from day-to-day interaction as well as long-term relationships of participants. In school restructuring, teacher isolation has been identified as the most powerful impediment to implementing reform (Lieberman, 2015) and little change indeed occur in schools unless teachers constantly observe, help and interact with one another (Barth, 2016).

Welch et al. (2015) noted that teaching terminologies of collaboration are often exchanged and used synonymously. For example, terms like co-teaching (Tobin, 2013) cooperative teaching (Bauwen, 2011) and team-teaching (Welch, 2015) refer to a similar instructional delivery system. (Cook, 2006) identified four key components of co-teaching: educators, delivery of meaningful instruction, diverse groups of students and common settings. Team-teaching has a variety of operational definitions. For example, the term may refer to; a simple allocation of responsibilities between two teachers, team planning but with individual instruction or cooperative planning, instruction and evaluation of learning experiences (Sandholtz, 2013). These varying operational definitions of team-teaching result in varying amounts of collaboration among teachers.

Clearly not all team-teaching approaches offer equivalent opportunities to foster collaboration and enhance teachers' professional development. Co-teaching involves two or more teachers whose primary concern is the sharing of teaching experiences in the classroom, and co-generative dialoguing with each other. They take collective responsibility for maximizing learning to teach or becoming better at teaching while providing enhanced opportunities for their students to learn (Tobin, 2013). Co-teaching provides us with a zone of proximal development, the interaction between individuals and a new form of societal activity.

The central purpose of co-generative dialoguing is to further develop the existing understanding of the teaching situation in order to increase professional growth. Roth et al. (2015) considered co-teaching as an effective means of achieving deep learning of science concepts while learning alternative ways to teach the same subject-matter. Co-teaching also provides opportunities for new teachers to obtain greater opportunities of learning to teach (Cook, 2006). The presence of co-teachers increases access to social and material resources thereby increasing opportunities for actions that would not otherwise occur.

In whole-class situations, the coordination and reciprocity of the teachers' actions are crucial where the potential arises for miscues and non-complementary actions to occur (Tobin, 2013). Because co-teachers teach together, interactions continuously occur; thus the actions of any of the participants in the new classroom structure in the field are resources that provide ample opportunities for others' action. Co-teachers continuously create material and social resources that allow for new forms of subsequent agency. Such resources include physical, social spaces and meaning-

making entities: co-teachers take advantage of these resources in synchronized and coordinated ways (Tobin, 2013).

Social constructivists emphasize that the notion of inter-subjectivity is highly important. Inter-subjectivity allows the meeting of two minds, with each operating on the other's ideas, 'using the back-and-forth of discussion to advance his or her own development'. It also allows for joint thinking, problem solving and decision-making processes from which the learner appropriates new knowledge (Sandholtz, 2013). No one person construes the stream of events in the same way as others; as they interact with one another, they develop ideas that, because they are held in common, create a universe of discourse, a common frame of reference in which communication can take place (Connolly, 2012). Knowledge is collaboratively constructed between individuals from where it can be appropriated by each individual. Team-teaching gives teachers the opportunities to act on their ideas and reflect in and upon their actions.

Their understandings evolve through a meaning negotiation process, in which they discuss their own ideas and consider the ideas of others (Bayer, 2012). Bennett (2008) state that: collaboration can only be effective when there is a genuinely equal relationship between all parties; differing knowledge bases, including theoretical knowledge and practical knowledge, must be of equal importance; both parties must commit to engaging in ongoing dialogue and mutual inquiry; all participants must have opportunities to experience others' reality in a mutually supportive environment; and collaborators must be able to openly discuss any issues or problems that arise.

In addition, Bennett (2008) suggest that the following three characteristics are essential for effective partnerships: a degree of dissimilarity between the partners, the mutual satisfaction of self-interest and a measure of selflessness on the part of each partner, while assuring their satisfaction of self-interest in the partnership. The link between the above studies on team-teaching and the this study is that they have explored the influence of team-teaching on the students' academic performance generally while, the this study investigate, among other factors, the influence of team-teaching on the students' performance in Mathematics.

