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Differences in Mathematics Teachers' Perceived Preparedness to Demonstrate Competence in Secondary School Mathematics Content by Teacher Characteristics

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Abstract
A sample of 300 mathematics teachers drawn from a population of 1500 participated in this study. The participants were selected using systematic random sampling and stratified random sampling (stratified by qualification and gender). The data was collected using self-report questionnaires for mathematics teachers. One tool was used to collect data; Teachers Preparedness Questionnaire (TPQ) for mathematics. The instruments were validated by experts in the department of Curriculum, Instruction and Education Management. The instruments were pilot tested and reliability coefficient was calculated and found to be 0.83, which is above the required threshold coefficient of 0.70, Cronbach alpha in social science research. The collected data was analysed using both descriptive (means and percentages) and inferential statistics (ANOVA and t-test) to establish differences in teacher's perceived preparedness to demonstrate competence to implement secondary school mathematics content by Teaching Experience, qualification and Gender. To establish whether there were statistically significant differences in mathematics teachers' perceived preparedness by qualification, ANOVA was used. The hypotheses were tested at coefficient Alpha (α) level of 0.05. The test of differences show that there is a statistically significant difference in teachers' perceived preparedness to implement secondary school mathematics content by teaching experience; however there is no statistically significant difference by teacher qualification and gender.
Keywords: Mathematics Content, Teaching Experience, Qualification, Gender

Introduction

Policy makers and school administrators are increasingly focussing on professional development of teachers as a means to improve teaching quality. Pimm (1988) argues that mathematics educators need to face their responsibility in encouraging pupils to have high expectation of their ability to succeed in mathematics. Curriculum developers must identify the types of knowledge and skills acquisition necessary to become effective mathematics teachers and the context most conducive to learn how to teach. Shulman and Grossman (1988) suggested seven domains of teacher professional knowledge. These include knowledge of subject matter, knowledge of the curriculum, pedagogical knowledge, knowledge of learners and educational aims. Milton, Rohl and House (2007), points out that there is need to understand whether beginning teachers achieve 'adequate' understanding of mathematics instruction. The desired outcome of tertiary teacher education courses is the graduation of teachers who are competent to teach mathematics in secondary schools. They point out that secondary school teachers not only need to be conversant with their own subject areas, general methods and subject specific pedagogical strategies but also need to know how to teach students with a wide range of educational needs. Ngala (2005) points to the fact that successful teacher training and upgrading of practising teachers to be ICT compliant can lead to effective instruction

Shulman (1986) reported that researching on teachers' knowledge means more than investigating the number of mathematics courses teachers have taken or the procedural knowledge of mathematics they possess. Knowledge of mathematics teaching includes knowledge of pedagogy as well as understanding students thinking and being able to asses students' knowledge to make instructional decisions. Similar sentiments are reported by Leinhardt, Zaslavsky and Stein (1990) whose work indicate that teachers have two organised knowledge bases; general teaching skills and strategies used in lesson planning, presentation and domain specific information necessary for content presentation.

Success is determined by an individual's ability not only to read and write, but also to frame and solve complex problems and continually learn new skills (NCES, 1999). Education systems of the world are increasingly being asked to provide learners with the skills needed to compete in an increasingly complex international market place. For this to be achieved good teachers are integral part of children's intellectual and social development. Therefore they must know how to teach in ways that help learners reach high levels of competence. A national profile of teacher quality is a necessary tool for tracking our progress towards this goal.

Ball, Thames and Schilling (2008) has identified three types of subject matter content and three types of pedagogical content knowledge as non- overlapping categories in the domain of mathematics knowledge for teaching. A good mathematics teacher should be well grounded in these domains for effective mathematics instruction. Hauk, Toney, Jackson, Nair, & Tsay (2014) noted that there is an inter-play amongst conceptually rich mathematical understanding, experience and the social interaction in a classroom. This confirms that a mathematics teacher has to be well trained in subject matter content as well as pedagogical content knowledge.

