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RESEARCH ARTICLE

Examining the performance of secondary school students' towards mathematics in illuabor and bunno bedelle zone, oromia, Ethiopia, 2018

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ABSTRACT

Introduction: Academic performance is an individual's inherent potentials in terms of intelligence combined with other sociological factors. In this era of globalization and technological revolution, education is considered as a first step for every human activity. It plays a vital role in the development of human capital and is linked with an individual's well-being and opportunities for better living. It ensures the acquisition of knowledge and skills that enable individuals to increase their productivity and improve their quality of life. **Objectives:** The aim of this study is to predict the performance of high school students towards mathematics in Illubabor and BunoBedelle zone. **Methods:** The study was conducted in Illubabor and Buno Bedelle zone secondary schools. For this study data were collected by using questionnaires. So, the researchers were used primary data collection method. In this study, the researcher applied simple random sampling and stratified sampling technique which is used to select samples from the target population and the sample size used in the study was 375 observations. The researcher is primarily used based on quantitative research, which constructed multiple regression models to identify and measure the predictors of performance of students towards mathematics in the study area. **Results:** A total of 375 health workers were included and the frequency and percentage of age Below 15,Between 15 to16, between 16 to18,and 18 to 20 are 34(9.1%) 188(50.1%),122(32.5%) and31(8.3%) respectively. Among those, most of the age of students is between 15 to 16. From descriptive analysis the average score results for students during the study period is about 60.9 and the standard deviation is 10.9. Therefore, this implies that there is no absence of moderate variations among the values of average score across the performance of students towards mathematics included for this study. As illustrated in the correlation analysis of performance of students indicate that, there is statistically and significantly positive correlation between age, marital status, grade level, economic status and classroom instruction with average score of student's results. This means that as these variables increase average score results of students also will increase and vice versa. **Concussion:** Grade level, economic status, father education background, mathematics remedial test, and distance from school have statistically significant effects on the average score results of students.

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INTRODUCTION

In this era of globalization and technological revolution, education is considered as a first step for every human activity. It plays a vital role in the development of human capital and is linked with an individual's well-being and opportunities for better living (Battle & Lewis, 2002). It ensures the acquisition of knowledge and skills that enable individuals to increase their productivity and improve their quality of life. This increase in productivity also leads towards new sources of earning which enhances the economic growth of a country (Saxton, 2000).

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The quality of students' performance remains at top priority for educators. It is meant for making a difference locally, regionally, nationally and globally. Educators, trainers, and researchers have long been interested in exploring variables contributing effectively for quality of performance of learners. These variables are inside and outside school that affect students' quality of academic achievement. These factors may be termed as student factors, family factors, school factors and peer factors (Crosnoe, Johnson & Elder, 2004). The formal investigation about the role of these demographic factors rooted back in 17th century (Mann, 1985). Generally these factors include age, gender, geographical belongingness, ethnicity, marital status, socioeconomic status (SES), parents' education level, parental profession, language, income and religious affiliations.

These are usually discussed under the umbrella of demography (Ballatine, 1993). In a broader context demography is referred to as a way to explore the nature and effects of demographic variables in the biological and social context. Unfortunately, defining and measuring the quality of education is not a simple issue and the complexity of this process increases due to the changing values of quality attributes associated with the different stakeholders' view point (Blevins, 2009; Parri, 2006). Besides other factors, socioeconomic status is one of the most researched and debated factor among educational professionals that contribute towards the academic performance of students. The most prevalent argument is that the socioeconomic status of learners affects the quality of their academic performance. Most of the experts argue that the low socioeconomic status has negative effect on the academic performance of students because the basic needs of students remain unfulfilled and hence they do not perform better academically (Adams, 1996). The low socioeconomic status causes environmental deficiencies which results in low self esteem of students (US Department of Education, 2003). More specifically, this study aims to identify and analyze factors that affect the quality of students' academic performance.

