

Students' attitudes and interaction in learning mathematics in Botswana Junior Secondary schools

Luckson M. Kaino
Faculty of Education
University of Botswana
P.O.Box 70025, Gaborone, Botswana

Email: kaino_dr@hotmail.com and kainol@mopipi.ub.bw

Abstract

Students' interests in mathematics subject and their interaction in mathematics lessons are analyzed by gender. Data was collected using closed and open-ended questionnaires as well as an observation schedule. The analysis presented the responses into percentages and the chi-square test was used on some data to analyze the variation of gender differences in some of the variables used. The findings showed that students' interests in the subject were average and most students perceived mathematics as a difficult subject to learn. While many girls and boys were comfortable with the interaction in mathematics lessons, some students of both sexes were not comfortable with classroom practices which prevented them from concentrating on academic affairs. These findings indicate that some practices by both girls and boys during class lessons, and the learning environment in a co-educational setup could affect some students of both sexes in learning.

Introduction

For many years now, research on gender differences in the study of mathematics have been done and some strategies have been in place to reduce the gender gap. The efforts made to reduce the gap, can be attributed to the realization that mathematics is a filter in career choices and those who opted out of mathematics were denied some important opportunities (Clifford, 1998). Some research done in developed countries, in the past ten years, seemed to indicate that gender differences in mathematical performance were diminishing (Lafortune, 1989; Hyde et al, 1990 and Frost et al, 1994). However, some studies done in these countries have contradicted this view. The study by Kaiser-Messmer (1994) done in Germany, showed that boys performed better than girls and a recent study by Fennema (2000) show that gender differences still existed in learning complex mathematical tasks in middle and secondary schools in America.

Some studies have indicated a number of factors which could contribute to the emergence of gender differences. One of the factors is said to be from people who believed that mathematics was a male subject and that boys performed better than girls (Boswell, 1985 & Goddar-Spear, 1989). The other factor is believed to be from family influences and socio-economic status of parents (Gilbert 1986), and cultural and traditional influences (Ngameza, 1991; Duncan, 1989; Clegg, 1984 and Finn, 1980). Such factors were believed to be significant in the trend towards learning of mathematics and could influence girls on subject and job selections.

Curricular materials used in the schools, have also been singled out as an influencing factor in the study of mathematics. For example, in some textbooks women were portrayed as insignificant or invisible as compared to men who dominated in presentation, and were referred to as pioneers and great scientists (Scott, 1980; Turbull et al, 1983; Whyte 1983; Kelly, 1987 and Abraham 1989).

Some textbooks reinforced masculine language, for example through pictures presenting women pushing prams, cooking, being sex symbols, and presented in selling items (Walford, 1980).

Interaction in classroom, between boys and girls, and the teacher, is also said to affect girls where boys were looked upon to be more competent than girls. Boys' use of verbal and non-verbal language to command more of the teacher's time in both attention and classroom control, and boys being more mobile in class than girls tend to influence some teachers' beliefs that boys were more competent than girls (Serbin, 1978; Barry, 1981; Jungwirth, 1991 and Lee, 1990). Some teachers also believed that boys' contributions were more impressive than those of girls and teachers could rate boys' work higher even if girls' work was identical to that of boys (Goddard-Spear, 1989; Fennema et al, 1990 and Fennema, 1990).

Furthermore, the studying environment where boys and girls study together, in co-education schools, has been an issue in current educational debates. Some emerging evidences also suggested that single-sex schools could provide the environment where girls could shine (Anstey, 1997 & Kaino, 1998). The latter view is realized from some studies which have indicated that girls in girls' only schools were performing better than girls in co-educational schools. Girls in girls' only schools were also performing equally good as boys in boys' only schools. There are emerging views that in a co-education setup, girls and boys should be separated during class sessions i.e. boys and girls study separately in the same school. Whether this suggestion of separating boys and girls in classes could improve girls' performance in co-educational schools remains to be seen from future studies.