3.0. RESEARCH METHODOLOGY

This study adopted a descriptive survey design. The target population of this study included the school administrators (school principals and deputy principals) and the Mathematics teachers from the 46 registered Public Secondary Schools which presented candidates for the KCSE examinations at the end of the year 2017 in Makueni Sub-County. There are 46 school principals and 230 Mathematics teachers in the 46 PSS mentioned below to give a total target population of 276 teachers.

Table 2: Target Population

Category	Number (n)	Percentage (%)
School Administrators	46	16.67
Mathematics Teachers	230	83.33
Total	276	100

Source: Director of Education, Makueni County, 2018

The school administrators (the school principals and deputy principals) consisted of 16.67% while the Mathematics teachers consisted of 83.33% of the target population. The study sample consisted of both school principals and Mathematics teachers. Census method was used to obtain 46 principals from the 46 targeted registered public secondary schools while random sampling was conducted to obtain 30% of the Mathematics teachers from every PSS to obtain a total of 118 study participants on which questionnaires were administered.

Table 3: Sample Size

Category	Number (N)	Number Sampled (n)	Percentage Sampled (%)
School Administrators	46	46	100
Mathematics Teachers	230	72	31.3
Total	276	118	42.8

Source: Makueni County Director of Education

A standardized questionnaire was developed to capture the various variables investigated in this study. (Mugenda, 2003). The researcher used a questionnaire in this study because the data can be collected from a large sample with minimal biasness since it is filled by the respondents without the presence of the researcher hence confidentiality is maintained. The questionnaire was divided into two main parts; one to capture the respondent's background information and the other part to capture information on the major areas of study. It contained both closed ended and open ended questions. The closed ended questions provided precise information minimising biasness while the open ended questions gave respondents the freedom to express themselves.

Prior arrangements were made during a pre-visit to each of the 46 PSS from which data was collected. The questionnaire was piloted on 10 Mathematics teachers randomly selected from the Public Secondary Schools in Kilungu Sub-County, which neighbours Makueni Sub-County to the East. Data was collected and the analysis of the quantitative data was by the regression model below. Descriptive statistical tools such as frequencies, percentages, mean and standard deviation were used to describe the data. To establish the effect of independent variables on dependent variable, multiple regressions were performed using SPSS version 21. The researcher used multiple regression analysis to test the effect of change of independent variables on dependent variables. The following regression model, which was authored by (Pardoe, 2012) and previously used by (Ladd, 2014; Lieberman, 2015; Yara, 2012) was used to express the value of the predicted (dependent) and the predictor (independent) variables and an error term:-

Regression model: $\mathbf{Y = \alpha + \beta_1 X_1 + \epsilon}$

Where:-
Y = students' performance in Mathematics
α = Constant
β_1 - β_4 = Model coefficients
X_1 = Team-teaching
ϵ = Error factor

4.0. RESULTS AND DISCUSSION

The findings of this study were summarized and discussed as follows:-

4.1. Pilot Study Analysis

The researcher prepared and administered ten (10) questionnaires to Mathematics teachers who were randomly selected from the public secondary schools in Kilungu sub-county which is to the East of Makueni Sub-County. The basic characteristics of the piloting respondents were summarized in table 4 below. The questionnaires were distributed and the respondents were given a period of five (5) days to complete them before collection for analysis with an aim to improve the questionnaire.