Academic performance is an individual's inherent potentials in terms of intelligence combined with other sociological factors. In secondary school, some researchers for instance, have found that it is common knowledge that the majority of the students in secondary schools dislike mathematics. When comparing the two sexes, internationally females have been noted to have more negative attitudes (Ojerinde, 2009).Taking this in to account, Ethiopia had formulated education and training policy about two decades ago in which all citizens participate equally with a considerable affirmative action given for the formerly marginalized groups, especially women. Supporting this idea the ministry of education of the country mentioned that, though this much effort is made to foster science and technology for the wellbeing of the country as well as the individuals, educational sector is being challenged by limited achievement of female students' in mathematics and sciences at different educational levels (MOE, 2001). Mathematics is believed to be a core subject in all disciplines and in the area of natural sciences in particular and it is clear that mathematical knowledge matters the knowledge of other fields of studies such as Science, Technology, Engineering and Mathematics (STEM). Promoting this idea, Kolawole (2004) stated that mathematics is the bedrock of all sciences. In spite of this fact and the effort made to equip the citizens with the necessary knowledge of science and technology to keep the pace of the country with that of globalized world by producing efficient manpower from both sexes, the achievement and participation of female students in natural science subjects in general and in mathematics in particular is less than that of male students. In this regard the American Association of University Women (AAUW) reported that girls and women are still not equally represented in some areas of education (AAUW, 2000).

Statement of the problem: Currently, Ethiopian Ministry of Education paid due attention for science and technology. Related to these education expansion efforts, a professional mix guideline based on a 70:30 annual intake ratio favoring placement of students into science and technology programs over programs in the social sciences and humanities has been published respectively (MoE, 2008). This mainly indicates how much consideration the government has given for the advancement of science and technology; and this in turn show the needs sufficient and skilled citizens to attain the targeted development of the country. The country has also given due attention for the equality of its citizens especially of gender equality. That is, both male and female citizens of the country have equal opportunity, right and responsibility. The new education and training policy of Ethiopia for example, has given emphasis to female by granting affirmative action in many aspects particularly in education. This happens because national development that contributes for a whole global development is a collective responsibility, which requires the collective efforts of citizens of the two sexes regardless of their diversities. The issues of equity in education between male and female groups have been a serious problem in Ethiopian education system at all levels in general, and of higher education in particular (Habtamu, 2004).

Mathematics has been one of the compulsory subjects that are given at national examinations at secondary school level and at University Entrance Examination (UEE). Even though the subject is accredited this much, female students usually score below the desired average than male students. The previous research also showed that participation of female students in the teaching-learning process during mathematics lesson has been less than the male students (Habtamu, 2004). Thus, the researchers suspects that these problems may emanate from the attitude difference between male and female students toward mathematics. To eliminate problems of women's education, to narrow down the educational inequality gap, and consequently to increase women role in development endeavor, worldwide movements have been taking place for many years. In this regard, International Conferences of Education for All (IWEFA) by the year 2000 and International Women's Conferences (ICW) are the cases in point.

At the national level, too, The Transitional Government of Ethiopia, Educational and Training Policy (TGE, (1994) has been formulated in such a way that it addresses educational equity through providing educational opportunity to women at all levels of schooling to realize its goal. Various programs and projects comprising different strategies have been subsequently designed (MoE, 1997). Therefore, this study focuses on predicting the performance of high school students towards mathematics. The main reasons that inspire the researchers to focus the study on the secondary school students' performance towards mathematics is most of first year natural and computational science and pre-engineering students in Mettu University, they can't achieved the expected result in mathematics at different times. During their stay in this University, the researchers observed that, first year Mettu University students are expected to solve different mathematical problems that need various steps from the simplest to complex, for most of the students these activities were difficult tasks and they have not achieved the expected outcomes at that level. Therefore, these reasons initiated the researchers to assess factors in relation to achievement in mathematics of secondary school students and come up with possible solutions that help to develop positive attitude towards mathematics among the students.

Objectives of the Study

General objective: The general objective of the study is to predict the performance of high school students towards mathematics in Illubabor and BunoBedelle zone.

Specific objectives

The specific objectives of the study are:

- To determine school based factors that affect students' performance in mathematics.
- To measure the strength to which these predictors exert affect on academic performance of students towards mathematics.

Significance of the research

This study is supposed to have the following importance:

- It helps to know personal and school based factors that affects performance of the students in learning mathematics,
- It is hoped to raise awareness to officials about the factors which could negatively affect the secondary school students' performance in learning mathematics,
- It helps for the concerned authorities to design strategies for reducing the problems of the student,
- It gives suggestions for further study in future.