Some studies done in Botswana by Finn (1980), Case (1982), Clegg (1984), Duncan (1989), and Taiwo & Molobe (1994) indicated that cultural expectations of society could give rise to differences in performance between girls and boys in school subjects and that such expectations could influence occupational choices between the two sexes. The study on mathematics by Marope (1992) in Botswana Junior Secondary schools, showed that girls had more negative attitudes towards mathematics than boys. Like in some other studies done elsewhere, the study by Marope did not analyze the course of gender differences. Many studies on gender differences have generally confirmed the existence of gender differences, and mainly factors such as performance between girls and boys, availability of teaching materials and accessibility to schooling have been involved. Factors such as classroom interaction, students' interests, confidence and difficulties, teachers' gender attitudes, social and economic aspects have not been brought up to explain the magnitude to which they could contribute to the gender gap.

Purpose of the study

The study intended to identify possible factors that could influence gender differences in the study of mathematics in Botswana Junior Secondary schools.

Research questions

The study was guided by the following questions:

- (i) what were the students' interests ratings and reasons in mathematics learning
- (ii) how was the classroom interaction between boys, girls and teachers in learning mathematics

Limitation of the study

The study involved only co-education schools as there are no single sex schools for girls and boys in Botswana. A setup in single sex schools would have provided some important information for the Botswana case study and for comparison to other studies done elsewhere. Because of time constraints and nature of the study, only a few variables were analyzed. Other variables will be considered in a larger study on gender differences in learning mathematics.

Research design

The study involved a questionnaire which contained closed and open ended questions. Both quantitative and qualitative methods were used to analyze the data collected.

Target population and sample

The target population was all students and mathematics teachers in Botswana junior secondary schools. As the study covered the whole country, the sample was stratified into the country's nine districts. Gaborone city having a substantial number of schools, was also taken as a district in the sample. Thus the sample contained 10 districts. From each district, 2 schools were selected at random, which made a sample of 20 schools. As the number of students in the sampled schools was too large for the study, 2 streams of students in form 3 from each school were involved. The stream was assumed not to contain more than 40 students, and the sample contained 1600 students. The selection of form 3 students took into account that at this level students had some considerable classroom and school experiences before they went to senior levels and that some useful information could be obtained from this group. After data collection, the total number of students who responded was 1441 (795 girls and 646 boys). This represented about 90% of the students intended for the sample.

Validation, Data analysis and Data collection

Responses from closed questions were put into frequencies and transformed into percentages. Some similar views from open-ended questions were grouped together and put into frequencies and then into percentages. The Chi-square method was applied on some data to study the significance of gender differences among the variables studied.

Data was collection by the researcher and research assistants in the period April – July, 2001. Pre-testing was done in one school and the instruments were validated by two members of staff.

Findings

The findings presented in sections A, B and C are part of the responses for the first and fourth research questions i.e. on students' interests in learning mathematics and classroom interaction of students and mathematics teachers. The analysis of the whole data is not yet completed.

Section A: Students' interest in learning mathematics

Students were asked to rate their interests in mathematics and those who responded that their interests in the subject were low or very low were asked to provide reasons (Tables 1, 2 and 3).

| | Very High | High | Average | Low | Very Low |
|--------|-----------|------|---------|-----|----------|
| Female | 23% | 24% | 27% | 14% | 11% |
| Male | 30% | 22% | 23% | 10% | 16% |

$F = 795$, $M = 646$, $df = 4$, $\chi^2 = 2.91$

Table 1: Students' rating of their interest in learning mathematics

More boys (30%) than girls (22%) rated themselves very highly and some more girls (24%) than boys (22%) rated themselves highly (Table 1). Girls also rated themselves averagely (27%) than boys (23%). Generally, the interest of students in the subject can be said to be average i.e. 52% (for boys in levels of high and very high) and 47% (for girls in levels of high and very high). The Chi-square test had a value of 2.91 which was not significant at 5% significant level, which indicated that small differences of interest that existed between the two sexes were not significant.