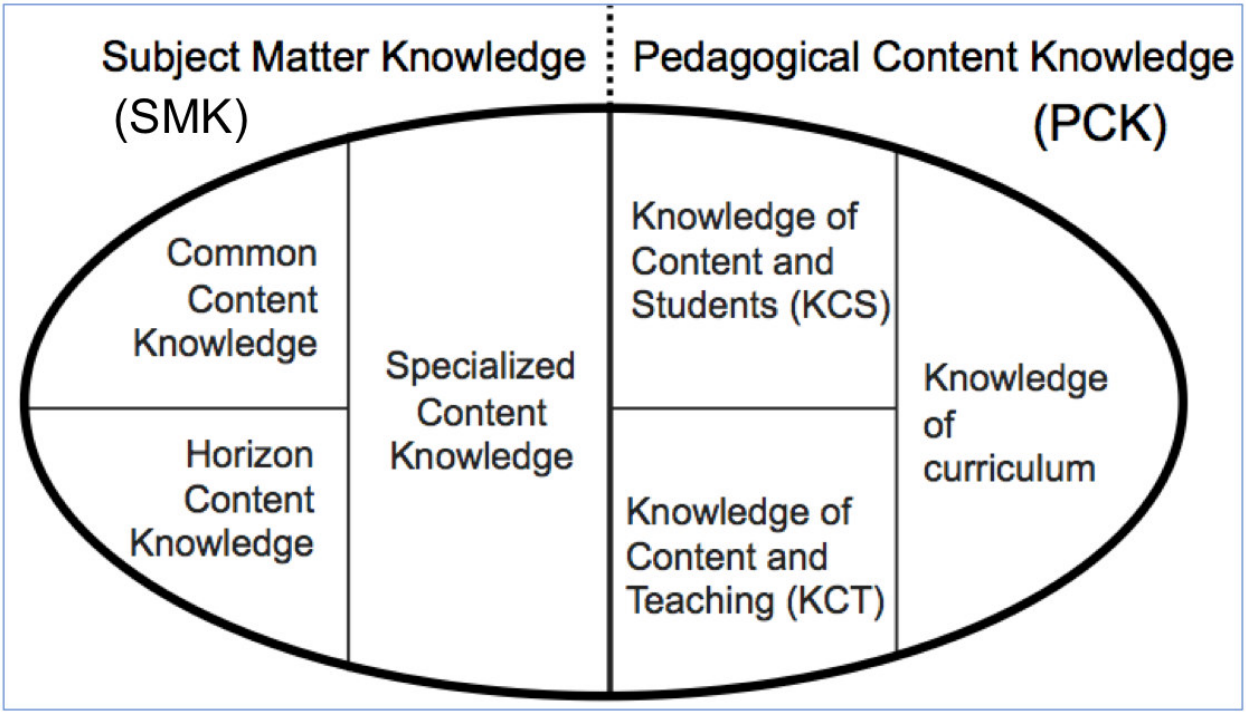

Figure 1: Dimensions of mathematical knowledge for teaching (MKT) from Hill, Ball, and Schilling (2008).

Figure 1shows the dimensions of mathematics knowledge for teaching. Subject matter content include the common content knowledge that all mathematics teachers should poses. A mathematics teacher should also have horizon content knowledge which includes the historical development of mathematics, the proponents of various theories and their application in everyday life. Specialized content knowledge is the technical mathematics skill that enables a teacher to show the learners the operations of certain mathematical operations. A mathematics teacher should also be well versed with the pedagogical content knowledge which entails the instructional skills of a teacher and the ability to deal with the psycho-social dynamics in a a classroom setting. Knowledge of content and students is the teacher's ability to relate the content and the students' ability levels and be able to meet individual needs of each learner. Knowledge of content and teaching is the ability of the teacher to apply relevant teaching approaches to all mathematics concepts and skills. Knowledge of content and curriculum is the ability of the teacher to sequenced mathematics content as per the curriculum requirements having in mind the prerequisites required by each concept and skills.

