

Research article

Relationship between Instructional Leaders' Gender and Student's Academic Achievement in Sciences and Mathematics

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Abstract

One major emphasis in the educational arena in Kenya and internationally has been the continuing demand for greater accountability to increase student academic performance on the part of the school principal. The Ministry of Education and the communities around the schools require schools to ensure that all students achieve mastery of curriculum objectives, and focus on implementing those requirements to the best of their ability. Principals must therefore focus on teaching and learning in terms of measurable students' progress. They can do this by being effective instructional leaders in their schools. In this study the researchers sought to determine if there exists a relationship between the instructional leaders' gender and students' academic achievement in Sciences and Mathematics. The study was conducted in Makueni County, Kenya and the target population was all secondary school principals and Sciences and Mathematics teachers working under these principals. Students' academic achievement was measured through their performance in the Kenya Certificate of Secondary Education (KCSE) for a period of four years that the principal had been in a given school. The sample was obtained through proportionate and simple random sampling techniques. A total of sixty eight principals representing sixty eight schools were determined as the sample size. In each school, the principal, a Mathematics teacher and three Science teachers were selected for the study. Data was collected using questionnaires for both the principal and teachers together with an interview guide for the principals. The chi-square test was used to test the research hypothesis. A weak relationship was found between principals' gender and students' academic achievement in Sciences and Mathematics, however

more research was needed before conclusively declaring women principals better instructional leaders than their male counterparts.

Key words: Academic Achievement, gender, Instructional Leader, Mathematics, Sciences

Introduction

Instructional leadership is viewed as a process by which someone as a head of an institution influences staff towards accomplishment of set educational goals (Makura, 2008). This task requires men and women to be endowed with skills and attributes in educational leadership and management. A debate existing in academic circles is whether men and women lead differently or exhibit similar leadership and managerial styles. Some studies claim that there is a similarity (Kariuki, 2004; Park, 1997) and others refute this claim (Collard, 2001; White *et al.*, 2010). Social roles and expectations within our African context demand that men and women perform roles in conformity to their gender (Makura, 2011). This practice has resulted in men and women being acculturated within that context. Existing management literature has attempted to show that the controversy in leadership and gender is whether or not men and women lead differently (Elms, 2006; Ismail & Rasdi, 2008; Manwa, 2002; White *et al.*, 2010).

Instructional leadership is a broad construct that encompasses a variety of roles and tasks that range from the technical to the interpersonal (Weller & Weber, 2002). Broadly, instructional leadership includes such work as the supervision of instruction (Haughey & MacElwain, 1992, Hoerr, 1996, Kleine-Kracht, 1993), the evaluation of the curriculum (Begley, 1994; Sergiovanni & Starrat, 1998) and the oversight of change and school improvement (Gainey & Webb, 1998). Others when describing instructional leadership have included any actions designed to improve conditions for teaching and learning (Carter & Klotz, 1992; Daresh, Gantner, Dunlap, & Hivizdak, 2000) all loosely coupled to the intent of instructional supervision.

In their study investigating the links between leadership and learning, Louis, *et al.* (2010), determined that for improved instruction, principals need to adopt certain practices which should ensure that their schools are focused on goals and expectation of student achievement (Cayetano, 2011). Principals should keep track of the professional development of the teachers, including prescribing as well as managing the attendance of the teachers. They should also create structures and opportunities for collaboration among teachers, to the extent of scheduling

meeting times (Alig-Mielcarek, 2003). Other practices perceived to be important are monitoring the work of teachers in the classroom, providing mentors to new teachers, being easily accessible, providing backup with discipline and supporting parental involvement in the learning of students (Green, 2010). There exists a perception among teachers and principals that instructional leaders are responsible for establishing an instructional climate and actions in their schools (Cayetano, 2011).

Instructional climate is established as a result of a vision that students can all perform at high standards. One means of establishing this vision is through the adoption of value of research based strategies and another is through a personal vision of the principals to break cycles of poverty that exists in their communities (Louis *et al*, 2010; Cayetano, 2011; Alig-Mielcarek, 2003). Instructional leadership involves providing instructional support to teachers. Principals should be cognizant of the teaching and learning that occurs in their institutions and should be directly involved with teachers ensuring that formative assessments are conducted (Louis *et al*, 2010).

