ANALYSIS OF STUDENTS' COMMITMENT AND ATTITUDE TOWARDS MATHEMATICS IN SECONDARY SCHOOL OF DEGA WOREDA, OROMIA NATIONAL REGIONAL STATE, ETHIOPIA

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ABSTRACT

The purpose of this research was to analyze the magnitude and intensity of student commitment and attitude towards mathematics in secondary schools of Dega Woreda. A single case study with the involvement of 283 students of grade 10 and 12 of Dega Woreda and all mathematics teachers of the respective grades were considered. Purposive and simple random sampling techniques were employed to select the subjects of the study. Questionnaires and interview as tools for the collection of data were used. The findings reveal that students' scholastic performance is a pass mark and yet, it is not up to the expected level. Though students believe to have favorable attitude and commitment towards mathematics, their performance is very low especially on grade 10 and 12 national examinations. This implies that the behavioral (action) aspect of attitude towards mathematics is relatively the most challenging area in learning mathematics. The results indicate that there is no significant mean difference in attitude towards mathematics between male and female and between secondary and preparatory school students. It is suggested that mathematics teachers should apply appropriate methods of teaching, make an ongoing evaluation, and give continuous feedback to the students with the class size reduced to an optimum number of students (40 to 50). Teachers need to motivate and create conditions in which female students can effectively deal with mathematics classes. In this regard, professional women in science and technology fields may be invited to address how they succeeded in their study to build up the self-esteem of female students in mathematics.

Keywords: *student, students attitude, commitment, mathematics, secondary schools*

INTRODUCTION

Currently, the Ethiopian educational system has paid due attention to school subjects with special emphasis on Science, Technology, Engineering, and Mathematics (STEM) education. Related to these expansion efforts, Ministry of Education in Ethiopia has published professional mix guidelines based on a 70:30 annual intake ratio favoring the placement of students in the field of science and technology (MoE, 2008). This indicates the extent that the country has paid attention to science and technology, and how much consideration the government has given for the advancement of science, technology, and mathematics education. The country has also given due attention for the equality of its citizens, especially of gender equality. It is known that the education and training policy of Ethiopia has emphasized the female by granting the affirmative action in many aspects particularly in the education sector. This happens because national development that contributes to whole global development is a shared responsibility, which requires the collective efforts of all citizens (MoE, 2015; MoE, 2010).

Meanwhile, mathematics is taken to be a core subject in all disciplines in general and in the area of natural sciences in particular. Due to this, several types of research have been conducted in different countries. For instance, Haron (2001) has found that many students identify mathematics as the most difficult subject to learn and yet, they consider it as the most important part of the school program. In their research, Nicholaidou and Philippou (2003) have shown that negative attitudes are the result of frequent and repetitive failures or problems when dealing with mathematical tasks and these negative attitudes may become relatively permanent. According to these authors, when children first go to school to learn, they usually have the positive attitude toward mathematics and enjoy attending it. However, as they progress to higher grades, their attitudes become less positive and frequently developed to become negative at the high school. Research supports that attitudes towards subject matter have a positive relationship with achievement and success in the subject. When it comes to mathematics, this can be defined in terms of either positive or negative emotional disposition towards mathematics (Zan & DiMartino, 2007). Successful experience of students in mathematics tests and tasks can make him/her develop positive attitudes towards learning (Akinsola and Olowojaiye, 2008).

Various researches emphasize that students' attitude toward mathematics play a vital role and has the positive or negative effect on their commitment thereby achievement in mathematics. For example, Barton (2000) has found that teaching methods, academic support of all concerned, and students' attitude towards school affect performance in mathematics. More importantly, Furinghetti and Pekhonen (2002) have argued that the achievement and participation of female students in natural science subjects in general and in mathematics, in particular, are less than that of male students. In this regard, some African authors also suggest that overall attitudes are partially responsible for female students' low or poor performance in Mathematics and Science subjects (Aghenta 2010; Bajah & Bozimo, 2010). However, these authors fail to identify the specific attitudinal components presumed to have an inhibitory or enhancing effect on actual behavior and commitment of students.

