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Sex, Gender-typing and Performance in 2015 JSC 3 Mathematics by Students in Gaborone

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ABSTRACT

An important reason why learners differ in their performance in mathematics is differences in the psychological environment created by socialization process presided over by their parents. Biologically sex makes learners differ physically and these differences are capitalized on, and that unevenly, through the gendering process which imposes different expectations on the male and female children. Hence differences in sex might not be as influencing on learners' behavior as differences that result from the gendering process, for example, gender-typing of mathematics as a male subject. To test this speculation in the case of performance in mathematics a survey descriptive study using data from 735 students (298 boys and 437 girls) students who were taking the 2015 final JSCE examination from five randomly selected junior secondary schools in Gaborone was undertaken. Through testing two main null hypotheses it was found that girls, significantly more than boys, are more likely to gender-type mathematics as a male subject. The level to which the students perceive mathematics as a male subject has significant influence on their attitude towards the subject, the level to which they participate during lessons in mathematics classes, and their performance during the 2015 final JSCE examination in mathematics. Finally, sex was found to have a significant influence on the students' performance during the 2015 final JSCE examination in mathematics, but such influence was less significant than that shown by level of gender-tying the subject. The findings were discussed and recommendations following from them were made.

Key words: Sex, gender, gender-typing, attitude towards mathematics, participation in mathematics lesson, mathematics performance, Gaborone.

INTRODUCTION AND BACKGROUND

The effectiveness of exploiting, harnessing and developing a learner's potential depends, to a significant extent, on the psychological environment within which a child grows, learns and exhibits his/her cognitive, affective and psychomotor behaviours. Such environment is created by words of mouth, actions and the reward system by the parents and society under which the child grows. To a large extent the child behaves as indoctrinated, approved and rewarded by the society. For example, the child's behavior towards or interaction with others, and even with different subjects at school, is as a result of the socialization process by the immediate society within which he/she learns and grows.

Nature makes us males and/or females and the society cash in on the resulting biological differences, through the gendering process, to assign us roles and expectations that differentiates significantly between us. Except for biological roles, none of the discriminating roles assigned through the influence of the society or the socialization process is naturally peculiar to each sex group. According to O'Neil (2011), "Human infants are born without any culture. They must be transformed by their parents, teachers, and others into cultural and socially adept animals" (p. 1). We are different to the extent that our society imbibes us with differentiating roles. That is why in some society, we are more or less different than in others. So the society plays a significant role in exploiting the biological differences between different boys and girls for her own selfish interest. In other words, sex reflects our naturalization, whereas gender reflects our culturalization through socialization.

Through the socialization process, the society tends to imbibe us, as a group, with the characteristics of the players of the role into which our group has been socialized. In other words, the society tends to role-type us in various perspectives. For example, "teaching is an inferior career"; "mathematics is a male subject', "Black is an inferior race" etc. and consciously or more so unconsciously, we learn to behave in ways as expected by such behavior-typing (Steele & Aronson, 1995). Of interest to this paper, is the second example given above. Being characterizing as gender-typed tends to influence our behaviours much more than sex on which the gender-typing is based (Nenty, 2000). Gender-typing is the process of socializing children to exhibit behaviour ascribed to them by the society based on the expectation of what their roles should be because they are boys or a girls.

THEORETICAL FOUNDATIONS

Gender Stereotype

This paper is anchored on Bem's (1981) sex schema theory in attempt to understand the role of sex in the mathematics performance of JC students. Bem describes a schema as a "cognitive structure that organizes and guides individual's perception. It functions as an anticipatory structure, a readiness to search for and assimilate incoming information in schema relevant terms". Bem further suggests that "Schematic processing is thus highly selective and enables the individual to impose structure and meaning onto the vast array of incoming stimuli." (1981, p. 355). On the other hand, West (2015), suggests that "gender schema theory is a process that schemas are active in facilitating a relationship between the children's thought behaviour and in turn shaping the development of their sex and attitude towards the self" (p. 61). Children irrespective of their sex learn how their cultures and/or societies define the roles of men and women and then internalize this knowledge as a sex schema, or unchallenged core beliefs. Hence, it would be relevant to look into the performance in mathematics by children and examine the effect of gender using the gender schema theory perspective.