Table 4: Piloting Respondents

Designation	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Principal	5	50.0	50.0	50.0
HOD	3	30.0	30.0	80.0
Teacher	2	20.0	20.0	100.0
Total	10	100.0	100.0	
Level of Education		**Percent**	**Valid Percent**	**Cumulative Percent**
Master	4	40.0	40.0	40.0
University Degree	5	50.0	50.0	90.0
Diploma	1	10.0	10.0	100.0
Total	10	100.0	100.0	
Teaching Experience		**Percent**	**Valid Percent**	**Cumulative Percent**
10-14 years	3	30.0	30.0	30.0
15-19 years	4	40.0	40.0	70.0
20 years and above	3	30.0	30.0	100.0
Total	10	100.0	100.0	

The results in table 4 above revealed that there was a 100% response rate since all the questionnaires piloted were collected. From the analysis of the way the questions were answered, it was observed that there were no major issues of concern which would warrant a second piloting. The only thing that was noted was that all the respondents left the open-ended questions unanswered. The researcher improved the tool by removing all the open ended questions leaving the questionnaire with closed ended questions only. There were no technical issues detected and the respondents had no problem with the format of the questionnaire. During piloting, the researcher also noted that using a motorcycle for transport was faster cheaper and convenient compared to any other vehicle. All these observations were noted and effectively applied during the main data collection process.

4.2. Response Rate

The study population consisted of administrators and Mathematics teachers from the 46 public secondary schools in Makueni Sub-County. The targeted population was 276; 46 school administrators and 230 Mathematics teachers. The study sampled all the school administrators and 30% of the Mathematics teachers giving a total of 118

study respondents. Only 112 study respondents successfully completed and returned their questionnaires. This translated to 94.92% response rate (see table 5 below).

Table 5: Response Rate

Category	Number Sampled (n)	Responded	Response Rate (%)
School Administrators	46	44	95.65
Mathematics Teachers	72	68	94.44
Total	118	112	94.92

The response rate of this study was high and acceptable since there were other previous studies with lower response rates (Mugenda, 2003). According to Kothari (2014), a response rate of 80% and above is acceptable. Therefore, it was justifiable to work with a response rate of 94.92% which indicated a reasonable representation of the entire population.

4.3. Respondents' Designation

The designations were classified into five categories; principal, deputy principal, senior master, head of department and teacher. The principal and the deputy principal were considered as school administrators while the others were classified as Mathematics teachers. The designations were summarized in table 6 below.

Table 6: Respondents' Designation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Administrators	44	39.3	39.3	39.3
	Senior Master	12	10.7	10.7	50.0
	HOD	29	25.9	25.9	75.9
	Teachers	27	24.1	24.1	100.0
	Total	**112**	**100.0**	**100.0**	

According to table 6 above, majority of the respondents were the administrators (the principals and deputy principals) (39.3%) while the least of the respondents were the senior masters (10.7%). The heads of departments were 25.9% and the teachers were 24.1% of the total respondents.

4.4. Teacher's Level of Education

The teacher's level of education was classified into five categories; craft certificate, diploma, bachelor's degree, master's degree and PhD. The number of respondents in each of these different levels of education was summarized and presented as shown in table 7 below.

Table 7: Respondents' Level of Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	PhD	4	3.6	3.6	3.6
	Master	34	30.4	30.4	34.0
	University Degree	68	60.7	60.7	94.7
	Diploma	6	5.4	5.4	100.0
	Total	**112**	**100.0**	**100.0**	

According to table 7 above, none of the respondents had craft certificate as the highest level of education. Majority of the respondents were holders of a bachelor's degree (60.7%) while the least of the respondents were PhD holders (3.6%). Those with diploma as their highest level of education were only 5.4% of the total respondents conducted.

4.5. Teaching Experience

The teaching experience of the respondents was classified into five groups; those with experience below five years, five to nine years, ten to fourteen years, 15 to 19 years and those with 20 years and above. The number of respondents in each of these categories was summarized in table 8 below.

Table 8: Teaching Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20 years and above	21	18.8	18.8	18.8
	15-19 years	33	29.5	29.5	48.3
	10-14 years	21	18.8	18.8	67.1
	5-9 years	16	14.3	14.3	81.4
	below 5 years	21	18.8	18.8	100.0
	Total	**112**	**100.0**	**100.0**	

The results presented in table 8 above revealed that majority of the respondents had a teaching experience of between fifteen and nineteen years (29.5%) while the least of the respondents had a teaching experience of between five and nine years (14.3%).

