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Effects of Principals' Organization of Mathematics Contests on Students' Performance in Mathematics in Kenya Certificate Of Secondary Education Examinations In Meru County

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Abstract
Performance of candidates in Kenya Certificate of Secondary EducationMathematics in Meru County of Kenya from 2012 to 2016 has consistently been deteriorating. This has called for this study so as to establish whether this trend has anything to do with organization or otherwise of external Mathematics contests in secondary schools of Meru County of Kenya. The study adopted ex post facto design because the effects of independent variable on dependent variable had already occurred. Research instruments were Mathematics teachers' questionnaire, and Principals' interview guide. The target population was 299 principals and 836 Mathematics teachers in the County. This study used stratified random sampling with proportional allocation. The sample size was 30% of the total target population.It was established that most principals did not organize Mathematics contests, to the detriment of performance of their KCSE candidates.

Key Words: ***Principals' organization, Mathematics contests, Kenya, Kenya Certificate of Secondary Education***

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I. Introduction

To improve students'performancein Mathematics, teachers and the school administration have to perform evolving instructional administrative roles by applying practitioner-based effective teaching and learning strategies. This means that in order to help students perform better in Mathematics, different teaching strategies may be used singly or in combination (Mohanty, 2005). Further, Mohanty (2005)observes that in schools where multiple changes in learning and activities have been effected, students' learning outcomes have significantly improved. Such strategies may include in-service training,workshops and seminars for teachers of Mathematics, use of the learning cycle approach, use of computer simulations, organizing remedial classes for weak students, inviting specialists to talk to students on how to enhance academic performance in Mathematics as well as organizing external Mathematics among schools. Such organizations are done by Mathematics teachers with the principals playing supervisory and facilitative roles.

Davis *et al* (2011) indicate that the problems of organizing Mathematics Contests in worldare among them; South Africa, Nigeria, Uganda and Rwanda.

- hard dependence of pupils on their teachers` expertise
- restricted access to suitable sources for preparing students for high level math competitions
- difficulties in spreading the rich experience of some teachers
- difficulties in organizing the competitions by correspondence or via Internet
- the great amount of competition stress

The continentalproblems of organizing Mathematics contests are:

Problem solving: the cultivation of mathematical ingenuity, creativity and heuristic thinking by setting students open-ended, unusual, and sometimes unsolved problems. The problems can range from simple word problems to problems from international mathematics competitions such as the International Mathematical Olympiad. Problem-solving is used as a means to build new mathematical knowledge, typically by building on students' prior understandings.

The problems of organizing Mathematics contests in Kenya are:

- limited space in classes due to high number of Mathematics student as Mathematics it is a compulsory subject

- The great amount of competition stress

The problems of organizing Mathematics contests in Meru County are:

- Inadequate finances to support Mathematics competition
- Limited space in classes to adhere to COVID-19 social distancing to spread of corona virus, Ruscyk (2020). The government of Kenya has always cited lack of enough infrastructure which has hindered a lot of activities in schools.

The problem that necessitated this study is the continued poor performance of students in KCSE Mathematics in Meru County from 2012-2016. The researchers conducted the study to know the strategies used by the principals to improve the KSCE performance in Mathematics in Meru County. The findings reviewed that used of Mathematics contents help the student's share the ideas with this improve the thinking capability and improve problem solving skills leading to improved performance in Mathematics.

An analysis of the county's Mathematics results from the years 2012 to 2016 shows that performance in KCSEMathematics examinations has been below average (KNEC, 2017). While as other Counties in the country have consistently performed well in the subjects for instance KNEC 2012 to2016 Meru County Mathematics scores have been below average (2.8) which is averaged from the mean obtained between 2012 to 2016 an indication of grade D plain on average. While Tharaka-Nithi and Embu counties had means of 4.5 and 4.91 which are grades D+ and 4.91 respectively in the same period. Therefore, there is a strong reason to believe that there is a problem worth researching on in Meru County.