Despite the key role it plays in students' learning, instructional leadership preparation and development is a new phenomenon in most countries (Coles & Southworth, 2005), even though studies (Bush & Jackson, 2002, Commonwealth Secretariat, 1996, Fink, 2005; Huber, 2004,; Huber & West, 2002; Kitavi & Van Der Westhuizen, 1997; West & Jackson, 2002) indicate that the preparation and development of school principals on matters of instructional leadership can lead to school improvement and effectiveness. Principal preparation helps them get the skills, knowledge and attributes (Bush & Oduro, 2006; Walter & Dimmock, 2006) to run schools in a professional and effective manner to ensure good teaching and learning practices which subsequently can lead to improved learning outcomes. This study focuses on three main practices of instructional leadership as postulated by Hallinger (2009). These are communicating shared goals, monitoring and providing feedback on the teaching learning process and promoting school wide professional development. Differences are observed in how male and female principals execute these practices in the course of their school management.

A Comparison of Men and Women Leadership Behaviours

Societal roles and expectations within the African context demand that men and women perform their roles in conformity to their gender (Makura, 2011). This practice has resulted in men and women being socialized within that context. Management literature has attempted to show that the controversy in leadership and gender is whether or not men and women lead differently (Elms, 2006; Ismail & Rasdi, 2008; Manwa, 2002; White *et al*, 2010). Men

and women play their roles of instructional leadership differently (Eagly et al, 1992). This is due to their orientation to general leadership, coupled with the realization that much of their practice is not out of training. This study focus on

A number of past studies (Burns, 2001; Perreault, 2005; Coleman, 1996) note that instruction is central to women leaders. Women leaders are likely to introduce and support strong programmes in staff development, encourage innovation and experiment with instructional approaches. They are likely to stress the importance of instructional competence in teachers and be attentive to task completion in terms of instructional programmes (Funk, 2004). A study by Coleman (2002) found out that the highest value emphasized by secondary school female principals in England and Wales was student achievement.

Some past researchers cast women leaders as servant leaders, (Smith- Campell, 2002; Shapiro, 2004; Brunner, 1997; Alston, 1999). Women seek to serve others by being the facilitators of the organization, bringing groups together, motivating students and staff and connecting with the outside groups. Funk (2004) said that “by utilizing their unique strengths including collaborative and transformation leadership, a focus on curriculum and instruction, inclusion of all clienteles in decision making, empowerment of teachers, students and parents and articulation of new visions of what schools should be like, female leaders of public schools and school districts could make the difference needed to ensure successful changes in education, (p.2)”. Men on the other hand tend to be more authoritative and aggressive (Reed et al, 1997). They delegate more without meddling as opposed to their female counterparts who always want to focus on details (Bolman et al, 1992). Male principals exercise their authority on their staff with less persuasion as compared to their female counterparts who use their tact in bringing all stakeholders on board in their management.

Previous studies (Eagly, 1992; Burns, 2001; Funk, 2004; Fennell, 2002) have focused on a comparison in the leadership styles of men and women. Women school principals have been termed more cooperative, collaborative and more dedicated to team building than their male associates who only want to see the bigger picture. They intervene more than their male counterparts. They evaluate students’ progress more often and manage more orderly schools. According to Burns (2001), women demonstrate more often than men the kind of behaviour that promote achievement and learning as well as high morale and commitment by members of staff. Men principals are more results oriented with little attention to the process, and are more often commercially focused.

Women school principals are generally more committed to the teaching and learning aspect of the

principalship. They are more socialized to focus on relationships much more than men. Smith et al (2004) found women principals to have significantly higher self perceptions for instructional leadership. Female principals are perceived as possessing collaborative leadership styles. They consult their staff before making major decisions (Martin, 2004; Watson & Newby, 2005, Ismail & Watson, 2008). They bring into an organization creativity, communication and interpersonal skills, authenticity, consistency and focus (White et al, 2010). Daley & Naff (1998) argued that women tend to use democratic and transformational leadership practices more often than men do. Men on the other hand are likely to emphasize on goal setting and goal attainment in an institution.