Gender differences are a frequent topic throughout the literature in academic studies in general and in mathematics studies in particular. Mathematics is often considered to be a domain in which boys are higher achievers, both in terms of attitudes and self-concept. Contrary to this, the findings of Scafidi and Bui (2010) and Lindberg et al. (2010) have shown that mathematics school achievement and grades do not differ significantly between boys and girls. Asante (2012) have argued that when compared with boys, girls lack confidence, have debilitating causal attribution patterns, perceive mathematics as a male domain, and are anxious about mathematics.

Farooq and Shah (2008) in the research of secondary school students in Pakistan have found no significant difference in confidence and commitment of male and female students towards mathematics. They rather find that students' success in mathematics depends on attitude towards the subject. Furthermore, the school environment, teachers attitudes and beliefs, teaching styles, and parental attitudes are identified as explanation factors that account for student's attitudes towards mathematics. The researches have conducted to determine the relationship between students' attitude towards mathematics and achievement in mathematics has yielded contradictory results (Nicholaidou & Philippou, 2003; Mato & DelaTorre, 2010). The findings have thus lacked consistency on the subject. Some types of research have demonstrated a strong and significant relationship between mathematics, attitude, commitment, and mathematics achievement (Schenkel, 2009). In Schenkel's research of elementary school pupils, a positive correlation between student attitude and student performance is found. Student beliefs and attitudes are found to have the potential to either facilitate or inhibit learning.

Research conducted by Akey (2006) has concluded that several aspects of school context (e.g., teachers' ways of giving support, student-to-student interaction, and the academic and behavior expectations of the teacher) are significantly related to student attitudes towards mathematics. Vaughan (2002) has identified that there is a significant relationship between the learning environment

and attitude towards mathematics. The students with a higher perception of the learning environment have a more positive attitude towards mathematics. Mohamed and Waheed (2011) have reviewed literature's aim at understanding attitudes and the influences on their development in relation to differences between students. And it identifies three groups of factors; factors associated with the students themselves (e.g. mathematical achievement, anxiety, self-efficacy and self-concept, motivation and experiences at school), factors associated with the school, teacher, and teaching (e.g. availability of appropriate teaching materials, teachers' knowledge of the subject matter, classroom management, guidance and belief), and factors associated with the home environment and society (e.g. parental expectations and follow up, educational background of the society and the like).

The conceptions, attitudes, and commitment of the students regarding mathematics and mathematics teaching-learning are considered to be significant factors underlying school experience and achievement (Reed, Drijvers, & Kirschner, 2010). According to Singh, Granville, and Dika (2002) have high achievement in mathematics is a function of many interrelated variables such as students, parents, and schools. Among student variables, attitudes and commitment are regarded by several researchers as a key factor to understand and explain the variability in student performance in mathematics. Georgiou, Stavrinides, and Kalavana (2007) have shown that high academic achievement in mathematics could serve to predict a positive attitude towards mathematics, but such an attitude could not predict stronger achievement. However, these authors emphasize the role of teachers and schools in changing attitudes stating that mathematics achievement could be improved by, better teaching methods, more motivated teachers, and better course books, are the corollary to the improvement of attitudes towards mathematics and better achievement in mathematics.

Educators generally have assented that learning clearly has an affective component and developing a positive attitude that is important for students' achievement. One definition that is commonly used to describe attitudes is to include the three components; cognitive, affective, and behavioral/action (Zan & DiMartino, 2007). These three components are defined by Reid (2006) as knowledge about the object, beliefs, and ideas component (cognitive); feeling about the object or the like or dislike component (affective); and a tendency towards action or the objective component (behavioral). As Kind, Jones, and Barmby (2007) have pointed out this definition is a sensible view of attitudes because these components are closely linked. For example, people know about mathematics (cognitive), and accordingly, they have a feeling or an opinion about it (affective) that may cause us to take a particular action (behavioral).

Other researchers, on the other hand, have suggested that the three components should be treated more independently and that attitudes should be viewed as the basis for evaluative judgments (Crano & Prislin, 2006). They have pointed out that it is important to account that these evaluative judgments are always towards something, often calls the attitude object. According to Reid (2006), when someone has an attitude, he/she judges something along emotional dimensions, such as good or bad, harmful or beneficial, pleasant or unpleasant, important or unimportant. George (2000) has defined attitudes solely in terms of the affective component viewed attitudes as being formed spontaneously and inevitably, involving the attributes of an object (Ma & Xu, 2004).

