



Students' Attitude Toward Mathematics, their Academic Performance, and Factors Influencing Mathematics Learning : in Selected Secondary Schools , Southern Tigray

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Abstract

The purpose of this study was to examine students' attitude toward Mathematics, their academic performance, and the factors influencing mathematics learning in selected secondary schools (Maichew, Korem, and Alamata), Southern Zone, Tigray region, Ethiopia. The study had done on 365 sampled students (male=179, and female=186) from these schools. The Sample size of the students was determined using proportional rule, whereas the schools were selected by employing stratified random sampling technique. The mainly used research instrument for data collection was primary data (questionnaires) and secondary data (academic achievement test for both grades 9 and 10 students collected from teachers' roster). We analyzed the collected data with the help of a statistical package for social sciences (SPSS) version 20. The findings reveal that the students have positive attitudes towards mathematics, and the students' attitudes towards mathematics also shown that insignificant impact in their academic achievement. In addition no significant difference was observed between male and female students on their attitude towards mathematics. However, there was a statistical difference in mathematics achievement between male and female students, in both grades 9 and 10. Moreover, our results revealed that students' motivation and readiness were the most influencing factor in learning mathematics.

Keywords: Mathematics, Academic achievement, Students' attitude

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1. Introduction

Mathematics is an essential instrument that can be used to solve the society's everyday problems. It helps us to think logically, to define and clearly state the problems, to prepare and design how to solve the problems, and then to apply the necessary methods/techniques for identifying, evaluating and solving the problems facing our society. As a result, mathematics has become one of the most important and critical subjects in the school curriculum, since then, it has been considered a compulsory course in the Ethiopian secondary school curriculum and in the world as well. In schools, colleges, and universities around the world, more mathematical lessons are likely to be taught than any other subject (Orton & Frobisher, 2004). The low achievement of students in mathematics is not just a concern for a particular nation, but concerns the world in general.

Nowadays, our current world, which increasingly focuses on science, engineering and technology, is increasingly demanding the mathematical know-how and talents of more people. In addition, the sector of the next day could require even more demands on properly educated people with a strong historical past in mathematics within today's technological society as technology is dynamic; and at least some mathematical concepts need to be developed. Mathematical expertise and capabilities play a key role in modern society. In particular, knowledge of mathematics is

essential and critical to secondary school students. Mainly, we should apprehend the student's attitude towards mathematics at all grade levels in order to meet the demands, as the student's performance relies on his or her approach to the subject. At the secondary level, students' attitudes towards mathematics play a vital role in learning mathematical concepts with a high level of interest (Kannam et al., 2015). Students' success in mathematics and science education at secondary school is vital for all students to learn their career paths throughout their lifetime.

Despite the fact that mathematics is essential for students' lifelong careers at all school levels, most students, especially female students, are hardly deal in mathematics (Boki & Kebede, 2012; Ernest, 2004; Meelissen & Luyten, 2008; Hyde et Al., 1990; Odell & Schumacher, 1998). They do not have the required level of knowledge, skill and competence in mathematics and science education. Although the enormous efforts and initiatives that have been made with the help of the government of Ethiopia to enhance the breadth of education at all levels of educational institutions, there are a number of challenges that have an impact on students' achievements in mathematics in secondary education.

Learning mathematics is a common problem phenomenon among students around the world; Ethiopia encounters the problem, too. Maichew, Korem, and Alamata are towns located in the Southern Tigray, Ethiopia, which encountered a

series of learning mathematics problems as, observed during the Raya University research thematic area selection committees' survey. During this survey, the schools' senior mathematics teachers demonstrated that students have a series problem in learning mathematics, and in turn poorly performed on it. Moreover, no scientific research has been carried out on students' attitudes, academic achievement, and factors affecting learning mathematics in secondary schools of the Southern Zone, Tigray region, Ethiopia. This critical and urgent issue motivated the authors to conduct scientific research in order to identify the root causes of the problem, and provide an important recommendation to the concerned bodies. The aim of this study is, therefore, to investigate the attitudes of students towards mathematics, students' academic achievement in mathematics, and factors affecting learning mathematics.

Research Questions: this research would like to get answers to the following questions:

- (1) What are the attitudes of students towards mathematics?
- (2) Is there any significant difference between the attitudes of male and female students towards mathematics?
- (3) What are the important factors that affect the students' attitude towards mathematics?
- (4) How the students' attitudes affect their academic achievement?