Objectives of the Study

This study pursued the following objectives:

a) To establish whether secondary school principals in Meru County of Kenya organized or had their students participate in external Mathematics contests.

b) To determine whether those principals who organize or had their students participate in external Mathematics contests performed better in KCSE Mathematics examination in Meru County of Kenya.

c) To find out the challenges faced by principals who did not organize or participate in external Mathematics contests in Meru County of Kenya.

II. Research Methodology

This study adopted*ex-post facto*research design because the variables under investigation had already occurred (Creswell, 2013).*ex-post facto*design its investigations*after the fact*, that is, the t variables had already had their effects. Therefore, in this study, the researchers did not manipulate the variables for cause-effect relationships.

This study targeted a population of 299 principals and 836 Mathematics teachers in secondary schools in Meru County. In this study, a classification of the schools in terms of gender mixed schools (211), Girls' schools (54) and Boys' schools (34) was done. The sample was selected based on the recommendations of Creswell (2013) and Mugenda and Mugenda (2003), that the sample size should be 30% of the target population. This obtain the following sample per category of schools: Mixed secondary schools was 19, Girls' secondary schools was 5, Boys' secondary schools was 3 thus, making a total of 27 schools. Principals in the sampled schools were interviewed and a total of92 Mathematics teachers in those schools were served with questionnaires. Items in the interview guide and questionnaire focus on the problem of the study. Data obtain from the teachers was analyzed quantitatively, while that from the principals was analyzedqualitatively.

III. Results and Discussions

While pursuing the objectives of this study, the majority of the teacher respondents, 194 or 87.78%, indicated that their principals did not coordinate the efforts of organising Mathematics contests, while a minority, that is, 27 or 12.22% asserted that their principals coordinated efforts to organize Mathematics contests.

These results suggested that in the majority of schools, principals did not coordinate efforts to organize Mathematics contests. Considering the identified poor performance of the schools in Mathematics, then it was asserted that the lack of coordination of Mathematics contests was a contributing factor. As in the study by Riley & Karnes (2006) suggested, learner's self-directed skills and autonomy were enhanced through competitions. This meant that Mathematics competition purposed to motivate, excite, create interest in the subject and furnish parents and schools with more information about the ablestudents.

Therefore, the minimal levels of external Mathematics contests limited the student's motivation, excitement and interest in Mathematics. The students are comfortable with the status quo in Mathematics performances ranking in their schools which would otherwise be challenged by external competitors.

In contrast, the schools that enter external Mathematics contests were likely to reap the benefits of external competitions. For instance, Bicknell, & Riley, (2012) claimed that participating in outward

competitions could result in the awarding of certificates while also being selected to partake in the competitions is a sign of prestige. Therefore, when students are allowed to take part in external competition, then their competitive spirit was aroused and they would invest time and energy perfecting their Mathematics skills and learning to overcome any challenge in regards to finishing the test on time, while working accurately.

However, care should be taken to ensure that competitiveness did not overemphasize on the need to be a winner in the competitions, but rather, focus should be on developing the talents. This stems from the potential stress that could arise from the competitions as postulated by Davis *et al* (2011) who reported that organizing external contests did not promote improved student performance, but leads to stress and feelings of failure.

However, if the teachers and the event organizers encouraged students to build their talents rather than on the competitive aspect of Mathematics contests, then the benefits of entering these contests would be derived by the students.

Similar concerns were also raised by Ruscyk (2012) who cautioned that if the focus of competition is on speed and memory, but not on the ability to think creatively and find a solution to the challenging tasks then the purpose of the Mathematics contests is negated.

This shows that caution should be taken to ensure that when Mathematics contests were organized, it was geared towards encouraging creative approaches to Mathematics challenges rather than on boosting student memorization of solutions. The principals were also asked to indicate how often they organised external Mathematics contests in their schools and the majority of them (72.8%) admitted that they had never organised or had their students participate in external Mathematics contests, 16 or 17.4% of them organised them occasionally, while only four or 4.35%. organised and participated in the Mathematics contests frequently. From these findings, it was discerned that in the majority of schools in Meru County, principals rarely organised or participated in external Mathematics contests for their students.