The central idea to Bem's theory is that children become sex-typed through sex based schematic process. Sex typing is the process that society 'transmutes male and female into masculine and feminine' (Bem, 1981, p. 354). In particular, the theory proposes that sex-typing results, in part, from the fact that the self-concept itself gets assimilated into the sex schema (p. 355). West (2015) further explains that children embody specific characteristics and beliefs that are deemed appropriate for one sex but not the other and believes this categorization of sex related information is relevant to the individual. Child's attitudes, lifestyle, sexuality are learnt from society as a characteristics of a given sex (p. 61). Hence, the societal expectations towards boys and girls are different in various societies.

Bem's theory is appropriate in establishing sex and sex typing influence in mathematics performance because society in general holds stereotype that certain subjects are masculine

while others are feminine. Mathematics and science are traditionally stereotyped to be a male subject. Males are traditionally deemed to be smart at problem solving while females are believed to be good in humanities subjects-story tellers. These beliefs result in sex stereotypes which can be defined as generalized beliefs, ideas, about differences, and roles of individuals and/or groups based on their sex. Stereotypes can be positive or negative, but they rarely communicate accurate information about others (Hilton & von Hippel, 1996). For example, a stereotype that women make bad drivers, women are weak therefore cannot do other activities that demands strength.

Early research has linked girls' performance in mathematics to the stereotype that males are superior to females because of their intellect that is more than that of girls (Sterling, 1992). In the context of Botswana where male supremacy is idealist and inequality characterizes all structural aspects of the society, the sex gap in mathematics performance should be analysed in consideration of all aspects that may contribute to learning hence the applicability of sex schema theory in this study.

Recent evidence show that stereotyping begins as early as between ages 8-9 years. Other scholars observe that girls two years earlier than the onset of this already perceive themselves as good in arts than in mathematics activities (Fredricks & Eccles, 2002, and Lanza, Osgood, Eccles & Wigfield, 2002 as cited in Cvencek, Meltzoff & Greenwald, 2011). The effect of negative group stereotype threat has been found among the causes of women's low performance in mathematics tests (Schmader, 2002).

Problem and Purpose of the Study

The problem of poor and deteriorating performance in mathematics by primary and secondary school pupil in Africa is created by and is not new to the society. In Botswana, like in other societies, the first 'school' where mathematics is taught is the home, and unfavorable disposition toward the subject by parents is easily assimilated by the child learner. Children differ in their performance in mathematics as a result of differences in the psychological environment created by socialization process presided over by their parents. This socialization adulterates 'sex' into 'gender' which imbues the growing child with several discriminating expectations that exaggerates inequality between boys and girls. This constitutes a big problem to the education process, for example, gender-typing mathematics as a male subject tends to constitute a block to the learning of the subject among students to an extent higher than what sex does. The purpose of this study therefore is to determine the extent to which mathematics-related behavior, including performance, is influenced by gender-typing above and beyond the influence of sex.

Research Objectives and Questions

To determine the influence of sex as well as the influence of stereotyping mathematics as male-only subject on (i) attitude to; (ii) participation during lesson on; and (iii) performance in mathematics during the 2015 JSCE examination by Gaborone students. Hence the research questions are:

1. Does sex influence attitude to, participation during lesson on, and performance in mathematics during the final examination by 2015 JS3 students in Gaborone?
2. To what extent does stereotyping mathematics as a male subject impact on Gaborone students' attitude to, participation during lesson on, and performance in mathematics during the 2015 final examination in the subject?

Research Hypotheses

1. Among Gaborone students who took the 2015 JSCE examination in mathematics sex has a significant influence on the level of gender-typing mathematics as a male subject
2. Gender, level of gender-typing of mathematics and the interaction between them, each has significant influence on students':
   - attitude towards mathematics among 2015 final year JS 3 students in Gaborone;
   - participation by 2015 final year JS 3 students in Gaborone during lesson in mathematics class; and
   - performance in mathematics by students during the 2015 JSCE final examination.