Research Hypothesis: The following two null hypotheses are formulated to guide the study:

H₀₁: students' attitude towards mathematics has no significant effect on academic achievement

H₀₂: there is no significant difference between the attitudes of male and female students towards Mathematics.

2. Review of Related Works

2.1. Students' Attitude Towards Mathematics

Several researches had been carried out in many countries to find out the factors that influence students' achievements and performance in mathematics, their attitude towards mathematics and factors affecting learning mathematics (Bramlett & Herron, 2009; Mohd et al., 2011; Ma & Kishor, 1997; Nicolaidou & Philippou, 2003; Papanastasiou, 2000). The attitude of students towards mathematics is becoming an important factor that has been consistently studied among these factors.

Attitudes towards mathematics are an important part of the achievements and participation of students in mathematics education. Under achievements and the dislike of mathematics at secondary school level, however, the problem of the attitude of the students has increased recognition, for example (Amunga & Musasia, 2011; Bayaga & Wadesango, 2014; Lee & Anderson, 2015). A mathematical concept is used as a basis on which almost all natural sciences and some fields of social science are built. The subject of mathematics is also more closely related to one's day-to-day activities compared to other

subjects; except for one's mother tongue, there is no other subject more closely related to daily life than mathematics. Due to this, mathematics becomes a relevant and important course at school, college, and university levels. A recommendation suggested by Amunga & Musasia (2011) indicated that it's importance for students to be competent in the field of mathematics because it plays an important role in career choices and professional development and also limits the opportunities for competitive professional courses at all tertiary levels in the field of mathematics.

Leisure(enjoyment) in mathematics, motivation in mathematics, self-assurance(confidence in mathematics learning and mathematics values are some of the different dimensions of student attitudes towards mathematics inventory. Mathematical scale values are used as one part of the attitude towards mathematical scales to measure student attitudes (Atnafu, 2010). This scale has made a significant contribution to the achievement of students in mathematics (Palacios et al., 2014). Student attitudes, either positive or negative, could have a significant effect on their cognitive activities. Students believe that mathematics is a relevant subject if they have a good attitude towards it; and as a result, they are striving to improve their mathematics learning and to become better attainers. On the other hand, if students have a negative attitude towards studying mathematics, they seem to have trouble paying attention to learning mathematics and

enhancing their success in mathematics. That is, they become poor achievers.

Mathematics enjoyment is an extremely strong orientation that affects the extent and consistency of involvement in the understanding of the world, the choice of strategies and the strength of understanding. Mathematics enjoyment has an important contribution to make students' performance as referred by Palacios et al.(2014). In most cases, boys like more than girls. Motivation in mathematics is a crucial element of student calculation of the scale of thought closer to the mathematics inventory. Since the program is recognized as one of the life and career skills that are vital to bringing together post-secondary students and a community of staff. In addition, encouragement may benefit school students as a source of power that is accountable for why they decide to participate, how long they are willing to continue their activity, how diligent they will be to follow their task, and how connected they feel to action.

As to Monteiro (2013) pointed out, attitudes are affective reactions that follow activity that starts with a motivational state. Attitudes can also be directly related to motivation and provide crucial information for a deeper understanding of attitudes and motivational processes. In the field of mathematics, study has had some special connection, (as researched by Singh et al., 2002), used a collection of motivational objects, in which one correlated with attendance at school and class; alternative

involvement and preparation for mathematics instructions. Whereas another research (Hemmings & Kay, 2010) has taken into account that motivation influences effort, effort influences the end result, and a positive end result results in potential growth. Continued efforts are undeniably and strongly linked to mathematical attitudes as shown in Hemmings & Kay (2010). Furthermore, many studies of self-confidence among learners were undertaken primarily through the use of psychologists and educational researchers. Recently, studies have looked at school students' self-confidence in their skill in mathematics in a variety of countries around the world. Student confidence in understanding mathematics has consistently emerged as an important part of gender-related variations. Studies comparing gender variations in self-confidence / belief mathematics have generally shown that girls have lower self-confidence / belief in mathematics than boys (Singh et al., 2002; Scafidi & Bui, 2010). Despite such variations, Singh et al. (2002) has shown that women's self-confidence/belief in mathematics has made significant progress in education where women have been actively learning about mathematics.