The main reasons which were given by both female and male students who had low and very low interest in the subject was that mathematics was difficult (73% girls and 71% boys, Tables 2 and 3). Other reasons given, though with small percentages, indicated that some students of both sexes needed more help in mathematics learning and others did not consider mathematics to be of help in their future careers.

| Reasons | Percentage |
|--------------------------|------------|
| Mathematics is difficult | 73% |

| | |
|--|----|
| Mathematics teacher does not teach properly | 9% |
| Mathematics teacher explains to only a few students he chooses | 9% |
| My future career will not involve mathematics | 9% |

Table 2: Girls' reasons why their interest in mathematics were low

| Reasons | Percentage |
|---|------------|
| Mathematics is difficult | 71% |
| I do not get help from teacher or any other | 15% |
| My future career will not involve mathematics | 14% |

Table 3: Boys' reasons why their interest in mathematics were low

Section B: Students' feelings in a mathematics class

Students were asked to state how they felt in a mathematics class when the teacher was teaching and those who said were not happy and worried during mathematics class sessions were asked to give their reasons. The findings showed that more boys (75%) than girls (58%) were comfortable in mathematics classes, and more girls (34%) than boys (16%) were worried during mathematics classes (Table 4). The chi-square test gave a value of 8.76 which was significant at 5% significant level. This finding implied that significant gender differences existed in class where boys were more comfortable than girls during mathematics lessons.

The reasons of being worried and not happy in mathematics classes showed many of the students were afraid of mathematics teachers (girls 68% and boys 57%, Tables 5 and 6). The other reason given was that they were shy in class (girls 25% and boys 35%).

| | I feel happy | I become worried | I feel I want to go out of class |
|--------|--------------|------------------|----------------------------------|
| Female | 58% | 34% | 8% |
| Male | 75% | 16% | 9% |

$F = 795$, $M = 646$, $df = 2$, $\chi^2 = 8.76$

Table 4: Students' rating of their feelings in class

| Reasons | Percentage |
|---|------------|
| I become afraid of mathematics teacher | 68% |
| I feel shy in class | 25% |
| I hate mathematics teacher | 4% |
| Mathematics teacher uses corporal punishment in class | 1% |
| Mathematics is boring | 1% |
| Mathematics teacher not helpful/cooperative in class | 1% |

Table 5: Girls' reasons why they felt uncomfortable during mathematics classes

| Reasons | Percentage |
|--|------------|
| I become afraid of mathematics teacher | 57% |
| I feel shy in class | 35% |
| I do not understand the teacher | 2% |
| I hate mathematics teacher | 2% |
| Mathematics is boring | 2% |

| | |
|---|----|
| Mathematics teacher uses corporal punishment in class | 2% |
| Mathematics teacher not helpful/cooperative | 2% |

Table 6: Boys' reasons why they felt uncomfortable during mathematics class

Section C: Students' interaction in a mathematics class

Students were asked whether they were comfortable with the way they interacted among themselves in learning mathematics i.e. studying with the opposite sex in class. Many students said they had no problems in studying with classmates of opposite (girls 75%, boys 79%), Table 7. The chi-square test gave a value of 0.44 which was not significant at 5% level indicating that the differences that existed were not significant. However, about a quarter of the students of both sexes (girls 25%, boys 21%) said they had some problems when studying with students of opposite sexes. Though this number is not the majority, it is a substantial number which cannot be ignored.

| | Yes | No |
|--------|-----|-----|
| Female | 75% | 25% |
| Male | 79% | 21% |