In Kenya learners have been performing dismally in secondary school mathematics at KCSE national examinations. Table 1 show students mean scores for paper 1 and paper 2 and the overall mean out of 200% at KCSE for the last five years

Table 1: **Students' Performance at KCSE Mathematics Examination**

YEAR	PAPER	MAX SCORE	MEAN SCORE
2010	1	100	26.21
	2	100	19.92
	Overall	200	46.07
2011	1	100	21.36
	2	100	28.22
	Overall	200	49.57
2012	1	100	29.46
	2	100	27.86
	Overall	200	57.31
2013	1	100	28.12
	2	100	27.03
	Overall	200	55.15
2014	1	100	24.54
	2	100	23.50
	Overall	200	48.04

Source: KNEC 2014, 2015

The figures in table 1 indicate that the mean score for each paper is consistently low. This poor performance has been attributed to learners' poor attitude, lack of interest and low motivation to learn mathematics (Otieno, 2005). Central to raising students' achievement in mathematics is improving mathematics teaching. Students who receive high quality instruction experience greater and more persistent achievement gains than their peers who receive low quality instruction (Rivkin, Hanushek & Kain, 2005; Wright, Horn & Sanders, 1997).

Teaching practice according to Ogbonnaya (2007) refers to instructional methods or techniques that teachers use to accomplish their classroom learning objectives. Teaching practice specify ways of presenting instructional materials or conducting instructional actions. Teaching practice is a critical factor in promoting students' achievement in mathematics (Peterson, 1998; Stigler and Hilbert, 1999; & Wenglishky, 2002). Teaching practice can either greatly facilitate students learning or serve as an obstacle to it. Ponte and Brunheira (2001) in their study; analysing practice in pre-service mathematics teacher education acknowledged that teacher education institutions need to make sure that student teachers acquire an adequate preparation both in the subject they will teach and its teaching methods. They noted that mathematics teachers need to know about students learning processes, recognise the influence of socio-cultural backgrounds, and be aware of the critical features of mathematics curriculum. The current study has shed light on the differences in teacher practices at the classroom level by qualification.

NCES (1999) points out elements that characterise teacher quality. These are teacher preparation, qualification and teacher practices. The first refers to mathematics learning and the second refers to the actual quality of teaching that teachers exhibit in their classrooms. These two elements of teacher quality are not mutually exclusive. Excellent teacher preparation and qualifications are expected to lead to exemplary teaching. A review of literature indicate teacher qualifications and preparations are important factors in determining student achievement (NCTAF, 1997). The learning of mathematics is very dependent on good teaching. A teacher needs to know what classroom strategies will lead to the learners understanding of concepts. Brahier (2005) asserts that learning is an active process that involves the discussion and allowing students to reach their own conclusions. This requires that teachers organise the classroom in an inquiry mode that emphasises cooperative learning and active hands on lessons.

The continued failure in mathematics in Kenyan secondary schools shows that there is something amiss in mathematics teaching. Most teachers in primary schools use teaching methods that encourage rote learning or drilling in their teaching, which cannot develop quantitative thinking because it treats mathematics as a collection of isolated bonds of facts rather than an integrated set of patterns and principles (Resnick & Ford, 1981; Hohn, 1995). They cannot adequately facilitate the acquisition of mathematics skills and knowledge to the learner hence the perennial poor performance in mathematics and sciences in the National examinations (Kinyua, 2001; Aduda, 2001). KNEC (2014, 2015) reported that candidates have continued to register poor examination results in mathematics at KCSE. Ball and Bass (2000) observed that during teaching practice mathematics teachers lack confidence and pedagogical content knowledge. Teachers must know the mathematical content very well to achieve the level of confidence in teaching mathematics. It should be noted however that it is not what mathematics teachers know, but how they know it and what they are able to mobilise mathematically in the course of teaching.

Good and Brophy (2003) reported that teachers must be well versed in mathematics in order to teach the subject effectively. In a study related to teaching and learning of functions and graphs the researchers concluded

that teachers' subject matter knowledge empowers the teacher with the confidence and capability to make interconnections, build analogies and create examples and interrelationships in mathematics (Leinhardt, Zaslavsky & Stein, 1990). Limitation on teachers' subject matter knowledge on the other hand reduces his/her flexibility and creativity in teaching the subject. Teachers' subject matter content knowledge or declarative subject knowledge include teachers' knowledge of the concepts, procedures and problem solving processes within the domain in which they teach as well as in related content domains and pedagogical knowledge (Shulman, 1986)The focus of this study is to survey mathematics teachers' preparedness to effectively implement secondary school mathematics curriculum in Kenya. It particularly establishes; the teachers preparedness to handle different topics in secondary school mathematics. This study set out to establish whether there is a difference in perceived teacher preparedness to implement secondary school mathematics content by teacher characteristics. The teacher characteristics of interest were teaching experience, teacher qualification and gender.