2.2. Gender and Attitude Towards Mathematics

Mathematics is regarded, in most situations, as a male domain than female (Mata et al., 2012). Several research results show that boys do better in mathematics than girls do. This belief could have an impact on the attitude of girls towards mathematics. As to Mohamed and

Waheed, (2011), secondary school students in Pakistan found that there was no significant difference in the confidence of both male and female students in secondary school mathematics. It found rather that the success of the students in mathematics depended on attitudes toward the subject.

In addition, a finding in Hilton & Berglund (1974) indicated that more males than females were interested in mathematics and viewed it as useful, whereas more females than males described boring mathematics. However, such a significant difference was evident between Grade 9 and Grade 11 students, but not between Grade 7 students. However, Sherman (1980) did not detect gender differences although these differences were observed when the same students reached eleventh grade. On the other hand, several studies (Mohd et al., 2011; K"o"ğce et al., 2009; Nicolaidou & Philippou, 2003) have shown that there is no significant difference between male and female students' attitudes towards mathematics. It can therefore be suggested that the attitude of students towards mathematics is very subjective and varies between students.

2.3. Attitude Towards Mathematics and Academic Achievements

A number of studies have been conducted to investigate the relationship between the attitude towards mathematics and the academic achievement of the students. However, scholars who had conducted studies to determine the relationship between students' attitude to

mathematics and their achievement in mathematics have shown inconsistent results. In a comparative analysis of factors influencing academic achievement in mathematics, (as mentioned by K"o"ğce et al., 2009, found that a positive correlation exists between the attitudes of students towards mathematics and the academic achievement of students). The correlation has shown that the more positive the attitude of students towards mathematics, the higher their level of achievement in mathematics. Most of the studies have shown that there is a strong and significant relationship between the attitude of students towards mathematics and their academic achievement (Mohd et al., 2011) and the achievement of problem solving (Nicolaidou & Philippou, 2003). Studies have also shown that students' attitude towards problem-solving patience, trust, and willingness has a positive relationship to student success in mathematics (Mohd et al., 2011).

However, some research studies have shown that the correlation between the attitude towards mathematics and the achievement of mathematics was rather poor and could not be considered of practical significance (Wolf & Blixt, 1981). Ma and Kishor (1997) found a negative association between the attitude of the students towards mathematics variables and their academic achievement in mathematics, which was statistically negligible.

2.4. Factors Affecting Students' Attitude Towards Mathematics

Investigating the important factors that have a great impact on students' attitudes towards mathematics has become a potential area that has attracted a number of researchers. Many scholars have noted that no one born with attitude, but it gradually evolves and improves over time. Some research on the attitude of the students towards mathematics indicates that several factors contribute greatly to affect the attitude of the students. These factors can be classified into three different groups: (i) student mathematical achievement score (K"o"ğce et al., 2009), mathematical anxiety, student self-efficacy and self-concept (Tahar et al., 2010) and experience at high school (Bobis & Cusworth, 1994) is related to students themselves; (ii) Factors related to teaching materials used by teachers, classroom management, teacher content knowledge and personality, teaching subjects with real-life examples, other student opinions on mathematics courses (Yılmaz et al., 2010), and the attitude of teachers towards mathematics (Karp, 1991); (iii) variables relating to the home atmosphere and society such as parents, history in education, profession of parents (K"o"ğce et al., 2009), and parental aspirations (Tobias, 1993) play a crucial role in shaping the attitudes of students towards mathematics. However, some other studies indicate that students (Tezer & Karasel, 2010; Yılmaz et al., 2010) have a reasonably optimistic attitude towards mathematics.

3. Methodology

3.1 Sample And Sample Size Determination

To evaluate the sample size for this analysis, the optimal level of confidence was assumed to be 95%. Since it is impossible to study the total (target) population, the investigators considered a sample of the target population, and determined the sample size using proportional rules. A sample of each grade level and class was selected according to the proportional allocation rule. The total sample size was calculated using the sample determination formula (Zewude & Ashine, 2016):

$$n = \frac{N}{1+N(e)^2}$$

where n is the sample size, N is the total population size (both grades 9 and 10) and e is the level of precision. Moreover, the sample size for each grade level was determined by:

sample size for grade 9: $\frac{n_9}{n} = \frac{N_9}{N}$, sample size for grade 10: $\frac{n_{10}}{n} = \frac{N_{10}}{N}$,