The researchers have observed that through secondary (grade nine and ten) and preparatory (grade eleven and twelve) school students are expected to solve different mathematical problems that require careful steps that for most of the students these activities are not easy tasks. In this connection, review of local studies conducted in Ethiopia indicates different results. For instance, according to Habtamu (2004), the issues of equity in education between male and female groups have been a serious problem in the system of Ethiopian education. The number of admission, retention, and graduates has not been proportional to the size of the population when compared to male and female students (MoE, 2014).

Moreover, the Ethiopian third national learning assessment of grade 8 students (MoE, 2008) have indicated that students' achievement in grade 8 have related with six blocks of variables such as school structure and curriculum materials, teacher variables, school management, students home background and behavior, woreda education office instructional support as well as languages of instruction. School structure and curriculum materials, school management and instruction, and student understanding are significantly associated with students' achievement. From the regression analysis, school structure and curriculum materials explain 20,5%, teachers' attitude explains 32,5%, and school management contributes 11,1%, student background as independent group explains 36,6% of the variation in learners' achievement. Similarly, the Ethiopian first national learning assessment of grades 10 and 12 students (MoE, 2010) have showed that the mean score for grade 10 students in mathematics (34,7%) is the second from the least, and only 14,7% of grade 10 students score 50% and above (pass mark) in mathematics that is 85,3% of the students fail in mathematics. For grade 10, boys achieve (37,4%) significantly higher mean scores than girls (30,9%). This means that the gender as a variable has its own contribution to the achievement of students in mathematics education.

In this regard, critical observation of researchers discloses the fact that most students are not committed to mathematics classes. Therefore, the research initiates to analyze the attitude of students and the extent of their commitment towards better achievement in mathematics and come up with possible solutions to this existing problem. This research attempts to seek answers to the subsequent research questions. These are (1) what attitudes do secondary, and preparatory school students have towards mathematics? (2) To what extent students are committed towards the improvement of mathematics achievement? (3) To what extent respondents vary in their commitment and attitudes with respect to certain demographic variables? And (4) which component(s) of students' attitude towards mathematics of secondary and preparatory school is the most valuable or challenge in learning mathematics? The result of this research is believed to have notable significance to secondary and preparatory school students, mathematics teachers, and curriculum designers. It is expected to have the high contribution in providing information to policymakers on students' attitude towards mathematics. It would help to know the level of students' commitment and the type of attitude they have towards mathematics subject. Hence, among other things, the results will contribute to improving the mathematical competency of students that lead to successful implementation of science and technology-focused education in Ethiopia.

METHODS

The research is confined to three secondary schools of one Woreda. Thus, single case design is preferred over other methods. In this research, out of a total population of (N=1010), 28% (n=283) students are considered. Among these students 51,6% (n=146) are male and 48,4% (n=137) female. Thus, 146 male and 137 female students are selected using random sampling technique. Also, veteran teachers are included in the interview. Questionnaires as means to gather essential data on commitment and attitude of students' in learning mathematics are used. Also, the interview is used in order to collect primary data from teachers and students to cross-validate the results obtained through the questionnaire. In addition to this, the Ethiopian General Secondary Education Certificate Mathematics Examinations (EGSECME) for grade 10, the Ethiopian University Entrance Mathematics Examination (EUEME) results for grade 12. Also, grade 9 and 11 mathematics results are carefully considered.

The Likert scale is constructed with five response categories of strongly agree, agree, undecided, disagree, and strongly disagree. The scale is assigned scores that range from one (strongly disagree) to five (strongly agree) for each of the statements. The negative statements are reversely coded to see the results of each of the three components of attitudes toward mathematics. After the

scale is assigned to each of the statements, and negatively phrased statements confirm with positive statements, it is computed for each subject by adding the mean scores of the individual responses against the provided statements. The data are analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0 and the qualitative data are narrated in words. Thus, the data are obtained through different instruments of data collection that are analyzed using both qualitative and quantitative methods of data analysis.