Research Methodology

This study used an *ex-post facto* (causal comparative research) research design. *Ex-post fact* research determines and reports the way things are (status quo). Fraenkel and Wallen (2000) identified three types of Causal comparative research design; the first type explores the effects caused by membership in a given group, the second explores consequences of intervention and the third explores the causes of group membership. The current study falls into the first category where exploration of effects caused by membership in a given group on teachers' perceived preparedness to teach secondary school mathematics content. Samples of 300 respondents were study out of 1500 Mathematics Teachers in Rift region of Kenya. The data were analyzed using both descriptive and inferential statistics. The hypotheses were tested using t-test and ANOVA to establish differences by teacher characteristics.

Results and Discussion

Differences in Mathematics teachers' perceived Preparedness to Demonstrate Competence in Secondary School Mathematics Content by teaching experience

The null hypothesis that was tested H_o1: $\mu_1 = \mu_2 = \mu_3 = \mu_4$ against the alternative hypothesis
H_A1: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$ is accepted at $\alpha=0.05$.

The hypothesis of the study addressed differences in teachers' perceived preparedness to demonstrate competence in secondary school mathematics content by teaching experience. The differences in teachers' perceived preparedness to demonstrate competence in secondary school mathematics content by teaching experience are grouped into four categories; below five years, five to ten years, eleven to fifteen years and over fifteen years. Out of a sample of 300 respondents 297 completed the questionnaire successfully, of these 106 had a working experience of below five years, 90 had five to ten years working experience, 47 had eleven to fifteen years working experience and 54 had over fifteen years working experience. Table 2 shows the means and standard deviation of each group.

Table 2

Descriptive results on Teacher Preparedness to Demonstrate Competence in Secondary School Mathematics Content by Teaching Experience

Teaching Experience	N	Mean	SD
Below five years	106	4.5307	.51457
five to ten years	90	4.4190	.46402
Eleven to Fifteen years	47	4.5846	.84104
Over fifteen years	54	4.2318	.49882
Total	297	4.4510	.57213

The results of Table 2 indicate that the teachers feel they are competent to implement secondary school mathematics with an overall means score of 4.451 out of the possible score of five (5). The findings indicate that teachers of eleven to fifteen years teaching experience feel more competent (4.58) followed closely with the new teachers of less than five years experience (4.53). There is however an indication that the older teachers have a lower level of preparedness (4.23) to implement secondary school mathematics. These are the people who have been teaching for a long time and may be experiencing burn out and are preparing to retire. The teachers whose experience is between five and ten years also have a lower mean score of 4.42. This low level could be attributed to teachers who have not settled down and are still hoping to move to other professions.

Table 3 reports the differences in mathematics teachers' preparedness to implement secondary school mathematics content by teaching experience.

Table 3
ANOVA Results Showing the Difference in Mathematics Teachers' perceived Preparedness to Demonstrate Competence in Secondary School Mathematics Content by Teaching Experience

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.199	3	1.400	4.425	.005
Within Groups	92.691	293	.316		
Total	96.890	296			

Critical values $F_{(df = 3,293,\ \alpha = 0.05)} = 2.60$

The results indicate that there is a statistically significant difference in teachers' preparedness to implement secondary school mathematics by working experience since the calculated F (4.425) is higher than F critical (2.60) at α=0.05, level of significance. This is an indication that teacher's perception of their preparedness to implement secondary school mathematics content differs in favour of those who have worked for ten to fifteen years. This group of teachers comprise of those who have settled down and have concluded that teaching is their career and no longer look out for other openings. The group of teachers who have worked for over fifteen years is reported to be the least prepared compared to the other groups. This can be explained by the fact that they are now looking forward to retirement and no longer want to take up new approaches to teaching. The findings of this study disagrees with the findings of Betts, Zau and Rice (2003) and Rivkin, Hanushek and Kain (2005) which show that teachers with longer work experience perceive themselves to be more competent in implementing secondary school mathematics content. Hauk, Toney, Jackson, Nair, & Tsay (2014) noted that there is an inter-play amongst conceptually rich mathematical understanding, experience and the social interaction in a classroom. In this study the senior most teachers perceive themselves to be less prepared to implement secondary school mathematics content. These could be because of their unwillingness to embrace new approaches of teaching secondary school mathematics.