LITERATURE REVIEW

Nenty (2000), using both primary data from, and secondary data on, some 716 randomly sampled final year junior secondary school students in Lesotho, investigated the influence of gender-typing of mathematics on their achievement-related behaviour and performance in the subject. The results showed that there is a significant sex influence on gender-typing of mathematics, but much more than sex, gender-typing ha**d** significant influence on almost all the eight mathematics achievement-related variables under study as well as on their performance in the subject.

Different studies have attempted to establish contributing factors to the sex gap that for many decades tended to show females low representation in mathematics participation, achievement and performance (Johnson, 2000; Santos, Ursini, Ramirez & Sanchez, 2006; Ercikan, McCreith, & Lapointe, 2005). Earlier research tended to pay much attention to the social and cultural processes which boys and girls are subjected to, which affect their math participation, achievement and performance other scholars. For example, Leder (1992) proposed that the research on the gender-math gap should emphasize on "socialization processes and hidden cultural pressures, because female facts cannot be studied in isolation hence the emergence of sex as a category of analysis" (Santos, Ursini, Ramirez & Sanchez, 2006, p. 42).

Attitude towards mathematics

Lee and Anderson (2015) explored why more boys than girls in Australia continue to study higher levels of mathematics in senior school when there appear to be no gender differences in achievement in earlier years. Analysing data collected from students in a single-sex boy's school, a single-sex girl's school and a coeducational school the researchers found that significant differences in attitude to mathematics with girls in the single-sex school having the most positive attitudes and girls in the coeducation setting having the least positive attitudes.
According to the researchers, the suggestion that gender differences in attitudes to mathematics may be more pronounced in coeducational schools than single-sex schools raises the larger issue of gender stereotyping and the possible impacts of school setting. "It may be that in a coeducational school, students are more likely to conform to gender stereotypes, whereas in single-sex schools there is more freedom for students to not 'live up to' gendered expectations." (p. 363).

Similarly, Owiti (2011), using a sample of 205 Form 3 students (126 girls and 79 boys) of Kenya students, investigated whether there was any significant gender difference in attitudes toward mathematics. The findings of the study indicated that more boys than girls (93.7% of boys compared to 59.5% of girls) had positive attitudes toward mathematics while more girls than boys (35.7% of girls compared to 6.3% of boys) showed negative orientation towards mathematics.

Teacher' disposition have an influence in student's attitudes towards mathematics. Afzal, Saleem and Islam (2013) citing Swetman (1995), described how girls demonstrate positive attitudes in mathematics during their primary schooling only to develop negative attitudes towards in later years of their education. Despite this, they found that boys had positive attitudes when compared with girls whose attitudes were negative. On the other hand Adebule and Aborisade (2014) in their study comparing attitudes of 300 males and 300 females students at senior secondary school in Ekiti State, Nigeria towards mathematics. The researchers found no significant difference in the attitudes of both males and females. Both males and females had positive attitudes towards mathematics.

Another study in Kenya by Korir and Laigong (2014) which intended to assess the extent to which boys and girls held attitudes toward sex role stereotype, and their influence in mathematics performance. The findings of the study showed no significant difference in the attitudes of 104 boys and104 girls from eight (8) secondary schools towards mathematics and chemistry. The researchers also found no significant difference between the attitude they held towards sex role stereotype and performance in mathematics and chemistry. In another study, Gunderson, Ramirez, Levine, and Beilock (2012) observed that children endorse gender stereotypes about mathematics at a very early stage from their preschool days. Gunderson et al. observed that girls from pre-school and elementary school level display lower self-concept about math than boys "and girls being negatively affected by implicit and explicit activation of math-gender stereotypes" (Ambady, Shih, Kim, & Pitttinsky 2001, p. 386). Moreover, the same authors observe that parents and teachers expectations also play a critical role in influencing mathematics attitude in children citing that the two expectations for children's success in mathematics tend to carry some biases by their own gender stereotypes leading to lower achievement and lower mathematics-self concepts among girls than boys. These scholars further propose that adults' mathematics anxieties, beliefs and behaviours can also impact children's gendered mathematics attitudes.