Importance of Mathematics and Sciences

Science and mathematics not only provide students with highly relevant skills that are applicable to almost any workplace, they offer a flexible foundation enabling students to attain highly respected and well paid jobs and guarantee them a secure future, (Tyler, 2007). The study of these subjects is recognized as the most important in most fields of human endeavors and the level of students' interest and performance depends on the level of development, (Sjoberg & Schreiner, 2005). Their usefulness in the scientific world, technological activities, commerce, economics and even humanities is almost at par with the importance of education as a whole, (Tella, 2008). The study of Science and Mathematics helps to engage the learners positively, creating in him/her the ability to verify or reaffirm scientific concepts or principles, to engage students positively with the science enterprise, (Hofstein & Lunetta, 2004) and to develop understandings of investigative methods in Science, involving the gathering and use of evidence (Gott & Duggan, 2004). The role of the teacher in this process is to work with students' ideas, scaffolding them to establish the very powerful discourses of the scientific culture and scientific ways of viewing and dealing with the world (Wickmann & Ostman, 2002).

Studying Science and Mathematics equips students with essential skills that will make them very employable, be that in a scientific or non-scientific arena, (Aikenhead, 2006). Science enables the student to become more confident in numeracy, gaining proficiency with figures and calculations that will prove invaluable when it comes to future employment (Tyler, 2007; Lyons, 2005). This 'Mathematics within Science' is more than just putting numbers into formulae; it involves analyzing data and understanding trends in the same way that businesses might examine market data or sales figures (Tyler, 2007; Klein, 2006; Ryder, 2001). Problem solving is another key

skill that students master within Science; while this is important within a practical or experimental setting, it is essential to employers in all fields, especially when it is extended to evaluating alternative solutions provided by others (Klein, 2006). In addition, students gain crucial experience in communication skills. By presenting their work, be it verbally or in writing, students become so competent at expressing a logical argument, debating and persuading, that it becomes second nature to them, rather than something to be awkward and embarrassed about – this of course is a skill which is indispensable in the workplace (Wickmann & Ostman, 2002; Aikenhead, 2006).

The skills gained from studying Science and Mathematics are versatile and transferable and are applicable to any profession; a foundation in Science and Mathematics can lead to a huge variety of career options in all sectors, beyond those that might be predicted (Lyons, 2005). Science and Mathematics are obviously relevant to many Science-related jobs, such as Engineering, Information Technology, Medicine, Psychology, Sports Science, Music Technology, Animal Health, Forensics or Astronomy, but they are also significant to working in Banking, Journalism, Teaching, Television, Marketing, Law, Photography, Art Restoration, Media and Film Production, to name but a few (Klein, 2006; Tella, 2008). In addition to providing students with useful skills and making them highly employable, it has been shown that achieving further qualifications in Science and Mathematics bring greater rewards in monetary terms in future employment when compared to other subjects.

Science and Mathematics are omnipresent in modern society; due to the unsustainable demands we make on the world's resources and the impact we have on our environment, the contribution of science is vital to ensure the survival of our planet by developing new or alternative solutions for everything we do from fuel production to waste disposal, (Sjoberg & Schreiner, 2005; Oketch *et al* 2010). With current issues such as gene therapy, nuclear power, oil depletion, genetically modified foods, bird flu and global warming, future scientists have a fascinating and crucial role to play, be it developing new communications solutions or contributing to make the world a better place (Gott & Duggan, 2004; Ryder, 2001). Studying Science and Mathematics provides an excellent foundation, keeps options open and offers a good progression route either directly into employment or to higher education to study them or other related subjects further (Oketch *et al*, 2010). By opting for Science and Mathematics, students could find themselves contributing to ensuring the future of the planet as well as safe-guarding their own secure future in the world of employment.