where n_9 and n_{10} are sample sizes of grade nine and ten, respectively, whereas N_9 and N_{10} refer to the total number of grade 9 and 10 students, respectively. Probability sampling (stratified random sampling) technique was used in the selection of sample respondents in each grade to achieve the objectives of the school study. For simplicity, one school in each city was chosen randomly. Researchers have intentionally chosen Maichew, Korem, and Alamata Towns as an area of interest because they have enrolled a large number of students; and researchers' experience and observation of

problems in schools during the research thematic area survey. Grades nine and ten students also have deliberately selected because students are in a position to determine their future career and location of their study area at this time.

3.2 Instruments

In this research, both Questionnaires (primary) and Student Performance Tests from Teachers' roster (secondary) sources of information used to collect data. The study questionnaires have been adapted from the Attitude towards Mathematics Inventory (ATMI), the most common system developed by Tapia et al. (2004). The questionnaires included the values of mathematics, the enjoyment of mathematics, and personal trust in mathematics. The questionnaires administered to students during data collection consisted of 12 statements based on a 5-point Likert scale, such as "strongly agree", "Neutral", "Disagree", and "Strongly disagree". Moreover, prior to the administration of the questionnaires, the researchers clearly explained the purpose of the study to head teachers, teachers and students.

3.3 Data Analysis

Student responses and student math test scores were analyzed with the help of the Social Sciences Statistical Package (SPSS) version 20. The questionnaires are designed to identify students' attitude towards mathematics (confidence, enjoyment and benefits / values of mathematics). **Table 1** shows the criteria used to categorize these variables as low, medium, and

high, based on the range of scores given by Jamil (2001) as cited by (Mohd et al., 2011). To test the correlation between the students' attitude towards mathematics and their academic achievement, we computed the correlation coefficient using Pearson Product Moment Correlation Coefficient. And a T-test was conducted to find the significant difference between gender and students' attitude towards mathematics.

Table 1*Level of Variables*

Mean Score	Level
1.00 - 2.33	Low
2.34-3.66	Medium
3.65-5.00	High

4. Results and Discussions

This section is divided into six subsections: demographic characteristics, student attitudes towards mathematics, gender-based mathematics, factors affecting students' learning mathematics, students' achievement, and the correlation between student attitudes towards mathematics and academic achievement.

4.1. Demographic Characteristics

Respondents to this research were high school students. The demographic background of respondents by gender is shown in **Table 2**. The total numbers of respondents to this study were 365; of which 179 were males and 186 were females.

Table 2

Demographic Characteristics of Students According to Gender

	Number of Respondents Considered in Each School					
	T/Yigzaw		Korem		T/Ethiopia	
	G9	G10	G9	G10	G9	G10
Female	36	29	35	37	27	22
Male	37	25	37	35	26	19
Total	73	54	72	72	53	41

Note. T/Yigzaw= TilahunYigzaw, T/Ethiopia= Tadagiwa Ethiopia, G9= Grade 9, G10= Grade 10

4.2. Attitude of Students' Towards Mathematics

The questionnaires were analyzed to investigate the students' attitude towards mathematics.

Table 3*Mean and Standard Deviation of the Variables*

Variables	MS	SD	Level
Values of mathematics	4.52	0.84	High
Enjoyment of mathematics	3.91	1.07	High
Personal confidence	2.68	1.2	Medium
Overall attitude	3.70	1.05	High

Note. MS=Mean Score, SD= Standard Deviation

The response of students found different as depicted in **Table 3**. The students' response to the mathematics values show that the score was slightly higher (MS=4.52, SD=0.84) compared to the students' response to the enjoyment of mathematics (MS=3.91, SD=1.07). However, the students' response to mathematics values is much higher (MS=4.52, SD=0.84) than the students' response to personal confidence (MS=2.68, SD=1.24). In general, the overall attitude of students towards learning mathematics shows a high-level scale (MS=3.70, SD=1.05). As a result, it can easily be seen from this result that students have a positive attitude towards mathematics. This result had

supported by researches done by (Engida & Zeytu, 2017; Köğçe et al, 2009, Mohamed & Hussain, 2011).