4.6. Descriptive Analysis

4.6.1. Team-Teaching and Performance in Mathematics

Under team-teaching, this study collected data on the number of Mathematics teachers in each school, the number of departmental meetings held per term and if they practiced team-teaching in their school. Those that practiced team-teaching were asked to state the frequency and the nature of team-teaching they engaged in. Finally, the respondents were asked to state the challenges they faced in practicing team-teaching in Mathematics in their school. Their responses were summarized and presented in tables below.

4.6.2. Number of Mathematics Teachers per School

The number of teachers per school was grouped into five intervals; 1-2, 3-4, 5-6, 7-8, and 9 and above. The responses were summarized and presented in table 9 below.

Table 9: Number of Mathematics Teachers per School

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-2	31	27.7	27.7	27.7
	3-4	38	33.9	33.9	61.6
	5-6	30	26.8	26.8	88.4
	7-8	13	11.6	11.6	100.0
	Total	**112**	**100.0**	**100.0**	

According to table 9 above, the sub-county schools (27.7%) had 1-2, the county schools (33.9%) had 3-4, extra-county schools (26.8%) had 5-6 while the national schools (11.6%) had 7-8 Mathematics teachers in their schools. From these findings, it was evident that the national schools had more Mathematics teachers than the other schools in the lower levels. This was also reflected in their performance as those schools with relatively more Mathematics teachers had better performance in Mathematics compared to those with relatively few Mathematics teachers.

4.6.3. Departmental Meetings per Term

This study also collected data on the number of departmental meetings (Mathematics Department) the teachers had per term. The frequency of meetings was 1, 2, 3, 4 and above. The responses were summarized and presented in table 10 below.

Table 10: Number of departmental meetings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	38	33.9	33.9	33.9
	Twice	63	56.3	56.3	90.2
	Thrice	11	9.8	9.8	100.0
	Total	112	100.0	100.0	

The results in table 10 above revealed that majority of the respondents (56.3%) reported that they had a Mathematics departmental meeting twice per term while the least (9.8%) reported that they had three departmental meetings per term. The respondents were of the opinion that, since the departmental meetings were held to discuss how to improve performance, more meetings were associated with improved or better performance compared to the schools that had fewer departmental meetings.

4.6.4. Practice of Team-Teaching

This study sought to find out if the Mathematics teachers who participated in this study practiced team-teaching. They were asked if they practiced or not and their responses were recorded as either YES or NO. Their responses were summarized and presented in table 11 below.

Table 11: Practice of Team-Teaching

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Practiced	112	100.0	100.0	100.0

The results in table 11 above established that all the study participants (100%) reported practice of team-teaching in their respective schools. Practice of team-teaching was associated with good performance in Mathematics. However, the type of team-teaching activity and frequency of practice would also determine the performance since some of the team-teaching activities are assumed to be more effective than others. This study also sought to establish the frequency at which the respondents practiced team-teaching activities.

4.6.5. Frequency of Team-Teaching

The study respondents were also asked to state frequency at which they practiced team-teaching. The responses included rarely, sometimes, often and always. Their responses were summarized and presented in table 12 below.

Table 12: Frequency of Team-Teaching

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rarely	18	16.1	16.1	16.1
	Sometimes	51	45.5	45.5	61.6
	Often	25	22.3	22.3	83.9
	Always	18	16.1	16.1	100.0
	Total	**112**	**100.0**	**100.0**	

The results in table 12 above revealed that majority of the study respondents (45.5%) practiced team-teaching activities sometimes. The proportion of the respondents who practiced team-teaching rarely and always was 16.1% each. Those who practiced team-teaching often were 22.3%. More frequent practice of team-teaching was associated with better performance compared to those schools that rarely practiced team-teaching.

4.6.6. Team-teaching Activities in Mathematics

The respondents were asked to identify the team-teaching activities they engaged in from a given list which consisted of conveyor belt marking, use of common schemes of work, use of common lesson plans and notes and sharing teaching tools. The team-teaching activities they engaged in were summarized and presented in table 13 below.