Participation in Mathematics

Through an analytical study on influence on the learning and participation of minorities in mathematics. Matthews (1984) found that class participation was more focused on students' aspiration, completing the course while performance was focused achievement. He found that participation of minority students was influenced by parents, school and the students themselves. On the other hand, Voelkl (1995) suggests that learners who feel comfortable in a the classroom and feels free to interact with the teacher, and become more engage in the learning activities are likely to work harder in their classroom learning activities. This implies that learner who are comfortable with their learning of mathematics feel comfortable to interact with their teachers and participate in class activities; hence creating their own opportunity to perform well in mathematics.

With his intention to examine the effect of expectations and influence of peers, teachers and parents on the students' participation in advanced mathematics, Ma (2001) using the longitudinal data of 3116 from Grade 7 to Grade 10 found that students' future expectations were very important for students to take advanced mathematics in future. In fact, it was the parents' expectations and parents' college plans that showed very strong effect of mathematic participation (Ma, 2001). Ma further points out that the learner**s** not only need the right attitude they also need to have the cognitive ability and positive attitude for the peers, teachers and parents' expectations and influence to have effect in their in mathematics participation. This implies that support from others has an impact in learning mathematics if the learner has the right attitude and suitable cognitive ability to participate in advanced mathematics.

METHDOLOGY AND DESIGN

This survey descriptive study used data from a large sample of Gaborone junior secondary schools students learning of mathematics (Nenty, Kgosidialwa & Moeti, 2016). A total of 735 students (298 boys and 437 girls) from five randomly selected junior secondary schools in Gaborone served as the sample for the study. The curriculum for the schools is the same and all the students were preparing to take their final 2015 JSC final examination.

Instrumentation and Data collection

A questionnaire which comprised two sections was developed, validated and used to collect data for the study. Section 1 requested biographical data from the participants. Section 2 comprised of 48 6-point Likert type questionnaire items. The options ranged from 'Very strongly disagree' (VSD) = 1; 'Strongly disagree' (SD) = 2; 'Disagree' (D) = 3; 'Agree' (A) = 4; 'Strongly Agree' (SA) = 5 to 'Very Strongly Agree' (VSA) = 6. All the items were in English as it is the mode of instruction in Botswana schools. The items were designed to measure mathematics-related variables involved in the study. Provision for students' anticipated and actual performance in the forthcoming 2015 JSCE final examination in mathematics were made. With the assistance of mathematics teachers in their respective schools students responded to a questionnaire two weeks before they sat for their 2015 final Junior Certificate Examination. Participants were informed about their right to participate or not and how the information they share would be confidentially used. Despite the students responding to the questionnaire during the mathematics lesson the return rate was low for two of the five schools, the other three had 100% return rate.

Variables

This study considered two groups of variables, one comprising of participants' demographic variables like sex and age. The second set of variables consists of variables such as attitude toward mathematics, and participation in class during mathematics lesson. The Cronbach alpha reliability estimates for the two variables involved in this study are: attitude towards mathematics (5 items) was found to be $\alpha = .76$ and for participation in mathematics classroom (4 items) this was $\alpha = = .81$. Ethical issues were considered to protect the identity of the participants by first protecting identity of the schools. Schools were given identity number which was used in the analysis. Secondly, the students did not write their names, they were given numbers that would be related to their school identity to assist in the tracking of the final JC performance in mathematics (Nenty, Kgosidialwa & Moeti, 2016).

Data Analysis and Interpretation of Results

Data for this study were analyzed to test the two general hypotheses that were put forth to guide the study as a way of finding the answers to the research questions that the study intended to answer. All the null hypotheses were tested at the level of significance .05

To test the first hypothesis a chi-square analysis was performed (see Table 1), while three two-way analysis of variance were performed one for each of the three dependent variables with sex and level of gender-typing as the independent variables in each case. These were tested at the .05 level of significance.

The chi-square (χ^2) analysis carried out to test the first hypothesis resulted in a χ^2-value of 35.226 with 2 degrees of freedom (see Table 1). This was found to be a lot more than the critical value of 5.99 for 2 degrees of freedom and at $\alpha = .05$. The null hypothesis was therefore rejected. In other words, the sex of Gaborone students who took the 2015 JSCE final examination had significant influence on the level to which they gender-type or perceived

mathematics as a male subject. A close study of the contents of Table 1 shows that whereas 61 males where expected,

Hypothesis I

Among Gaborone students who took the 2015 JSCE examination in mathematics, sex has no significant influence on the level of gender-typing mathematics as a male subject.