The Post Hoc findings, was run to determine which of the particular groups differ significantly at α = 0.05 level of significance. The least significant difference (LSD) for unequal groups was used to determine the differences among the groups. The findings help us identify particular groups where significant difference is noted. The findings are shown in Table 4.

Table 4
***Post Hoc* Results With LSD to Show Which Particular Groups of Teacher Experience Differed Significantly in their Perception of their Preparedness to Implement Secondary School Mathematics Curriculum.**

(I) Teaching experience	(J) Teaching experience	Mean Difference (I-J)	Sig.
Below five years	five to ten years	.11174	.167
	Eleven to Fifteen years	-.05386	.585
	Over fifteen years	.29893*	.002
five to ten years	Below five years	-.11174	.167
	Eleven to Fifteen years	-.16560	.103
	Over fifteen years	.18719	.054
Eleven to Fifteen years	Below five years	.05386	.585
	five to ten years	.16560	.103
	Over fifteen years	.35279*	.002
Over fifteen years	Below five years	-.29893*	.002
	five to ten years	-.18719	.054
	Eleven to Fifteen years	-.35279*	.002

The results of Table 4 show that there was a significant difference between those who were still new in the profession and those who have been teaching longest. This could be attributed to the fact that those who graduated recently have been exposed to new approaches to teaching hence feel more prepared than their colleagues who were in college fifteen years ago. The findings also indicate a difference in teacher preparedness between the old teachers and those who have been in the teaching for less than fifteen years. The likely explanation for this is the fact that between the two groups one is now settling in the profession while the older

group is preparing to retire and are no longer keen to gain new skills. The null hypothesis which stated that 'there is no statistically significant difference in mathematics teachers' perceived preparedness to demonstrate competence in secondary school mathematics content by teaching experience' that is Ho1: $\mu_1 = \mu_2 = \mu_3 = \mu_4$ is therefore rejected in favour of the alternative hypothesis;

H_A1: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$ is accepted

Differences in Mathematics teachers' perceived Preparedness to Demonstrate Competence in Secondary School Mathematics Content by Qualification

The null hypothesis that was tested Ho2: $\mu_1 = \mu_2 = \mu_3$ against the alternative hypothesis H_A2: $\mu_1 \neq \mu_2 \neq \mu_3$ at α=0.05. The descriptive results on teachers' preparedness to implement secondary school mathematics curriculum by teacher qualification were put into three categories; post graduate (27), graduate teachers (194) and diploma teachers (77). A total of 298 teachers responded successfully to the questionnaire and the mean scores and standard deviations are shown in Table 5.

Table 5

Descriptive results showing teachers' perception of their preparedness to demonstrate competence in secondary school mathematics content by qualification

Teacher Qualification	N	Mean	SD
Post graduate qualification	27	4.4626	.68354
Bachelors degree	194	4.4714	.57363
Diploma	77	4.3866	.51935
Total	298	4.4487	.57018

The overall results show that the teachers perceived themselves prepared to implement the secondary school mathematics curriculum irrespective of their qualification. The overall mean score of 4.44 out of the expected score of 5 is quite high indicating a high degree of preparedness. The results indicate that teachers with Bachelors degree feel more prepared than those with postgraduate qualification and diploma qualification.

The difference in teachers' perception of their preparedness to implement secondary school mathematics by qualification is tested using one way ANOVA. The ANOVA results compares 297 teachers categorized into three groups of teachers; post graduate teachers, first degree holders and diploma teachers. The test results are shown in Table 6.

Table 6

ANOVA Results Showing the Difference in Mathematics Teachers' perceived Preparedness to Demonstrate Competence in Secondary School Mathematics Content by Qualification

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.403	2	.201	.618	.540
Within Groups	96.154	295	.326		
Total	96.557	297			