When the principals were asked to provide documentary evidence that they organized and facilitated Mathematics contests, 55.3% stated that they had payment vouchers for the teachers who organized the contests as evidence. Some 24.7% of the principals indicated that they had the visitors' books indicating there were Mathematics contests organized. Another 15.3% of the principals indicated the organization of the Mathematics contests through telephone calls and mobile phones' short text messages. Further, a small group of 4.7% of the principals indicated the used of letters of invitation as supporting documents for Mathematics contests. The study results established that the schools which organizedMathematics contestsfrequently had better performance than those which did not, while those who organizedMathematics contests rarely had lower performance. Therefore, the study found out that Mathematics contests led to increased students' interest in Mathematics and this resulted to improved Mathematics results to those who organized them frequently.

These results were reflective of the 194 (87.78%) Mathematics teachers in Figure 4.10 who claimed that their principals did not coordinate efforts to organise Mathematics contests in their schools. From these results, it was evident that despite the potential of Mathematics contests to stimulate student's interests and motivation in Mathematics, most principals neglected to coordinate external Mathematics contests.

Therefore, the principals limited their students from reaping the benefits of Mathematics contests as Bicknell & Riley (2012), claimed that the contribution of Mathematics programs was the motivation arising from competitions, which could be outward where certificates and awards are given, students being chosen for other competitions, and the prestige in the recognition.

Additionally, the frequency with which Mathematics contests are organized is crucial in determining how students could utilize the creativity they come up with during the contests and apply it on their day-to-day math classes. As Wambui (2002), states, Mathematics was a social complex activity and is difficult to teach and understand.

Therefore, in order for the rational understanding of the Mathematic descriptions, classifications and comprehension of the relationships, students should be involved in the processes to a great extent. Therefore, by organizing Mathematics contests frequently, schools facilitate social interactions between the students and Mathematics experts and specialists who could help simplify the complex concepts of the subject.

The researchers asked some of the principals to indicate the reason why they did not organise external Mathematics contests in their schools during the interview. The majority of them cited financial constrains as a major hindrance. For instance, one of the principals claimed:

We are often forced to organize internal contests because organizing external Mathematics contests required money set aside for transportation, lunch and a token for the teachers accompanying the students. However, we are under a tight financial budget and we do not have money to spare for external Mathematics contests.

Another principal opined:

In my school, we are yet to acquire a bus, and as such, taking the students for external Mathematics contests required us to facilitate an external means of transport at a fee. However, we are already struggling

financially as we are still a new school. Therefore, we forego external Mathematics contests in favour of internal ones due to lack of resources and finances.

From these excerpts, it was evident that the majority of schools faced financial constraints when it comes to organizing any external events that require the use of transportation. Therefore, with most schools lacking buses and being limited by the financial resources, organising external Mathematics contests becomes a challenge.

This shows that despite some of the principals being willing to take their students to the external Mathematics contests, their financial capabilities prevented them from doing so. Additionally, with the majority of schools being recently opened with a few students and limited support from the government, parents and other stakeholders like the NGOs and county government, principals are forced to prioritise things like provision of teaching and learning resources while overlooking external Mathematics contests which did not appear to be a priority when it comes to budgeting.

In this case, the majority of principals, though willing to organize or take their students out for Mathematics contests are forced to organize internal contests in a bid to save funds which were then used for other projects. This points towards the need for other stakeholders including parents and the county governments to facilitate funds for schools, especially the schools that were recently started which lacked the wide range of income sources enjoyed by well-established schools. This way, principals could have more funds which they could then invest in the school's Mathematics contests. To determine the extent to which principals organised Mathematics contests and how it affected the performance of students in KCSE, a chi-square test of independence was done and the Table 1 displays the results.

As depicted the table below, the majority of schools where principals frequently coordinated Mathematics contests were those that performed averagely 9 (9.78%) and 4(4.35%) were those whose performances was good. Among the schools where principals occasionally coordinated external Mathematics contests the majority 14 (15.22%) were those with average performance in Mathematics while all of the schools where principals never organized Mathematics contests 48 (52.17%) performed poorly in Mathematics.