4.3. Attitude Towards Mathematics Based on Gender

Table 4

Two-Tailed t-Test to See Gender Difference on Students' Attitude Towards Mathematics

	Mean(M)		SD		P-value	
	M	F	M	F	M	F
Values/benefits	4.49	4.15	0.91	0.78	-0.6	0.53
Enjoyment	3.76	4.05	1.16	0.96	0.04	0.6
Confidence	2.69	2.68	1.25	12.31	-2.59	0.02
Overall attitude	3.65	3.63	1.10	4.68	-1.06	0.38

Note. SD=Standard Deviation, M= Male, F= Female, Confidence= Personal Confidence

From **Table 4**, the mean attitudes of males and females in the study across the three subscales (values, confidence, and enjoyment) show that males and females have a positive attitude towards mathematics. In addition, the results showed that male students had a more favorable attitude towards the benefits of learning mathematics (M=4.49, SD=0.91) compared to female students (M=4.15, SD=0.78), which is similar to the result in (Engida & Zeytu, 2017). In contrast, female students (M=4.05, SD=0.96) have more favorable attitude towards learning mathematics enjoyment than male students (M=3.76, SD=1.16).

However, the attitude of both male (M=2.69, SD=1.25) and female (M=2.68, SD=12.31) students towards self-confidence in learning mathematics was described as medium. This result showed that students were frustrated with learning and doing mathematics. Overall mean attitudes towards mathematics for males

(M=3.65, SD=1.10) were not significantly higher than for females (M=3.63, SD=4.68). Furthermore, the (t-value (-1.06) for total attitude mean scores did not indicate a significant difference between males and females at $p < 0.05$. This reveals that both males and females in the study area, generally, had slightly similar attitudes towards mathematics. Thus, the null hypothesis two “(H_02): there is no significant difference between the attitudes of male and female students towards mathematics” was, therefore, accepted. This result had aligned with studies carried out by (Köğçe et al, 2009; Mohamed & Hussain, 2011; Mohd et al, 2011; Nicolaidou & Philippou, 2003).

4.4. Factors Affecting Students Attitude

As indicated in **Table 5**, the study investigated the impact of various factors on students' attitudes toward learning mathematics over the research areas of interest (Maichew, Korem, and Alamata secondary schools). Following the scale in Table 1, the results revealed that the factors considered in this study scored the medium level, highlighting that the factors moderately influence students' learning mathematics. Every item also indicated a statistically significant differences at the 5% level ($df=349, p<0.05$).

The method of teaching had a grand mean of 2.9, showing a medium level impact. It suggests that taught mathematics moderately contributes a positive influence for students' attitudes toward learning mathematics. Classical approach of teaching mathematics or teacher

centered instructional approach could hinder the students' interest and confidence in learning mathematics, and in turn, may affect their academic achievement. As depicted in Table 5, students' motivation and readiness scored the greatest grand mean of 3.46, though within the medium level, but slightly the upper boundary of the range. This shows that motivation and readiness put the greatest positive influence on students' attitudes toward mathematics, among the factors considered in this research.

In general, the results exhibited that school environment, family background, size of classroom, motivation and readiness collectively provide a medium influence on students' attitudes toward learning mathematics. Even though, none of the factors exert a high level of effect, their cumulative average influence indicates that improvement any of these factors could significantly enhance students' attitudes and academic achievement. Hence, reducing class size, enhancing students' motivation and readiness, strengthening school and family support are important to bring positive attitudes, and enhancing mathematics academic achievement.

Table 5

Mean Comparison on the Students' Response About Factors Affecting Learning Mathematics

Criteria	T/Yigzaw		Koreem		T/Ethiopia		Total	df	p-Value
	M	SD	M	SD	M	SD			
Teaching Method	2.61	1.943	3.66	1.425	3.10	1.526	2.92	349	0.000
Economy status	2.88	1.948	2.74	1.424	2.69	1.320	2.67	349	0.000
School environment	2.64	1.948	2.87	1.327	2.44	1.232	2.68	349	0.000
Educational background	2.64	1.958	3.61	1.371	2.86	1.403	2.91	349	0.000
Classroom size	3.38	2.338	3.32	1.418	3.25	1.358	3.25	349	0.000
Students class activity	2.81	1.294	2.93	1.487	2.92	1.309	2.89	349	0.000
Nature of subject	3.04	1.275	2.99	1.387	3.04	1.294	3.02	349	0.000
Motivation	3.28	1.486	3.33	1.472	3.86	1.223	3.46	349	0.000

4.5. Students' Academic Achievement

In order to investigate the current students' academic achievement in mathematics across all study areas, the first semester students' mathematics result out of 100% was collected from each school. The investigators used analysis of the data collected to assess the mathematics performance of students, and gender differences in mathematics achievement. According to the Southern Zone of Tigray region education bureau, **Table 6** shows the criteria used to categorize the range of scores at high school levels as low, medium, and high.