Mathematics and Science Education in Kenya

The Kenyan education system emphasizes the study of Sciences and Mathematics at all levels of schooling. At the primary and secondary levels Mathematics and Sciences are compulsory subjects of study, where at the secondary school level a student is expected to study at least two of the three Science subjects offered (Biology, Chemistry and Physics), and in some schools the three Science subjects are compulsory (KIE, 2001). For admission at the tertiary level (university and middle level colleges) a pass in Mathematics and Sciences is considered a preliminary condition in almost all courses. All students are therefore expected to excel in Mathematics and Sciences particularly at the secondary school level.

The strengthening of Mathematics at the secondary school level in Kenya was declared a priority in the seventh National Development Plan for industrialization and sustainability (Kanja, Iwasaki, Baba, & Uenda, 2001). This was due to existing evidence of deterioration in students' performance at the secondary school level which presented a worrisome challenge to Kenyan education (Global Literacy Project, 2008). Earlier in 1998, the Kenyan government in collaboration with the Japan International Cooperation Agency (JICA) had initiated the Strengthening of Mathematics and Science in Secondary Education (SMASSE) project with the aim of strengthening teaching and learning of Mathematics and Sciences. The SMASSE project advocated for change in teachers' instructional practices and recommended a shift from teacher-centered to student-centered instructional methods through an In-Service Education and Training (INSET) program (Wambui, 2005). This however did not give the best results expected as shown in Table 1, specifically in Makueni County, Kenya.

Table 1: Students' Mean Scores in Mathematics and Sciences in KCSE in Makueni County

YEAR	2008	2009	2010	2011
MATHEMATICS	2.85	2.86	2.79	2.68
CHEMISTRY	3.54	3.36	3.39	2.93
BIOLOGY	4.66	4.15	4.18	3.87

PHYSICS	4.12	4.24	4.28	3.93
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Source: County Education Office, Makeni

The numbers in the table represent academic achievement based on the Kenya National Examination Council (KNEC). Grades are awarded on a 1-12 scale with 12 as the best performance (representing grade A) and 1 as the lowest grade (representing grade E or failure). The above grades therefore show performance below average.

Further research was therefore needed to get more measures needed in order to improve students' achievement in these subjects. In a baseline survey conducted in Kenya under SMASSE project, poor instruction practices, lack of professional community, administration and management practices were identified as major factors affecting performance in Mathematics and Sciences in Kenyan secondary schools (Sifuna & Kaime, 2007). The current study therefore looks at the relationship between administration and management practices, specifically instructional leadership practices and students' academic achievement in Mathematics and Sciences. It seeks to see if students' academic achievement is related to the principals' gender.

Instructional leadership has many different definitions and models that conceptualize it. The current study synthesizes the many definitions and models of instructional leadership using theoretical and empirical considerations. It then compares the difference in instructional leadership practice of male and female principals and relates it with the academic achievement of their students in Sciences and Mathematics. The instructional leadership construct is defined in terms of principal behaviors that lead a school to educate all students to high student achievement. In the current study, instructional leadership incorporates behaviors which define and communicate shared goals, monitor and provide feedback on the teaching and learning process, and promote school wide professional development. These behaviours are broken into ten instructional leadership practices namely; frames school goals, communicates the shared goals, monitors students progress, protects instructional time, supervises and evaluates instruction, coordinates the curriculum, maintains high visibility, provides incentives for teachers, promotes professional development, provides incentives for learning.

Statement of the Problem

One debate in academic circles has been whether men and women leading schools display the same or different leadership styles. This has led to variation in the perceptions of the stakeholders towards principals based on their gender. Some look at women with men lenses while others believe that instructional leadership is the domain of women. Often principals have been posted to schools to a cold reception or total rejection on the basis of their gender. Therefore a question that emerges is whether there are differences in the instructional leadership practices between men and women? Is the principals' gender a contributing factor to the academic achievement of students in Sciences and Mathematics? This study, therefore sought to examine the relationship between principals' gender and students' academic achievement in Sciences and Mathematics.