MATERIALS AND METHODS

Study Area: This study was conducted in Illubabor and Buno Bedelle zone Secondary schools.

Study population and sampling design: The study population were consists of all students and mathematics teachers of Illubabor and Buno Bedelle Zone. The data for our study is obtained by applying simple random sampling. The sample of this study is obtained directly from the sample respondents, through self administered questionnaire and interview**.**

Sampling Technique and determination of sample size: Random sampling method used in this study to select representative sample form for the total population of respondents.

The total sample size was $n = \frac{384}{1+\frac{384}{17,340}} = 375$

Sources of data and method of data collection

Sources of data: The sources of data that is going to be used throughout this study is both primary and secondary data, which means that the primary data is collected directly either by observation or sending questionnaire for individual by interviewer data collector. Secondary data will be results of students from documented materials (records from the zone).

Method of data collection: For this study data will be collected by using questionnaires. So, the researchers was used primary data collection method. In this study the researcher collect data by using other five enumerators those were oriented before they participate in collecting data from the respondents. Specifically, the enumerators also took the orientation about the design of questionnaire from the researcher.

In other ways enumerators also will be given orientation about the objectives of the study to solve any ambiguity regarding data collection**.**

Study Variables

Dependent variables: The dependent variables are the variables in regression that cannot be controlled or manipulated, designated as the Y- variables. Performance of students in high school towards mathematics is the dependent variable for the purpose of this study.

Independent variables: Independent variables are the variables in regression that can be controlled or manipulated and designated as the X-variables.

The following are independent variables in the study:

- Age
- Sex
- Marital status
- Grade level
- Economic status
- Distance of school
- Mathematics remedial lesson
- Method of teaching mathematics
- Mother and father education background

Method of data analysis

Descriptive statistics

Descriptive statistics utilizes numerical and graphical methods to look for patterns in the data set to summarize the information which reveled in the data set and to present the information in convenient form. The main purpose of descriptive statistics to provide an over view information which collected. In most cases, descriptive statistics used to examine or explore one variable at a time. Always analysis of statistical data begun by describing the raw data; in order to achieve this, descriptive statistics plays an important role. Descriptive statistics describes the data collect through numerical measurement, chart, and frequency distribution and so on.

Inferential statistics: Inferential statistics describes the data with making any inferences by generalization and by summarizing sources of numeric data in to meaningful form. In this study regression will be used to identify potential risk factor that affects performance of students.

The regression Analysis: The method data analysis to measure the functional relationship between the dependent variable and one or more independent variables is a regression analysis. A linear regression equation of the dependent variables Y on K independent variables $x_1, x_2, x_3, \ldots\ldots, x_k$ is given by

$$Y = B_0 + B_1x_1 + B_2x_2 + \cdots + B_kx_n + \epsilon$$

$B_1, B_2, B_3, \ldots B_k$are the slopes(the change in Y for the unit change in the explanatory variable x_1). After fitting a linear regression model by estimating the coefficients, the researchers tested significance. This can be done either by testing the overall significance of the model or by testing the significance of the individual coefficients. The test about the overall significance of the model will employ F-test and t-test to check

whether at least one of the coefficients is significantly different from zero. The test about individual coefficients will employ the t-test and test whether each independent variable is statistically significant in determining the dependent variable. $B_0$is the value of Y when all independent variables assume zero value and $\sum t$ is the random disturbance term. The primary objective of regression analysis is the development of regression model to explain the given population. A regression model is the mathematical equation that provides prediction of values of dependent variables based on the known values of one or more independent variables. Linear regression has many practical uses. Most applications of linear regression fall in to one of the following two broad categories:

If the goal is prediction, or forecasting, linear regression can be used to fit a predictive model to an observed data set of Y and X values. After developing such a model, if an additional value of X is then given without its accompanying value of y, the fitted model can be make a prediction of the value of y.

Given a variable y and a number of variables $x_1, x_2, \ldots . x_p$ that may be related to y, then linear regression analysis can be applied to quantify the strength of the relationship between y and thex_j, to assess which x_j may have no relationship with y at all, and to identify which subsets of the x_j contain redundant information about y, thus once one of them is known, the others are no longer informative.