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Table 1
Chi-Square Analysis of the Influence of sex on Level of Gender-Typing Mathematics as a Male Subject

	Level of Gender-typing of Mathematics			
Sex	Low	Some	High	Total
Male	87[a]	102	109	298
	61.1[b]	91.9	145.0	298.0
Female	64	125	249	438
	89.9	135.1	213.0	438.0
Total	151	227	358	736
	151.0	227.0	358.0	736.0
χ^2 (2, n = 736) = 35.226**				

[a]Observed frequency; [b]Expected frequency.

These mean that significantly more boys than expected tended not to gender-type mathematics as male subject. Reversals in the trend of these perceptions were observed for female students. These mean that girls, more than boys, are significantly more likely to perceive mathematics as a male subject.

Null Hypothesis II(i)

Sex, level of gender-typing of mathematics and the interaction between them, each has no significant influence on students' attitude towards mathematics among 2015 final year JS 3 students in Gaborone.

The two-way analysis of variance performed to test this hypothesis (see Table 2) resulted in an $F_{(1, 698)}$-value of 2.59 which was found to be less than the critical F-value of 3.84 for 1 and 698 degrees of freedom, hence the null hypothesis was not rejected for the influence of sex on students' attitude towards mathematics. In other words, among the JS3 students in Gaborone who took the 2015 final examination in mathematics, there is no significant sex-related difference in their attitude towards the subject.

Table 2
Two-way ANOVA of the Influence of Sex and Gender-typing of Mathematics on JS3 Students Attitude towards Mathematics

Sex	LG-typing of Mathematics	n	Mean	Std. Deviation
Male	Low	80	15.4875	4.90671
	Some	93	14.2903	4.87135
	High	108	11.6574	6.10831
	Total	281	13.6192	5.61066
Female	Low	64	17.1406	4.33101
	Some	116	14.4224	4.27358
	High	243	12.0741	6.45668
	Total	423	13.4846	5.92442
Total	Low	144	16.2222	4.71635
	Some	209	14.3636	4.53849
	High	351	11.9459	6.34575
	Total	704	13.5384	5.79755

Source	Sum of Squares	df	Mean Square	F	Sig.
Gender	79.646	1	79.646	2.592	.108
LG-Typing	2064.416	2	1032.208	33.592	.000
Sex * LGTyping	53.247	2	26.623	0.866	.421
Error	21448.176	698	30.728		
Total	23628.964	703			

[a]R Squared = .092 (Adjusted R Squared = .086)

When it came to the level to which these students perceived mathematics as being boys' subject, the $F_{(2, 698)}$-value of 33.592 was observed (see Table 2). This value was found to be a lot larger than the critical F-value of 2.99 for 2 and 698 degrees of freedom at .05 alpha level. Given this observation, the null hypothesis was rejected and hence the level to which Gaborone students who took 2015 final JSCE examination perceived mathematics as a male subject has a significant influence on their attitude towards mathematics. Following from this, a post-hoc analysis using Fisher's least significance difference (LSD) methods showed that students in the low, some and high gender-typing groups differed significantly ($p < .05$) from each other in their attitude towards mathematics. Meaning that among Gaborone students who took the 2015 final JSCE examination the lower their level of gender-typing of mathematics as male subject, the more favourable their attitude towards mathematics (see Table 2). The interaction between sex and level of gender-typing of mathematics as a male subject was not found to have a significant ($F_{(2, 698)} = 0.866$; $p > .05$) influence on students' attitude towards mathematics.

Null Hypothesis II(ii)

Sex, level of gender-typing of mathematics and the interaction between them, each has no significant influence on students' level of participation during lesson in mathematics class among 2015 final year JS 3 students in Gaborone.

A similar analysis done to determine the influence of sex and gender-typing of mathematics on level of participation during lesson in a mathematics class by Gaborone students who took the 2015 final JSCE examination showed the same pattern of results. In this case, the level to which these students perceived mathematics as being boys' subject, gave an $F_{(2, 698)}$-value of 40.583 (see Table 3) which was found to be a lot larger than the critical F-value of 2.99 for 2 and 698 degrees of freedom at .05 alpha level.