Critical values $F_{(df=2,295,\ \alpha=0.05)} = 3.00$

The findings indicate that the calculated F = 0.618 is lower than the critical value of F = 3.00 hence the differences is not significant at α =0.05 level of significance. The null hypothesis that states that there is no statistically significant difference in teachers' perception of their preparedness to demonstrate competence in secondary school mathematics content by teacher qualification is therefore retained. This is an indication that trained teachers of mathematics at diploma or degree level feel they are competent to teach secondary school mathematics. The results also indicate that the teacher training programmes in Kenya are well structured right from diploma level and therefore once teachers have been trained at diploma level or degree level they are ready to implement the secondary school curriculum successfully. The findings of the current study contradict the findings of Rice, (2003) and Betts, Zau and Rice (2003) who reported that teachers with higher qualification had a positive impact on the achievement. Rowan, Correnti and Miller (2002) reports that certificate status has little effect on achievement in elementary schools which agrees with the findings of this study which show that there is no statistically significant difference in teachers' perception of their preparedness to implement secondary school mathematics content by teacher qualification. That is Ho1: $\mu_1 = \mu_2 = \mu_3$ is accepted at α=0.05.

Differences in Mathematics teachers' perceived Preparedness to Demonstrate Competence in Secondary School Mathematics Content by Gender

The null hypothesis that was tested Ho3: $\mu_1 = \mu_2$ against the alternative hypothesis H_A3: $\mu_1 \neq \mu_2$ at α=0.05.

Descriptive results showing gender mean score of teachers' perception of their preparedness to demonstrate competence in secondary school mathematics are shown in Table 7. There were a total 229 male teachers and 69 females. The sample had more male mathematics teachers than female mathematics teachers in Rift Valley

province.

Table 7

Descriptive Results on Gender Differences on Teachers' Preparedness to Demonstrate Competence in Secondary School Mathematics Content

Gender	N	Mean	SD
Male	229	4.4645	.59509
Female	69	4.3985	.48100

The findings indicate that male teachers have a higher mean (4.46) than the female mathematics teachers whose mean score was 4.39 of the expected 5 points. The findings show that teachers' level of preparedness is almost similar and all can perform their duties successfully irrespective of their gender.

The difference in teachers' perception of their preparedness to implement secondary school mathematics by gender was established using the independent sample t-test. The findings are shown in Table 8.

Table 8

Difference in Mathematics Teachers' perceived Preparedness to Demonstrate Competence in Secondary School Mathematics Content by Gender

	N	Df	t	Sig. (2-tailed)
Equal variances assumed	298	296	.842	.400
Equal variances not assumed	298	136.527	.943	.347

Critical values $t_{(df=296,\ \alpha = 0.05)} = 1.645$

The t test results show that the t value (0.842) is lower than the critical value of t (1.645) hence the differences in teachers' perception to implement secondary school mathematics content is not significant at $\alpha = 0.05$ level of significance. The null hypothesis that stated, there is no statistically significant difference in teachers' perceived preparedness to demonstrate competence in secondary school mathematics content (H_o1: $\mu_1 = \mu_2$) is therefore accepted at $\alpha=0.05$. This clearly shows that teachers of either gender are prepared to implement secondary school mathematics curriculum. From the sample taken it is clear that female mathematics teachers are very few and therefore there is need to encourage more females to train as mathematics teachers. The findings indicate that female teachers can perform very well as mathematics teachers provided they are given the chance. Hyde and Mertz (2009) on their study on Gender Culture and Mathematics performance reported that women are willing and able to learn the mathematics needed for advance degrees in their areas when provided with appropriate socio-cultural environment along with education and career opportunities. This is confirmed by the current study which, show that there is no statistically significant difference in teachers' perception of their preparedness to implement secondary school mathematics curriculum by gender.

Conclusions

That teachers' perceived preparedness to demonstrate competence in delivering secondary school mathematics content is favorable but differ significantly by teaching experience which show that there is an inter-play amongst conceptually rich mathematical understanding, experience and the social interaction in a classroom. In this study it has been noted that experience is a key factor in any mathematics instruction particularly in content mastery. There is however no statistically significant difference by teacher qualification and gender. The findings of this study show that teachers of mathematics are well prepared to handle secondary school mathematics content right from the diploma training. These findings suggest that we should not do away with the diploma course in education but instead strengthen it so that they supplement the training offered by universities. The other implication is that teachers once trained are effective irrespective of their gender.

References

Aduda, D. (July 2001 2nd). Failing in mathematics, teaching methods and attitudes blamed for Poor Results.*Daily nation* pp. 21.

Ball, D.L., & Bass, H. (2000). Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics. In J.Boaler (Ed.), *Multiple perspectives on the teaching and learning of mathematics* (pp. 83-104).