Purpose of the Study

The purpose of this study was to compare the instructional leadership practices by male and female principals and compare them with their students' academic achievement in Sciences and Mathematics in KCSE.

Research Hypothesis

The following null hypothesis was tested:

HO. There are no statistically significant differences between the principals' gender and students' academic achievement in Sciences and Mathematics in KCSE

Methodology

The target population for the study was all Principals and Sciences and Mathematics teachers from Makueni County. Makueni County is made of nine districts and the researcher wanted a representation from all the nine districts. Proportionate sampling was used to get a representation of schools from each of the nine districts. In each school the principal, three Science teachers and a Mathematics teacher were the respondents. Once the schools were selected the principal was the first respondent, while the Sciences and Mathematics teachers were selected through simple random sampling.

Data was collected using two different sets of questionnaires administered on the school principals and the

Sciences and Mathematics teachers. The Teachers' Attitude Questionnaire (TAQ) was used to collect views of teachers about the principals' instructional leadership practices and their impact on students' academic achievement. The Principals' Questionnaire (PQ) collected views from the principals themselves on their instructional leadership practices. Interview guides were also administered on the principal of every school to provide more in depth information on the principals' instructional leadership practices.

Data was collected by four research assistants who were trained on data collection techniques. The collected data was coded for analysis which was done through SPSS version 21.5. Descriptive statistics was used for this study because it involves the description, analysis and interpretation of circumstances prevailing at the time of the study (Cohen et al, 2004). Since the study involved the analysis of scores between two groups (principals and teachers, male and female principals, performing and nonperforming schools) a Chi square test was conducted to determine if there existed statistically significant differences between and within the two groups. Findings of the study were presented in form of tables and graphs.

Results and Discussion

The study sought to investigate if there is a statistically significant relationship between the principals' gender and students' academic achievement in Mathematics and Sciences in the KCSE. The researcher began by comparing the number of male principals to female principals. Findings of the study showed that 67.3 percent of the respondents were male and 32.7 percent were females. The results showed a big disparity in the gender distribution in the schools with most schools having male principals. This was an imbalance in view of this study, as it means more men have ascended into school administration compared to ladies, as shown in figure 1.