Given this observation, the null hypothesis was rejected and hence the level to which Gaborone students who took 2015 final JSCE examination perceived mathematics as a male subject has a

significant influence on their level to which they participated during lesson in a mathematics class. The interaction between sex and level of gender-typing of mathematics as a male subject was also not found to have a significant ($F_{(2, 698)} = 1.051$; $p > .05$) influence on students' attitude towards mathematics.

Similarly, Fisher's least significance difference (LSD) post-hoc analysis showed that students in the low, some and high gender-typing groups differed significantly ($p < .05$) from each other. Meaning that among Gaborone students who took the 2015 final JSCE examination the lower their level of gender-typing of mathematics as male subject, the more likely are they to participate during lesson in mathematics classroom (see Table 3).

Table 3
Two-way ANOVA of the Influence of Sex and Gender-typing of Mathematics on JS3 Students Participation during Mathematics

Sex	LG-typing of mathematics	N	Mean	SD
Male	Low	82	12.2073	3.25363
	Some	91	10.9780	3.50231
	High	107	9.3925	4.10190
	Total	280	10.7321	3.84321
Female	Low	61	11.9836	2.66766
	Some	115	11.3913	2.82127
	High	240	8.8833	3.77435
	Total	416	10.0313	3.64067
Total	Low	143	12.1119	3.00962
	Some	206	11.2087	3.13907
	High	347	9.0403	3.87948
	Total	696	10.3132	3.73660

Source	Sum of Squares	df	Mean Square	F	Sig.
Sex	1.653	1	1.653	0.134	.714
LG-Typing	997.994	2	498.997	40.583	.000
Sex * LG-Typing	25.855	2	12.927	1.051	.350
Error	8484.054	690	12.296		
Total	9703.718	695			

[a]R Squared = .126 (Adjusted R Squared = .119)

Null Hypothesis II(iii)

Sender, level of gender-typing of mathematics and the interaction between them, each has no significant influence on students' performance during 2015 JSCE examination in mathematics by final year students in Gaborone

A two-way analysis of variance was also carried out to test this hypothesis. For sex influence, the analysis gave an $F_{(1, 547)}$-value of 3.844 which was found to be just significant at .05 alpha level. A close look at the mean performance of boys and girls showed the mean for boys to be 51.71 while that for girls was 48.89 (see Table 4). In other words, sex had a significant influence on the performance of Gaborone students who took the 2015 final JSCE examination with the boys performing significantly ($\alpha = .05$) better than girls.

With an $F_{(2, 547)}$-value of 15.054, level of gender-typing was again found to have significant ($p < .05$) influence on the performance in mathematics of Gaborone students who took the 2015 final JSCE examination. A post hoc analysis showed generally the same trend as in the other two dependent variables. This implies that among Gaborone students who took the 2015 final

JSCE examination the lower their level of gender-typing of mathematics as male subject, the higher their performance

Table 4
Two-way ANOVA of the Influence of Sex and Gender-typing of Mathematics on Students' 2015 JSCE Performance in the Subject

Sex	Level of G-typing of mathematics	n	Mean	Std. Deviation
Male	Low	62	54.5571	9.58403
	Some	75	52.2448	10.52930
	High	77	48.8996	9.88988
	Total	214	51.7111	10.24876
Female	Low	53	52.6625	8.55073
	Some	95	50.9315	9.43160
	High	191	46.8406	9.68172
	Total	339	48.8972	9.71882
Total	Low	115	53.6839	9.13237
	Some	170	51.5109	9.92223
	High	268	47.4322	9.76809
	Total	553	49.9861	10.01245

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Sex	359.901	1	359.901	3.844	.050
LGTyping	2818.912	2	1409.456	15.054	.000
Sex * LGTyping	13.765	2	6.882	0.074	.929
Error	51214.250	547	93.628		
Total	55337.525	552			

[a]R Squared = .075 (Adjusted R Squared = .066)

during the 2015 final JSCE examination in mathematics (see Table 4). Again, the interaction between sex and level of gender-typing of mathematics as a male subject did not show any significant influence (see Table 4) on their mathematics performance during the 2015 final JSCE examination.