RESULTS AND DISCUSSIONS

In this section, the results and discussion of evidence procured are carefully considered. As a result, the background of respondents, students' responses in the three aspects of attitude, gender variation in attitude, school category and teacher interview are treated. Table 1 shows the average mathematics results of the 9th and 11th grade in Arjo Gudetu, Efa, and Diga.

Table 1 Average Mathematics Results of 9th and 11th grade in Arjo Gudetu, Efa, and Diga

Academic year	**2014/15**		
School	Arjo Gudetu	Efa	Diga
Grade 9 average result	54,70	58,12	-
Grade 11 average result	-	-	59,11
Cumulative average	**56,41**		**59,11**

Source: Arjo Gudetu and Efa secondary schools, and Diga preparatory school record offices

Data on students' performance are taken from the document, and their average mathematics results of grade 9 and grades 11 are calculated. From the Table 1, it can be inferred that the average results are 56,41 for grade 9 and 59,11 for grade 11. Overall, the data evidence that the achievement of both secondary and preparatory school students is the pass mark and yet, it is not up to the expected level.

Table 2 Ethiopian General Secondary Education Certificate Mathematics Examination Results of Grade 10 Students (2012/13-2014/15)

School	**Letter Grades**										
	A		**B**		**C**		**D**		**F**		**Total**
ArjoGudetu	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	
2012/13	26	6,2	122	29,3	85	20,4	176	42,2	8	1,9	417
2013/14	16	4,6	61	17,4	84	24,0	174	49,7	15	4,3	350
2014/15	-	0,0	77	18,4	94	22,5	212	50,7	35	8,4	418
2012/13-14/15	**42**	**3,5**	**260**	**21,9**	**263**	**22,2**	**562**	**47,4**	**58**	**5,0**	**1185**
Efa	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	
2012/13	11	2,7	97	23,6	164	39,9	112	27,3	27	6,5	411
2013/14	8	2,4	74	22,2	105	31,4	113	33,8	34	10,2	334
2014/15	2	0,6	29	8,4	137	39,8	117	34,0	59	17,2	344
2012/13-14/15	**21**	**1,9**	**200**	**18,4**	**406**	**37,3**	**342**	**31,4**	**120**	**11,0**	**1089**
Arjo and Efa	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	
2012/13-14/15	**63**	**2,8**	**460**	**20,1**	**669**	**29,7**	**904**	**39,7**	**178**	**7,7**	**2274**

f- frequency,

Source: Arjo Gudetu and Efa General Secondary Schools Record Offices

As it can clearly be traced from Table 2, the Ethiopian General Secondary Education Certificate Mathematics Examination results of three consecutive years of grade 10 students (2012/13-2014/15) are collected and tabulated. Out of 2274 students in these three consecutive years, 178 students (7,7%) fail and 904 students (39,7%) score D. Adding the two, it can get that 1082 (47,4%) of the students' score are below C grade. This generally implies that almost half of the students achieve the lower grade in the Ethiopian General Secondary Education Certificate Mathematics Examination. Moreover, among the remaining half, most of them also score satisfactory grade C, some score B, and few students score A. Overall, it can be understood that secondary school students' results are not up to the standard. The researchers conclude that the low achievement may be resulted from the attitude that students have towards mathematics (Mato & DelaTorre, 2010; Georgiou, Stavrinides, & Kalavana, 2007).

Table 3 Average Ethiopian University Entrance Mathematics Examination Results of Grade 12 Students of Diga Preparatory School (2012/13-2014/15)

Academic year	Total number of students per year			Students yearly score in different range									Average score
				<50%			50-75%			>75%			
	M	F	T	M	F	T	M	F	T	M	F	T	
2012/13	79	57	136	58	54	112	13	3	16	8	0	8	34,53
2013/14	92	73	165	81	70	151	8	3	11	3	0	3	22,78
2014/15	68	74	142	47	68	115	14	5	19	7	1	8	33,70
2012/13-14/15	**239**	**204**	**443**	**186**	**192**	**378**	**35**	**11**	**46**	**18**	**1**	**19**	**30,34**
Percentage				**77,8**	**94,1**	**85,3**	**14,6**	**5,4**	**10,4**	**7,5**	**0,5**	**4,3**	