Table 6

Range of Score Based on Ethiopian Ministry of Education

Score Range (100%)	Level
0 -50	Low
50 -74	Medium
75 -100	High

Table 7

Mean of achievement test score (collected from teachers' roster) for secondary schools

	Mean Score (100%) of the Secondary Schools					
	T/Yigzaw		Koreem		T/Ethiopia	
	G9	G10	G9	G10	G9	G10
Female	57	56	58	56	63	48
Male	62	56	59	60	62	53

Note. T/Yigzaw= TilahunYigzaw, T/Ethiopia= Tadagiwa Ethiopia

As shown in **Table 7**, mathematics achievement of secondary school grade 9 male and female students grand mean score were 61, and 59, respectively, which exhibited a medium level. The results indicated that there was a slight gap in the academic achievement of

mathematics between male and female grades 9. Moreover, there was a statistical difference between the academic achievement of grade 10 for male and female students. Grade 10 female students achieved a grand average of 53, and grade 10 male students achieved a grand average of 56. This result, however, shows that students, both male and female, have a slightly poor performance in mathematics.

As a result, we observed differences in students' achievement between male and female. Overall, the students' academic achievement in mathematics had revealed a medium level, which is slightly poor achievement. This could have occurred due to the different associated factors as identified in the previous studies (Bobis & Cusworth; K'oo'gce et al., 2009; 1994; Karp, 1991; Klein*, 2004; Tahar et al., 2010; Tobias, 1993; Yilmaz et al., 2010) besides the factors mentioned in this study.

4.6. Correlation Between Students' Attitude

Towards Mathematics and Their Academic Achievement

Correlation analysis was conducted to examine the association of student attitudes towards mathematics & academic achievement. The most commonly used correlation coefficient in an educational study is the Pearson product correlation coefficient, which ranges between -1 and 1 (Cohen, et al., 2013). The sign of the correlation coefficient shows the directions and the absolute value of the correlation coefficient shows the strength of the relationship.

Table 8

Correlation between students' attitude and their academic achievement

Variable Achievements	Students Attitude	Students
Student Attitude	-	0.013
Student Achievement	0.013	-

As depicted in **Table 8**, the result shows that there was a weak positive correlation, which is 0.013, and is statistically insignificant, between the attitude of the students and their academic achievement. This result seems against the theoretical aspect, individual's personal perspective and, most research outcomes. Some research findings, however, argue that positive attitudes could not guarantee in prediction of students' good performance (Wolf & Blixt, 1981), and could not always be considered in practical situations. Our research finding was, therefore, in agreement with the finding of (Wolf & Blixt, 1981, Ma & Kishor 1997). Therefore, it would be of interest to the null hypothesis one that "(H₀1): Students' attitude towards mathematics has no significant effect on academic achievement" was accepted.

5. Conclusions and Recommendations

In this research work, it was investigated the students' attitude towards mathematics, academic achievement and factors affecting learning mathematics in Southern Zone, Tigray region, Ethiopia. Our result has shown that the attitude of the students towards mathematics is very positive. We also investigated the fact that the attitude of students towards mathematics

has no significant effect on their academic achievement. This shows that there are no significant differences between the attitudes of male and female students towards mathematics. As a result, it has shown that the factors affecting students' attitudes towards mathematics are at a medium level; it indicates that there are potential rooms for improvement in this regard. Investigators are strongly advised to pay maximum attention to improving student performance in mathematics and to conduct further studies to identify factors that influence students' attitudes towards mathematics as this result has shown a medium level. Following our results, we would like to suggest that all stakeholders (such as students themselves, families, school teachers, the concerned educational officials, and all communities in general) should make intensive and integrated efforts to bring the students' desired level of mathematics achievement.

Data availability

The data used to support the findings of this study are available from the corresponding author upon request.

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Competing Interests

The authors declare that there are no competing interests regarding publication of this article.

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