Summary of Findings

Among Gaborone students who took the 2015 final JSCE examination, the study shows that girls, significantly more than boys, are more likely to perceive mathematics as a male subject. The level to which student perceive mathematics as a male subject has significant influence on their attitude towards the subject, their level of to which they participate during lessons in mathematics classes, and their performance during the 2015 final JSCE examination in mathematics. Finally, sex was found to have a significant influence on the students' performance during the 2015 final JSCE examination in mathematics, but such influence was not as much as that found for gender-typing.

DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

By its finding, the study showed that Gaborone students who took 2015 final JSCE in mathematics showed significantly high level of gender-typing of the subject. Girls, more than boys, were found to be more likely to perceive mathematics as a male subject. This supports Hirnstein, Andrews, and Hausmann's (2014) finding that "an interaction of gender stereo-typing and group sex composition affects the performance of men and women in sex-sensitive cognitive tasks" (p.1). Biased created by stereotypes, advising females against taking mathematics-related courses; mathematically gifted girls not being identified and nurtured; scarcity of women role models in math-intensive careers tend to lead girls to believe they do not belong with mathematics.

In analyzing these beliefs, this could have positive or negative consequences as some boys may put effort knowing that they are perceived as having more potential than girls since they also demonstrated high gender-typing or they showed that they had the belief that mathematics is a male subject. This could be a disadvantage for them, because girls who hold high on these beliefs may actual find themselves not doing very well as they may fail to apply as they already see themselves failing even before they fail. Even if they could have the potential to perform better, are male, and that would be an advantage for them. However, there may also be boys who may negatively be impacted by this beliefs as they may develop low self-esteem in mathematics, they may just relax and not put any effort with the belief that since mathematics is a male subject they will perform well just because they are male. On the other hand, the more girls also demonstrated high gender-typing or they showed that they had the belief that mathematics is a male subject. This could be a disadvantage for them, because girls who hold high on these beliefs may actual find themselves not doing very well as they may fail to apply as they already see themselves failing even before they fail. Even if they could have the potential to perform better, their low self-esteem and the stereotype belief would lead them to a psychological state of "learned helplessness" where they accept their failure without any attempt to solve the problem.

On the other hand, the low number of girls who did not have a belief that mathematics is a male subject has the potential to do well as they do not have any biasness against mathematics. This finding is in accordance with Beilock's (2008) study that suggest**s** that high stress situation creates worries about the situation and its consequences. This in turn disadvantaged the individual because the presence of worry or being threatened leads to a competition for the working memory normally available for performance. Thus, the performance of the individual who is put under pressure is most likely to decline. In addition Ashcraft and Kirt's (2011) study showed that part of poor performance in mathematics stems from anxiety induced depletion of the cognitive resources that support complex mathematics tasks. Tomasetto, Cadinu and Alparone (2011) have also noted gender differences in threatening environments where gender stereotyping is prevalent

Students who demonstrated low levels of gender typing regardless of whether they were boys or girls had more favourable attitudes towards mathematics than their colleagues. On the other hand Gaborone students who took 2015 final JSCE who showed high levels of gender-typing towards mathematics were found to have less favourable attitudes towards mathematics than those who showed less level of gender-typing. The finding is in agreement with those of Quinn, Spencer (2001)and Osbourn (2001**)** whose studies also revealed that when negative stereotypes are prevalent; (in this case that mathematics was for males), women under perform. It is also noted by the same authors that high levels of anxiety can add additional anxiety in the testing situation. Moreover, it is argued that mathematics anxious people are never math–proficient (Beilock, 2008). Tomasetto, Cadinu and Alparone, (2011) cited studies such as Else,-Quest, Hyde and Linn (2010); and that of Guiso, Monte, Sapienza and Zingales (2008) to argue that there is evidence that gender equality in society is inversely correlated with girls' underperformance in mathematics such that the math gender gap is still present in countries gender – unequal countries