Source: Diga Preparatory School Record Office

The Ethiopian University entrance mathematics examination results of three consecutive years of grade 12 students (2012/13-2014/15) are categorized into three ranges and tabulated in Table 3. Adding the two passing point ranges, it gets those only 65 students (14,7%) of the total students score 50% and above. The overall result obtained is discouraging as it compares to the total number of students. Among this result, the contribution of female students for the passing score is 12 (2,7%), which is negligible when compared with male students and even with that of their number. This may have resulted from the attitude and commitment of students and the attitude difference they have between male and female students. From this result, it can also be noted that students may not have the favorable attitude towards mathematics and this could be a possible factor that inhibits learners not to achieve better results in mathematics (Nicholaidou and Philippou, 2003).

Table 4 Analysis of Responses of Students in Cognitive, Affective, and Behavioral Aspect of Attitude

Variables	SD		D		U		A		SA		Mean
	f	%	f	%	f	%	f	%	f	%	
Cognitive	37	13,1	21	7,4	30	10,6	48	17	147	51,9	3,87
Affective	45	15,9	36	12,7	50	17,7	51	18	101	35,7	3,45
Behavioral	37	13,1	34	12	56	19,8	56	19,8	100	35,3	3,50

Table 4 indicates that the majority of the students are with the favorable attitude towards mathematics as they agree or strongly agree to the statements given with respect to the three categories of attitudes. It can also easily be understood that from the average values of the cognitive aspect (3,87), affective aspect (3,45), and behavioral aspect (3,50) of attitudes, the intellectual dimension is high. The data obtained through interview also indicate that most of the students believe that the subject matter is necessary and important, but the belief about the importance of the subject matter by

itself is not enough for students unless they implement it into practice. This means that students commitment is low or not up to the expected level.

Table 5 Mean Difference in Attitude towards Mathematics based on Gender

Variable	Group of the respondent	N	Mean	Standard Deviation	F	α
Cognitive	Male	146	3,86	1,16		
	Female	137	3,78	1,30	5,34	0,29
Affective	Male	146	2,68	1,44		
	Female	137	2,88	1,45	0,82	0,57
Behavioral	Male	146	3,13	1,28		
	Female	137	3,16	1,39	2,19	0,34

Table 5 discloses the fact that there is no significant mean difference in the three components of attitude; cognitive, affective, and action (behavioral) aspects of attitude towards mathematics between male and female students. Similarly, there is no significant mean difference in attitude towards mathematics of male and female students. The results indicate that the gender difference has no effect on the sample of secondary and preparatory school students' attitude towards mathematics. This result is contrary to the result obtained by Patterson et al. (2003), which have coined that male students have the more positive attitude than their female counterparts. The findings are contrary to the research of Tapia and Marsh (2000) that have found the male students are the higher positive attitude towards mathematics when compared to female students. Thus, in the context of a research site under discussion, the result entails that being male or female is not a factor to impact students' attitude and mathematics performance.

Table 6 F-test To Determine Mean Difference in Attitude towards Mathematics based on School Category

Variable	Group of the respondent	N	Mean	SD	F	α
Attitude	Secondary school	242	3,14	1,33		
	Preparatory school	41	3,16	1,39	2,08	0,36

Table 6 shows F is not significant. It means that there is no significant difference in attitude with respect to school category. The means that school category has no effect on the sample of secondary and preparatory school students' attitude towards mathematics. In addition to the quantitative data, interview extract is secured from mathematics teachers. Moreover, the outcome of the responses is analyzed in the following manner:

In response to the item, "Do secondary (preparatory) school students have a sufficient knowledge about mathematics?" One mathematics teacher forwarded in the following way:

> "Most of the students know how much the subject matter is necessary and important, by giving a simple example that the subject is compulsory and it is given at all levels of education from elementary school through higher learning institution. However, having knowledge about the subject matter by itself is not enough for students unless they are committed to do."

Similarly, in response to the item "How do you see the attitude of secondary (preparatory) school students toward mathematics?" Another mathematics teacher narrated as:

> "Overall, secondary school students' inclinations cannot be regarded as unfavorable attitude towards the subject. The problem is that most students come with poor

background knowledge of mathematics and they need and expect much support from their teacher including on the elementary concepts, e.g. operating fraction."