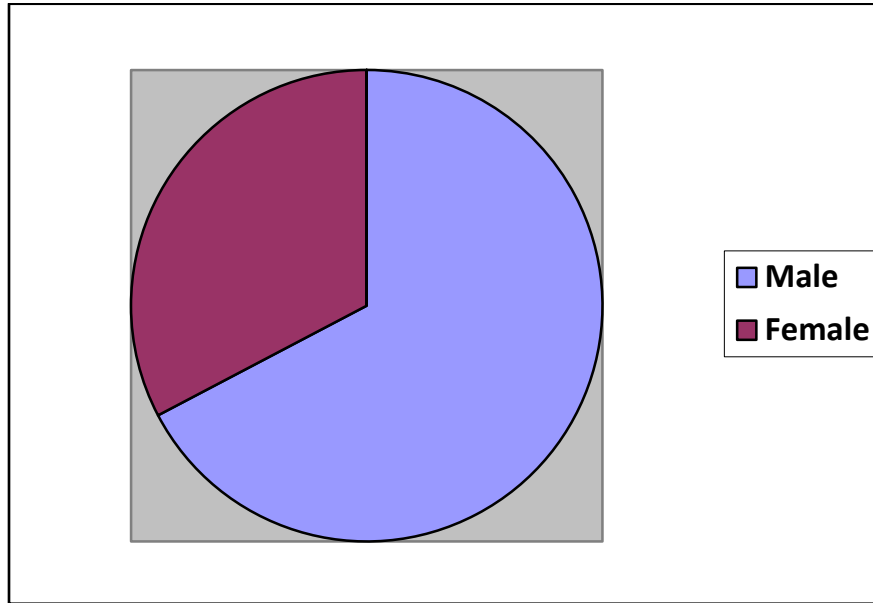


Figure 1: Gender of the Principals

These results called for a cross tabulation to compare the performance of students in Mathematics and Sciences with their principals' gender. Students' performance was given based on the KSCE administered by the Kenya National Examination Council (KNEC). Performance according to KNEC is based on a 1-12 scale (also known as mean scores), assigned grades A to grade E. The highest value of eleven and twelve corresponds to grade A (12- A, 11- A-), eight to ten grade B (8- B-, 9-B, 10-B+), five to seven grade C (5-C-, 6-C, 7-C+), two to four grade D (2-D-, 3-D, 4-D+) and the lowest level of one corresponds to grade E. For purposes of this study performance was given in four categories based on these values of mean scores grouped as; mean scores above 9 representing high students' achievement, between 6-9 representing performance above average, between 4-6, which is basically average and below 4 which shows performance below average.

A cross tabulation done between the principals' gender and the students' performance in Mathematics and Sciences shows that a total of 37 male principals participated in the study and of this number 2.7 percent had their students scoring a mean score above nine, 8.1 percent between six and nine, 37.8 percent between four and six and the remaining 51.4 percent had their students scoring a mean score below four in Mathematics. Their female counterparts had none of their students attain a mean score above nine in Mathematics, 27.8 percent had their students score between six and nine, 27.8 percent had their students score between four and six and the remaining

44.4 percent scored below four in KCSE. Female principals seemed to have a lower percentage of their students scoring the low grades below four as compared to their male counterparts as shown in Table 2:

Table 2: Principals' Gender and Mean Score Mathematics Cross Tabulation

GENDER		Mean Score Mathematics				Total
		Below 4	Between 4-6	Between 6-9	Above 9	
Male	Count	19	14	3	1	37
	%	51.4%	37.8%	8.1%	2.7%	100.0%
Female	Count	8	5	5	0	18
	%	44.4%	27.8%	27.8%	0.0%	100.0%
Total	Count	27	19	8	1	55
	%	49.1%	34.5%	14.5%	1.8%	100.0%

This is further shown in figure 2:

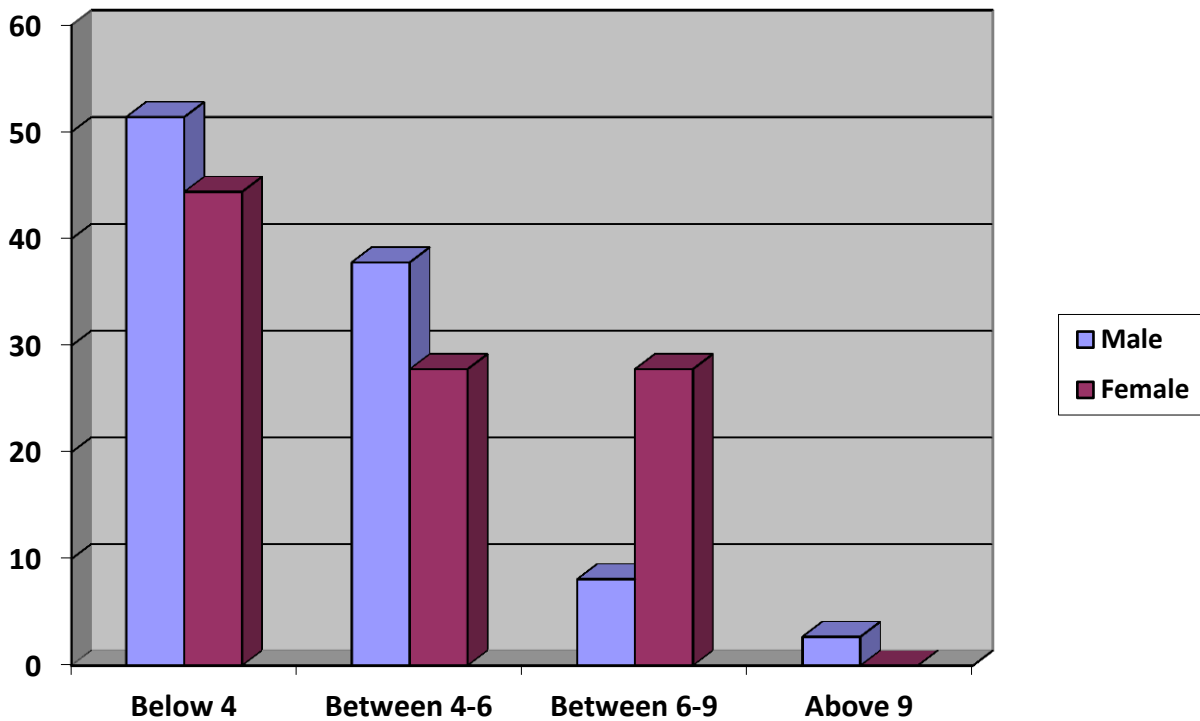


Figure 2: Principals' Gender and students' Academic Achievement in Mathematics

In the Science subjects, the findings showed that among the male principals 2.7 percent had their students scoring a mean score above nine in the Sciences, 24.3 percent had their students score between six and nine, 29.7 percent had their students score between four and six and the remaining 43.2 percent had their students

score below four in the Sciences. Their female counterparts had 11.1 percent with their students score a mean above nine, 33.3 percent had students who scored between six and nine, 16.7 percent had their students score between four and six while the remaining 38.9 percent had their students score below four in the Sciences in KCSE as is summarized in the table 3 below.

Table 3: Gender and Mean Score Sciences Cross Tabulation

GENDER		Mean Score Sciences				Total
		Below 4	Between 4-6	Between 6-9	Above 9	
Male	Count	16	11	9	1	37
	%	43.2%	29.7%	24.3%	2.7%	100.0%
Female	Count	7	3	6	2	18
	%	38.9%	16.7%	33.3%	11.1%	100.0%
Total	Count	23	14	15	3	55
	%	41.8%	25.5%	27.3%	5.5%	100.0%