$F = 795, M = 646, df = 1, \chi^2 = 0.44$

Table 7: Students' rating of their comfort when studying together

A number of reasons were given by students who said were not comfortable to study with opposite sex (Tables 7 and 8). Many girls (32%) stated that during discussions in class boys tend to propose love affairs instead of academic work. Also 29% said boys harassed or intimidated them in class. Boys (27%) said they could not concentrate when discussing with girls in class. While boys gave some reasons why they did not concentrate, girls did not give reasons. Boys said that during discussions with girls they concentrated on looking at girls' faces and felt like falling in love. The findings also indicated that more girls (18%) than boys (7%) laugh at the opposite sex when one fails to answer the question correctly in class.

| Reasons | Percentage |
|---|------------|
| Boys like to propose love affairs | 32% |
| Boys intimidate/harass girls | 29% |
| Boys become noisy and playful | 17% |
| I feel shy to work with boys | 10% |
| Boys laugh at you when you do not answer the teacher's question correctly | 7% |
| I cannot concentrate when working with boys | 5% |

Table 7: Girls' reasons why they did not prefer to study with boys

| Reasons | Percentage |
|--|------------|
| I cannot concentrate when working with girls | 27% |

| | |
|--|-----|
| Girls laugh at you when you do not answer the teacher's question correctly | 18% |
| I do not feel free to work with girls | 13% |
| Girls can propose love affairs | 10% |
| I feel shy to ask questions in presence of girls | 10% |
| Girls are not serious | 10% |
| I become afraid of girls | 4% |
| I feel shy to work with girls | 4% |
| Girls make noise | 4% |

Table 8: Boys' reasons why they did not prefer to study with girls

Summary

Students' interest in mathematics was generally rated as average and there were no significant gender differences in students' interest in the subject. Both girls and boys had some difficulties in mathematics learning and perceived mathematics as a difficult subject to understand. There could be a number of reasons for this perception and a number of studies have indicated that factors such as students' background, nature of mathematics content, teachers' approaches in teaching the subject and many others could be contributing factors.

The studying environment in class seemed to favor boys than girls where more girls than boys were worried during mathematics class lessons. Furthermore, more girls than boys were afraid of mathematics teachers. Some students' statements from both sexes that they got bored in class and they hated mathematics teachers could be due to the teachers' practices during mathematics classes where conducive atmospheres for learning were not available. Some teachers' use of corporal punishment during mathematics classes could be a contributing factor to such a situation. Many studies have indicated that the teacher was instrumental in creating a conducive classroom setting and stimulating atmosphere for constructive learning (Brophy, 1990 and Cheng, 1993).

The interaction between boys and girls in mathematics lessons seemed to be fine for many students though a number of students (about a quarter of both girls and boys in the sample) were not comfortable. Some girls were uncomfortable that boys tend to propose love affairs, intimidate and harass them during classroom sessions. Also some boys said that they could not concentrate on studies in the presence of girls as their attention was distracted from academics to love affairs. Both girls and boys were shy in class and laughed at each other when one failed to respond to the question correctly.

Some critics of co-education setup have argued that co-education schools were sites where boys practiced and established their dominance over girls, thus making co-educational schools dangerous places for girls (Jones, 1985). The dominance of boys over girls in class has been measured in terms of boys' use of verbal and non-verbal language to command more of class sessions' time and teachers' time in both attention and classroom control, and boys being more mobile in class than girls (Serbin, 1978; Barry, 1981; Jungwirth, 1991 and Lee, 1990). It is argued that the latter tend also to influence some teachers to believe that boys were more competent than girls. The above view puts up a contention that only boys were advantaged than girls in a co-education setup. The findings of this study indicate that both girls and boys could be affected in a classroom environment where both sexes were not comfortable with each other's practices in class.

Conclusion

The findings of this study cannot be taken to be conclusive without further analysis of some other variables that could influence gender differences. Factors such as students' difficulties and confidence in learning mathematics as well as students' career prospects involving mathematics could provide further information on students' interests in mathematics. Also mathematics teachers' views on students' attitudes in learning

mathematics, students' performance in the subject as well as students' interaction in class could provide a comparative analysis for both teachers' and students' views. The above mentioned variables are included in a larger study on gender differences in mathematics learning.

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