Table 1
Chi-Square - KCSE Performance and Mathematics Contests

Principal's support		KCSE PERFROMANCE				P=value
		N=92	Poor	Average	Good	
Coordination of Mathematics contests	Frequently	F	8	9	4	0.000
		%	8.7	9.78	4.35	
	Occasionally	F	8	14	1	
		%	8.7	15.22	1.09	
	Never	F	48	0	0	
		%	52.17	0	0	

From these results, it was seen that the principals' coordination of external Mathematics contests in their respective schools had an effect on student's performances in KCSE. These results are also reflected by the p value (0.000<0.05), which is not statistically significant. Therefore, we rejected the null hypothesis which stated that there was no relationship between organization of external Mathematics contests and student performance Mathematics.

This finding showed that organization of external Mathematics contests had statistically significant effects on student's Mathematics performance in KCSE. These results are supported by Riley and Karnes (2001) who declared that "the opportunities to tap and showcase kiwi talent far outweigh the negative elements often associated with competitions" (p. 25). Stress and failure feelings arising from excessive competition are stated as the negative outcomes of competition as stated by Rimm*et al.* (2011) as gave that not all competitions pass the threshold for a good competition.

In his study,Rusczyk (2012) cautioned that if a competition only sharpened memory and speed of students then it would lead them to memorization and thus not insist on their ability to think and find a solution to challenging tasks. Therefore, it was decided that among the schools that partook in external Mathematics contests got the opportunity to stimulate their student's minds and problem-solving skills.

By frequently exposing the students to external competitions allowed multiple method identification process. Moreover, the students were able to have a comparison of themselves with the others and hence work for personal achievement. Generally, Mathematics contests provided gifted students with an environment to excel, compete and even honor their abilities.

Further, the researchers asked the principals to state how many Mathematics contests they had organized in the last two years. It was established that the majority of the principals 67 (72.8%) had never organised Mathematics contests for their schools, while 10 (10.9%) had organised only two contests, six (6.5%)

had organised one contest, two (2.2%) had organised four contests and only one (1.1%) had organized more than five Mathematics contests in the last two years. From these results, it was evident that in most of the schools across Meru County, Mathematics contests were not a priority as only one school organised more than five Mathematics contests in two years.

However, the majority of the schools did not organise any Mathematics contests which prevented students from striving for personal achievement and comparing themselves with others. As a suggestion from Karnes & Riley (2006) competitions enhanced students' self-directed learning skills and sense of autonomy. Therefore, the lack of Mathematics contests in the majority of the schools limited the student's sense of autonomy a self-directedness contributing to the continued dismal performance of students in Mathematics. Therefore, with the results showing that over 70% of schools not organising Mathematics contests, the benefits of Mathematics contests stipulated by Ridge &Renzulli (2001) could not be derived by the schools.

According to the researchers Riley and Karnes (2006), Mathematics competitions were a source of motivation, excitement and interest in the Mathematicssubject. The students were able to meet and interact with peers from other schools, who could challenge them while also motivating them to be the best in Mathematics that they could be.

Therefore, when students interact with other students, they get to determine how their performance measures up to the other students from other schools. This was more so when the students were exposed to Mathematics contests from schools that were high performers in the subject. They get an opportunity to witness first-hand how the students from the other schools performed.

These interactions gave students opportunities to learn things from other students, gauge how they utilised their time during the contest and maybe even ask their teachers questions that could improve their approach to Mathematics. The researcher then conducted an ANOVA test to determine whether the differences in organizing Mathematics contests had a significant difference in the mean performance of the individual schools.

From Table 2 below, it could be seen that the majority 73% of 92 schools who never organized Mathematics contests had the lowest KSCE mean performance at 3.43 in a scale of 12, while those which had organized Mathematics contests four times had the highest mean at 8.08. The schools that organized Mathematics contests once had a mean performance of 4.36.It could be observed that the schools which organized Mathematics contests more often, in the period of two years, had better performance in Mathematics in KCSE.