Table 13: Team-teaching Activities

Team-teaching activity		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Conveyor belt marking	8	7.1	7.1	7.1
	Common schemes	25	22.3	22.3	29.5
	Common lesson plans/notes	69	61.6	61.6	91.1
	Sharing teaching tools	10	8.9	8.9	100.0
	Total	**112**	**100.0**	**100.0**	

The results presented in table 13 above revealed that majority of the respondents (61.6%) shared class lesson plans and notes while the least proportion of respondents (7.1%) participated in conveyor belt marking. The proportion of those who shared schemes of work was 22.3% while the proportion of those who shared teaching tools was 8.9%. No other team-teaching activity was reported by the respondents contacted.

4.6.7. Challenges in faced in Team-Teaching

The study participants were also asked to state any challenge they faced in practicing any of the team-teaching activity they engaged in. The challenges were to be picked from a given list which included lack of any of the following; teacher cooperation, administrative support, interest in sharing knowledge and team work spirit. The respondents were also at liberty of stating their challenge in case it was not among those provided above. The results were summarized and presented in table 14 below.

Table 14: Challenges in Team-Teaching

Challenges in team-teaching		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lack of teacher cooperation	64	57.1	57.1	57.1
	Lack of admin support	28	25.0	25.0	82.1
	Lack of interest in sharing knowledge	4	3.6	3.6	85.7
	Lack of team work spirit	16	14.3	14.3	100.0
	Total	**112**	**100.0**	**100.0**	

The results presented in table 14 above revealed that majority of the respondents (57.1%) experienced the challenge of lack of teacher cooperation while the least reported challenge was lack of interest in sharing knowledge (3.6%). The proportion of respondents that reported lack of administration support was (25%) while those that reported lack of team work spirit were (14.3%).

4.6.8. Performance in Mathematics and Overall Performance

The respondents were asked to state their school Mathematics mean score and the overall school mean score for the last five years. The results were summarized in table 15 below.

Table 15: Mathematics and Overall Performance

Average Performance	2013	2014	2015	2016	2017
Mathematics Mean Score	5.07	6.05	4.35	2.59	2.32
Overall Mean Score	5.896	5.846	5.580	4.650	4.217

The results in 15 above revealed that the overall and Mathematics' performance have been declining over the last five years. Over the last five years, the highest mean score in Mathematics and overall performance were recorded in 2014 and least was recorded in 2017 respectively. The respondents were then asked to state their perceived influence of Mathematics on the overall performance of students in the national examinations (KCSE). Their responses included 1 = Don't know, 2 = No effect, 3 = Low, 4 = Moderate and 5 = High and they were summarized in table 16 below.

Table 16: Perceived impact of Math performance on Overall Performance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High	25	22.3	22.3	22.3
	Moderate	55	49.1	49.1	71.4
	Low	32	28.6	28.6	100.0
	Total	**112**	**100.0**	**100.0**	

According to table 16 above, all the respondents were of the perception that performance in Mathematics influenced the overall performance of students. Majority of the respondents (49.1%) were of the view that the performance in Mathematics had a moderate influence while the least proportion of the respondents (22.3%) perceived that it had a high influence on the overall performance of the students in the national examinations. The rest of the respondents (28.6%) were of the perception that performance in Mathematics had a low influence on the overall school performance.

4.7. Inferential Analysis

4.7.1. Team-Teaching and Performance in Mathematics

The second objective of this study was to find out the influence of team-teaching on the students' performance in Mathematics. Correlations were performed to establish the relationship that existed between team-teaching activities and the student's performance in Mathematics. The results were summarized and presented in table 17 below.