Betts, J. R., Zau, A. C., & Rice, L. A. (2003). *Determinants of students' achievement: New effidence from San Diego*, San Francisco, CA; Public Policy Institute of carlifornia.

Brahier, J. D. (2005). *Teaching Secondary and Middle School Mathematics* Ally Bacon, Boston, USA

Good, T. L. & Brophy, J (2003), Looking in the Classroom. Boston: Allan & Bacon

Hauk,K. S., Toney, A., Jackson, B., Nair, R. & Tsay, J. J. (2014). Developing a Model of Pedagogical Content Knowledge for Secondary and Post-Secondary Mathematics Instruction. *Dialogic Pedagogy: An*

International Online Journal | http://dpj.pitt.edu DOI: 10.5195/dpj.2014.40 | Vol. 2 (2014)

Hill, H. C., Ball, D. L., & Schilling, S. G. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic-specific knowledge of students. *Journal for Research in Mathematics Education, 39,* 372-400.

Hohn, R. L. (1995). *Classroom learning and teaching.* New York, Longman publishers

Hyde, J. S. & Mertz, J. E. (2009). Gender, Culture and Mathematics Performance. PNAS. Retrieved April 10th 2012, from www.pnas.org/cgl/doi/10.107773/pnas

Kinyua, E. (2001 march 12th). College admission under the microscope: Trainee teachers failed in mathematics and English at K.C.S.E *Daily Nation* pp. 17.

KNEC, (2014). *The year 2013 Kenya Certificate of Secondary Education (KCSE) Examination Report.*

KNEC, (2015). *The year 2014 Kenya Certificate of Secondary Education (KCSE) Examination Report.*

Milton, M., Rohl, M. and House, H. (2007).*Secondary beginning teachers' preparedness to teach literacy and numeracy* ; A survey.

NCES, (1999).*Teacher quality*; *A report on the preparation and qualification of public school teachers*

Ngala, N. G. (2005). The *current situation in the training of mathematics and science teachers and some suggestions for sustainable future*.

National Commission on Teaching and America's Future. (1997). *Doing what matters most: Investing in quality teaching.* New York: NCTAF.

Ogbonnaya, U. I. (2007). *The Influence of teachers' Background Professional Development and Teaching Practices on Students' Achievement in Mathematics in Lesotho*. Unpublished M. Ed. Thesis.

Peterson, P. L. (1998). Teaching for Higher-Order Thinking in Mathematics: The Challenge for the Next Decade. In D. D. Grouws, T. T. Cooneys & D. Jones (Eds.), Perspectives on Research on Effective Mathematics Teaching (vol. 1) Reston, Va.: Lawrence Erlbaum Associates For the National Council of Teachers of Mathematics.

Pimm, D. (1988). *Mathematics teachers and children*.London, Hodder& Stoughton. *Psychology,* 84(3), 261-271.

Pomte, J. & Brunheira, L. (2001). Analysing Practice in Pre-service Mathematics Teacher Education. *Mathematics Education Research Journal: 3 16-27*

Rice, J.K. (2003). *Teacher quality: Understanding the effects of teacher attributes*. Washington, D.C.: Economic Policy Institute.

Resnick, B. L. & Ford, W. (1981). *The psychology of mathematics for instruction*. Hillsdale, Lawrence Erlbaum Associates, publishers.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools and academic achievement, *Econometrica, 73(2), 417-458*

Rowan, B., Correnti, R., & Miller, R.J. (2002). *What large-scale, survey research tells us about teacher effects on student achievement: Insights from the Prospects student of elementary schools.* Teachers College Record.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Shulman, L. S., & Grossman, P. (1988). *Knowledge growth in teaching: A final report to the Spencer Foundation. Technical report of the knowledge growth in a profession research projec*t. Stanford, CA: School of Education, Stanford University.

Stiggler, J. W. & Hilbert, J. (1999). The Teaching Gap. Best Ideas from the World's Teachers for improving Education in the Classroom. New York. Free Press.

Wenglinsky, H. (2002). How school matter: The link between teachers' classroom practices and students' academic performance. Education Policy analysis. Archieves 10(2) retrieved 12, 2006 available http://epaa.asu.edu/epaa/v10n12