Table 2
Report of number of Mathematicscontests organized in two years

Number of Contests Organized in a Period of Two Years	Mean	N	Std. Deviation
One	4.3590	6	2.63582
Two	6.8388	10	.53993
Three	6.4783	6	2.62689
Four	8.0830	2	1.10733
>than 5	6.0600	1	.
Never	3.4361	67	1.35223
Total	4.1941	92	2.00936

The difference in the performance of schools which had never organized Mathematics contests (mean = 3.43) and those that had organized them once (mean = 4.36) was small. Schools that had organized the Mathematics contests more than two times evidently had a higher mean performance in Mathematics as compared to those that organized them once, or those that never did.

These study results are supported by the study of Riley & Karnes (2006) who suggested that learner's self-directed skills and autonomy were enhanced through competitions. This meant that Mathematics competition purposed to motivate, excite, create interest in the subject and furnish parents and schools with more information about the abler students.

However, competition result discriminated ability levels of individuals at the participant's level in as much as it measured the students' mathematical ability. Furthermore, Campbell (2000) asserted that organizing Mathematics competition is critical for the metal well-being of the students. This was more so when the student was talented as external competition offers a platform where the student could build their skills and hone them to best suit their career projector. Additionally, it allows the student to measure their competency with other students with equal prowess.

It is also a good platform where students could challenge themselves while also sharing their expertise, knowledge and skills with peers. Therefore, at the end of the contests, the student would not have only tested their Mathematics skills, but would also leave with new knowledge and insight on challenges they would not have previously perceived. The contests are also critical in giving the students a chance to self-evaluate and

then self-direct based on the identified shortcomings during the contest. This shows that the higher the number of Mathematics contests the higher the performance in Mathematics.

This shows that the more students are exposed to Mathematics contests, the more they self-evaluate and self-direct to improve their performance by overcoming their weaknesses and improving on their strengths. Therefore, if principals were to improve their student's performance in Mathematics, then they need to improve the number of contests they expose their students to which as Watson (2003) concludes, would result in higher student performance.

The Analysis of Variance showed that there was a significant difference in the performance of the 92 schools under study ($p = 0.000$) at 95% confidence interval. It was established that there was a systematic change KCSE performance based on the number of contests organized by the principals. These findings revealed that organizing Mathematics contests had a significant effect on how the schools in Meru County performed. It showed that the there existed differences in mean scores posted by various schools in relation to their levels of organization or participation in external Mathematics contests.It was observed that schools whose principals organized more than two Mathematics contests performed better compared to those which organized less than one Mathematics contests in two years, which performed poorly.

Bicknell & Riley (2012) pointed out that competitions played an external role where certificates, awards, recognition and prestige were the reward. "Gifted children need to learn to deal with competition constructively considering the nature of Western culture as completion is a high level of achievement." Udvari(2000) stated in his comprehensive analysis of the literature on competitions (p. 215). Similar sentiments were expressed by Riley, Bevan-Brown, Bicknell, Carroll-Lind, & Kearney (2004) who claimed that organizing Mathematics contests is crucial for gifted and talented students.

It offers them the opportunity to showcase their skills. Mathematics contests offered the students an avenue to compare themselves to the others and crave for personal recognition when they show their prowess in the subject. This means that the contests were a way for the students to excel, compete and honor their abilities.

Therefore, with the organization of Mathematics contests evidently having a statistically significant effect on the performance of students in Mathematics contests, schools should strive to increase the number of contests they enter and organize. This implies that principals should come up with means of organizing the contests even if it means coming together with other principals to share the costs of the contests.

IV. Conclusion

From the results of the study, it was concluded that schools in Meru County did not generally organize external Mathematics contests. There was also a significant association between organization of Mathematics contests and poor performance. Therefore, the study concluded that poor performance in Mathematics among schools in Meru County could be associated with infrequent organization of Mathematics contests.

These results recommends that for schools to improve performance in Mathematics, they should find ways to overcome the constraints preventing them from organizing Mathematics contests and increase the frequency of the contests to allow their students reap the benefits of such events

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