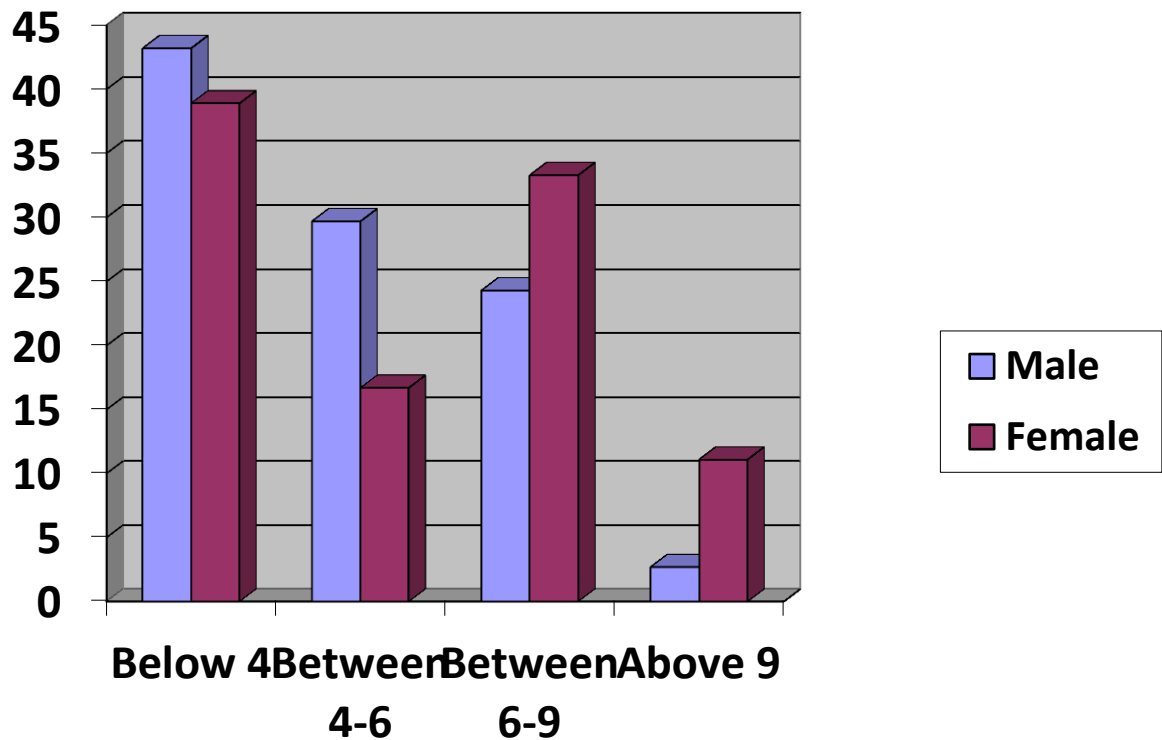


Figure 3: Principals' Gender and Students' Academic Achievement in Sciences

A difference was found in the performance of students in both Sciences and Mathematics in relation to gender of the principals. Female principals seemed to have more of their students scoring slightly higher scores as compared to their male counterparts. In order to test the null hypothesis, a Chi-square test was carried out between the principals' gender and students' academic achievement in Sciences and Mathematics. The results are shown in Table 3.

Table 4: Chi- Square Test on Principals' Gender and students' Academic Achievement

	GENDER
Chi-Square	6.564
Df	1
Asymp. Sig.	.010

The Chi-square test results were based on a probability of 0.05. Comparing the calculated values with the theoretical values shows that the $r0 \leq 6.564$ which is the calculated value, while the theoretical value is 3.84 for one degree of freedom. A weak relationship was therefore noted between gender and students' academic achievement.

CONCLUSION

Regarding to gender, either male or female, other researchers have found that the variable of gender can have a significant impact on the results of a study. These include studies by Kimura, 2002; McCarthy, Auger &Perrot-Sinal, 2002; Cahill, 2005; Brizendine, 2006 and Kruger, 2008. According to their findings, different genes, hormones and brain structures exist between males and females, which in turn can cause differences in personalities and behaviours.

The study was guided by the Transformational Theory which postulates that leadership occurs when a leader engages with a follower in such a way that both parties are raised to higher levels of motivation and morality with a common purpose. Females are said to lead in a more interpersonally oriented style making them more of transformational leaders than their male counterparts. This could probably explain the difference in students' performance in the schools led by female principals. Findings of this study correspond to results of previous researchers, (Kimura, 2002; McCarthy, Auger &Perrot- Sinal, 2002; Cahill, 2005; Brizendine, 2006; Kruger, 2008). All these researchers agree that males and females are quite different in many ways and so their leadership practices are also different. Austin, (2008)found that gender differences impact the values held by educational leaders, and the styles and approaches to management are distinguishable between male and female educational leaders. He further

found that these differences can influence decision making and institutional effectiveness. Studies by Shamir *et al* (2005); Appelbaum *et al* (2003) shows marked differences in the leadership approach between males and females. Females tend to be more oriented towards a strong pursuit for achievement, holding high expectations for self and others. Their leadership tends towards interpersonally oriented skills. To some certain extend females are more democratic, empathetic, cooperative and exchange ideas more effectively compared to men (Mauri, 2008). Their male counterparts tend to have a higher orientation towards strategic planning and organizational vision. They tend to practice more of business oriented skills in their leadership. Female principals tend to put more emphasis on teacher discipline, supervision from doing observations and instructional leadership (Auger & Perrot- Sinal, 2002; Cahill, 2005). These differences tend to contribute to some difference in performance between students led by a male and those led by a female principal. However, studies by Mauri (2008) in Indonesia, Bairagee (2008) in Bangladesh and Lue & Naijar (2009) in China showed that male principals are more effective in pursuing norms of leadership. Due to these differing findings, generalizing gender differences would not be accurate without further study.

Recommendations

From this study, it is recommended that further studies are needed in order to conclusively give gender as a factor that affects academic achievement in Sciences and Mathematics. A variety of research instruments need to be employed which may offer further insights into the leadership styles of males and females.

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