Table 17: Correlations: team-teaching and performance in Mathematics

Team-teaching activities		Performance in math	number of math teachers	Number of departmental meetings	frequency of team-teaching
Performance in math	Pearson Correlation	1	.500**	.022	.071
	Sig. (2-tailed)		.000	.820	.454
	N	112	112	112	112
Number of math teachers	Pearson Correlation	.500**	1	.356**	-.113
	Sig. (2-tailed)	.000		.000	.237
	N	112	112	112	112
Number of departmental meetings	Pearson Correlation	.022	.356**	1	.377**
	Sig. (2-tailed)	.820	.000		.000
	N	112	112	112	112
Frequency of team-teaching	Pearson Correlation	.071	-.113	.377**	1
	Sig. (2-tailed)	.454	.237	.000	
	N	112	112	112	112

**. Correlation is significant at the 0.01 level (2-tailed).

The findings in table 17 above revealed that, although weak, all the team-teaching activities were positively correlated with performance in Mathematics. However, only one of the team-teaching activity was found to have a significant influence on the students' performance in Mathematics; the number of Mathematics teachers (r=0.500,

p=0.000). The number of departmental meetings (r=0.022, p=0.820) and the frequency of team-teaching (r=0.071, p=0.454) did not have any significant influence on the students' performance in Mathematics.

4.8. Regression Analysis

Regression analysis was carried out to establish the extent to which the studied independent variables predicted the students' performance in Mathematics. The results were presented in table 18 below.

Table 18: Regression Model Summary

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	**.740[a]**	**.547**	.530	1.33231

a. Predictors: (Constant), team-teaching

From the model summary in table 18 above, the value of R=0.740 indicates a high degree of correlation between the predictors and the dependent variable. The value of R square = 0.547 suggests that 54.7% of the change in the students' performance in Mathematics can be explained by the four predictor variables studied. Therefore, the remaining proportion (45.3%) was due to other factors and could not be explained by team-teaching in teaching Mathematics. The results were presented in table 19 below.

Table 19: ANOVA

ANOVA[s]						
Model		**Sum Squares**	**ofdf**	**Mean Square**	**F**	**Sig.**
1	Regression	229.702	4	57.426	32.352	**.000[b]**
	Residual	189.929	107	1.775		
	Total	419.631	111			

a. Dependent Variable: Students' performance in Mathematics
b. Predictors: (Constant), team-teaching

The ANOVA table 19 above indicates that the regression model predicts the dependent variable significantly well. This is because the p value of 0.000 is less than 0.01 which means that; overall, the regression model statistically and significantly predicts the outcome variable, meaning that it is a good fit for the data. The study used standardized coefficients because they can compare the strength of the effect of the independent variable on the dependent variable as shown in table 20 below.

Table 20: Regression Coefficients

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	-1.126	.417		-2.703	**.008**
	Team-teaching	.768	.153	.389	5.031	**.000**

a. Dependent Variable: students' performance in Mathematics

The standardized regression coefficients in table 20 above were used to enable the study to compare the relative strengths of the four independent variables on the dependent variable; academic performance in Mathematics. The table provides the necessary information required to predict the students' performance in Mathematics from team-teaching in Mathematics.

Regression Model: $\mathbf{Y = \alpha + \beta_1 X_1 + \epsilon}$

Where:-

Y = students' performance in Mathematics, α = Constant, β_1 - β_4 = Model coefficients, X_1 = Team-teaching, ϵ = Error term.

Specific Regression Model: $\mathbf{Y= -1.126+0.389X_1}$

Students' performance in Mathematics = -1.126 + 0.389 (team-teaching in Mathematics). The regression analysis in table 4.31 above indicates how a unit change in the independent variable changes the dependent variable. Holding the other factors constant, the constant influences the academic performance of students in Mathematics negatively at -1.126. Since the beta (β) for team-teaching is positive, it indicates that a unit increase in team-teaching would lead to a change in the students' performance by 0.389. The error term was not included in the specific regression model because it had a negligible influence on the academic performance of students in Mathematics when the other factors are held constant. There was a significant prediction of the students' performance in Mathematics by team-teaching.