In this regard, Caglar (2003) has mentioned that it is impossible to gain necessary problem solving and application skills of higher level concepts and skills unless one gains lower level concepts and skills. Thus, poor background knowledge of mathematics is one of the core factors which affect the attitude towards mathematics of secondary and preparatory school students. Finally, teachers are asked about the solutions for effective implementation of activities to change the attitude of secondary and preparatory school students towards mathematics. In reality, before students learn mathematics, it is evident to know why they learn mathematics and this has to be the major area of concern that requires effort by all concerned. Unless this can be done and a positive change of attitude towards mathematics comes in early classes, improved achievement in mathematics at secondary or preparatory school is simply a dream. Students learn more effectively when they are interested in what they learn, and they will achieve better if they have favorable attitude and commitment towards mathematics.

Overall, the findings of the research indicate that most of the results obtained from the three aspects of attitude towards mathematics gives the mean value greater than 3 with the corresponding percentage for positive statements and mean value less than 3 for negatively phrased questionnaires. This implies that secondary and preparatory school students have the favorable attitude towards mathematics.

CONCLUSIONS

The main purpose of this research is to examine the magnitude of the students' attitudes and the extent of students' devotion towards mathematics in secondary and preparatory schools in DegaWoreda. Single case design is employed. The questionnaire, interview, and document analysis are used as a means to obtain necessary data from students and mathematics teachers of the selected schools and respective grades. The results obtained from most of the sample secondary and preparatory school students have shown mean value greater than 3. From this, it can be concluded that the sample of secondary and preparatory school students have favorable attitudes toward mathematics, though the computational performance of these students is below the expected level.

The assessment in the attitude of sample male and female secondary and preparatory school students show that there is no significant mean difference in attitude towards mathematics of male and female students. The result depicts that gender difference has no effect on the sample of secondary and preparatory school students' attitude towards mathematics. Based on this result, it is possible to conclude that both male and female students have the positive attitude toward the subject in secondary and preparatory schools. Similarly, the assessment of the attitude of students based on school category shows that there is no significant mean difference in attitude towards mathematics. The result indicates that the school level difference has no effect on sample secondary and preparatory school students' attitude towards mathematics. The results obtained from respondents of the questionnaire express that secondary and preparatory school students have the favorable attitude towards mathematics. Though students believe that they have the favorable attitude towards the subject, their performance in computations is very low as the data from the document and interview revealed. Since computational performance is categorized under the behavioral aspect of attitude, it is concluded that among the three components of attitudes, the action (behavioral) aspect of attitude towards mathematics is relatively the most challenging area in learning mathematics.

Overall, from the result obtained and conclusions drew, the investigators would like to forward the following recommendations: (1) mathematics teachers should apply appropriate methods of teaching in order to improve the attitude and achievement of students in mathematics. Among these, question and answer, individual project, peer and group discussion, presentation, cooperative learning, individual learning and guided discovery methods can be prioritized. (2) It is also recommended that mathematics teachers should make an ongoing evaluation and continuous feedback to minimize inappropriate behaviors developed by the students so that appropriate measure will be taken on time. Meanwhile, the class size should be reduced to an optimum number of students (40 to 50). (3) It is lot has to be done to fill the mathematics achievement gap between male and female students. Female students should be informed of the importance of mathematics as it is the basic tool for further education. Teachers need to motivate and create conditions in which female students can effectively deal with mathematics classes. In this way, the female student can develop confidence in mathematics. Once they acquire the interest to participate in mathematics activities, they can easily involve in practicing different mathematics related studies. (4) Mathematics teachers in collaboration with school-based supervisors should invite professional women in science and technology fields to address their life and how they succeeded in their study in order to boost the self-esteem of females in mathematics.

Last but not least, this research is a case study that focused on secondary and preparatory schools of Dega Woreda. Thus, although the findings are assumed to be helpful to make inferences about students' attitudes and commitment towards mathematics, care has to be taken about the findings to use it in all cases and circumstance. As a result, similar research should be done in wider scale in terms of space and depth to benefit more from the results of the study.

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