The finding that the level to which Gaborone students who took 2015 final JSCE examination perceived mathematics as a male subject has a significant influence on their level to which they participated during lesson in a mathematics class comes to strengthen the strong stereotypic emotion of learners when it comes to mathematics. This argument is strengthened by the observation that the lower their level of gender-typing of mathematics as male subject, the more likely are they to participate during lesson in mathematics classroom. This implies that

the Gaborone students who took 2015 final JSCE whose belief was low in mathematics as a male subject had high chances of participating in their mathematics classes as compared to those who had high beliefs that math was for boys. This contradicts Adebula and Aborisade (2014) and Korir and Laigong's (2014) findings that there is no profound differences in mathematics participation between boys and girls and concluded that neither sex nor gender-typing have significant influence on mathematics participation in among Kenyan and Nigerian students.

Consistent with the findings of previous studies (Cvencek, Meltzoff & Greenwald, 2011**),** the study found a significant sex and gender-typing related differences in students' mathematics performance during the 2015 JSCE. Looking at the influence of sex on performance boys were found to perform significantly better than girls in their final mathematics examinations. The level to which Gaborone students who took 2015 final JSCE believed mathematics to be a male subject was also found to have a significant influence in their performance in the subject with those who were low at gender-typing the subject performing significantly better than those with high perception of mathematics as a male subject. Cvenceck, Meltzoff and Greenwald's (2011) study similarly found that where math-gender stereotype is prevalent i.e., the association of self with female for women and mathematics for male, the weaker the association of self with math. They add that female weaker identification with mathematics is maybe from culturally communicated messages about mathematics being in the male domain in United States. The same authors, Cvenceck, Meltzoff and Greenwald are in consistence with earlier research (Beilock, 2008; Noesk, Banaji & Greenwald, 2002; Dowker, Bennet & Smith, 2012) that suggest that mere presence of gender stereotyping is enough to affect individual performance.

At the early age, the forces of socialization does not impact on emotions towards and performance in mathematics to influence a significant difference between boys and girls. With more influence of socialization, such impact continues to grow with age on the learners and hence bringing about significant difference in performance with age. This is in line with Smetackova's (2014) findings that 'gender beliefs about mathematics were pretty strong and . . . as children get older, differences between boys and girls increase as does heterogeneity within each group" (p. 211).

Conclusion

Through testing two broad hypotheses this study established the relationship between sex, gender typing and mathematics performance among Gaborone students who took their JSCE final examination in 2015. In consistent with earlier studies in other countries as his study revealed that girls, significantly than boys, are more likely to gender-type mathematics as a male subject as such this results in girls' negative attitude towards mathematics, less participation in mathematics leading to poorer performance than boys. The level to which the students gender-type mathematics as a male subject had significant more influence on their attitude to the subject, the level to which they participated during mathematics lessons and their performance during 2015 final JSCE examination in mathematics than their sexes.

Recommendations

Teachers and parents should retreat from creating stereotype-provoking environment about any school subject, especially mathematics, as well as associating this to the sex of the children as these tend to hinder the children's learning such subject even at an early age. There is need to raise an awareness in our society that the way we raise our children could have negative or positive impact on how our children approach school subjects or life in general. For example, it is the socialization process that 'empowers' girls to gender-type mathematics as a male subject

and hence tend, more than boys, to develop unfavourable attitude towards the subject, participate less in mathematics class and hence perform poorer than boys in the subject.

Teachers need to prompt non-sexist nature of subject in their classes and encourage the girl child to compete with the boy child in all learning areas without considering their sex. Following from their finding as earlier reviewed, Lee and Anderson's (2015) suggested that gender differences in attitudes towards mathematics may be more pronounced in coeducational schools than single-sex schools. This according to them, raises the larger issue of gender stereotyping and the possible impacts of school setting. "It may be that in a coeducational school, students are more likely to conform to gender stereotypes, whereas in single-sex schools there is more freedom for students not to 'live up to' gendered expectations." (p. 363). Hence given the finding by this study that gender-typing has significant more influence on students' attitude towards mathematics than sex, it might then be necessary to consider allowing girls and boys to have separate classrooms during mathematics lesson.

The enormity of the problem of poor and deteriorating mathematics performance by our children calls for several attempts at contributing solution to it through research.

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