5.0. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

The study investigated the influence of team-teaching on the students' performance on the assumption that those teachers who practiced different team-teaching activities would stand a better chance to discuss and find solutions to issues affecting their content delivery in the classroom hence improved performance in the academics. The findings of this study revealed that all the team-teaching activities measured had a positive correlation with performance in Mathematics among students in public secondary schools in Makueni Sub-County. However, only one of the team-teaching indicators; the number of Mathematics teachers, had a significant influence on the students' performance in Mathematics.

The researchers' opinion is that more teachers reduce the student-teacher ratio hence increases the effectiveness of the teacher while teaching. This enhances the teaching and learning process making students perform better than those in schools with relatively fewer teachers with high student-teacher ratio. The other indicators which included the number of departmental meetings and the frequency of team-teaching did not have a significant influence on the students' performance in Mathematics. This was despite the fact that the respondents reported facing multiple challenges which included lack of teacher cooperation, support from the administration and team work spirit, in trying to practice team-teaching.

Although there is very little research that has been carried out on the influence of team-teaching on the students' performance, the findings of the few studies that have been conducted elsewhere have concurred with the findings of this study. For instance, according to a study carried out by Roth et al (2015) it was established that team-teaching is an effective way of constructing deep learning concepts while learning alternative techniques of teaching or delivering the same content or subject matter. It was also established that it was a practice that enhances students' performance even in other subjects as it provides regular opportunities for interaction with colleagues which are essential in creating professional schools cultures (Welch, 2015). Despite team-teaching being a good practice, it has continued to face numerous challenges especially in the secondary school level as it was established by this study and confirmed by previous studies.

According to Roth (2002) team-teaching is a typical characteristic of the primary school level of education but it is less practiced and implemented in secondary school level of education probably because of the potential barriers created by the departments in the secondary schools which make collaborative teaching difficult (Roth, 2002). It was also noted by Tobin (2013) that team-teaching culture takes time to develop as it requires trust as well as mutual understanding which come from day to day interactions and long term relationships of participants. Generally, the discussion on the findings of this study can be summarized by stating that team-teaching was found to have a positive relationship with students' performance in Mathematics. The findings of this study were in agreement with those of the previous studies initially considered under the literature review.

5.2. Conclusions

According to the findings on the second objective it was concluded that, team-teaching influenced performance in Mathematics in PSS in Makueni Sub-County. This was confirmed by the correlation analysis which established a positive relationship between the various team-teaching activities and performance in Mathematics. It also revealed that the increase in Mathematics teachers in any given school, using common schemes of work and exchanging lesson plans and notes could lead to increased performance in Mathematics. Similar conclusion was made from the regression analysis which confirmed that teaching had a positive and a significant relationship on performance in Mathematics. It was also the major predictor of the dependent variable.

The study also concluded that the smaller schools ranked as Sub-County and County were inadequately staffed with Mathematics teachers compared to the bigger schools at the national and extra county levels. From the records on the departmental meetings, it was concluded that most schools have inadequate departmental meetings which would enable them discuss issues affecting the delivery and performance of their students in their schools. It can also be concluded that all teachers are interested and would be willing to practice team-teaching since all had confessed practicing team-teaching in one way or another. The main challenge faced when practicing team-teaching was lack of teacher cooperation and lack of administrative support.

5.3. Recommendations

The following are some of the possible recommendations which were made based on the findings of this study. The recommendations have been put into two categories and as per the objectives; to the policy makers and to the academia.

The study recommends that the secondary school academic staff and administrators need to cultivate or create an environment that promotes team-teaching among teachers not only to those teaching Mathematics, but also to those teaching other subjects. This is because other studies have also noted with concern that secondary schools will continue to realize very little change unless the teachers constantly practice, help, observe and interact with one another.

The knowledge gained from this study is that the administrators in the public secondary schools should invest more resources in establishing the other factors which explain the proportion of change in the students' performance in Mathematics not explained by the four independent variables studied in this study. The government through the Ministry of Education needs to facilitate public secondary schools with limited resources in acquiring the basic tools and services necessary to enhance students' performance not only in Mathematics but also in other subjects.

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