Multiple Linear regressions: If more than one independent variables are estimated with a dependent variables, than such a regression model is called regression model

$$Y = B_0 + B_1 x_1 + \cdots + B_k x_k + \epsilon$$

RESULTS AND DISCUSSION

Descriptive results for selected important variables: This section reports the descriptive results of factors affecting the performance of students towards mathematics. The sample size used in the study was 375 observations. The average score results for students during the study period is about 60.8 and the standard deviation is about 10.9.Therefore this implies that there is no absence of moderate variations among the values of average score across the performance of students towards mathematics included for this study.

Summary results of continuous variables: A total of 375 health workers were included and the frequency and percentage of age Below 15,Between 15-16, between 16 to18,and 18 to 20 are 34(9.1) 188(50.1%),122(32.5%) and31(8.3%) respectively. Among those, most of the age of students is between 15 to16.Similarly, the frequency and percentage of predictor variables are displayed above table 4.1 From the above table4.1, the method used in this study to test the existence of multi-Collinearity was by checking the Pearson correlation between the predictor variables. The correlations between the independent variables are shown in table 4.1 above. All the correlation coefficients results are less than 0.75 this showed that there is no multi-collinerity problem in the study. There is positive correlation between age, marital status, grade level, economic status and classroom instruction with average of student's results. The correlation coefficient of sex, method of teaching mathematics, math's remedial test, mothers and fathers educational level are -0.024, -0.033, -0.125,-0.056 and-0.070 respectively. This indicates that there is negative relationship between sex, method of teaching mathematics, math's remedial test, mothers and fathers educational level with average of student's results. As shown in figure 4.1 of sex of students male and females students were 58.13%, and 41.87% in that order. Furthermore, result of the study illustrated that 58.13% of male students had participating in this study.

Inferential Results for the outcome variable: In this section, the correlation matrix, colinearity information of independent variables and multiple linear regression results and checking the assumptions of multiple linear regression analysis are presented. In this section the correlations matrix were used to measure the degree of linear association between two variables. In our case, we have to correlate the relation between Independents and outcome variables. Variance Inflation Factors (VIF) greater than 10 are generally seen as indicative of severe multi-collinearity.

The 1/VIF column is the tolerance and it ranges from 0 to 1, with 1 being the absence of multi-collinearity. In our case all of the VIFs are below 10 and all of the tolerances are close to one indicating that there is no problem of multi-collinearity in our data. Variance Inflation Factors (VIF) greater than 10 are generally seen as indicative of severe multi-collinearity. The 1/VIF column is the tolerance and it ranges from 0 to 1, with 1 being the absence of multi-collinearity. In our case all of the VIFs are below 10 and all of the tolerances are close to one indicating that there is no problem of multi-collinearity in our data sets.

Multiple linear regression results: Model specification**:** Before we fit the multiple linear regression model, first we check for linear functional form based on graphical displays of the dependent variable with each of the independent variables. Next we fit a multiple linear regression model, for the dependent variable when all the explanatory variables are included, the functional form is:

The fitted multiple linear regression models are given by:

Y (average score results)=$\beta 0 + \beta 1 age + \beta 2 sex + \beta 3 maritul + \beta 4 grade + \beta 5 economicstatus + \beta 6 father\ educ + \beta 7 mother\ educ + \beta 8 maths + \beta 9 classroom + \beta 10 methods + \beta 11 distance + \varepsilon i.$

Where Bo is a constant which gives the value of Y, when X=0.It is called the Y intercept. $\beta 1, \beta 2, \ldots, \beta 14$isindicating the slope of the regression line, and it gives a measure of the change in Y for a unit change in X1, X2,….,X14. It is also regression coefficient of Y on Xi. The result of OLS (Ordinary least square estimation) estimates for the multiple linear regression model are shown in Table 4.3. From table 4.3 above multiple linear regression analysis results indicate that Grade level, Economic status, Father education, Mathematics remedial test, and Distance from school were significantly affect(since p-value(0.000,0 .001,0 .000, 0.023 and 0.000 is less than 5%) and age sex , marital status, mother education, Class room instruction and methods of teaching were not significantly affects the performance of students towards mathematics (since p-value is larger than 0.05) during the study period. From equation 4.1 above the fitted regression line from table 4.5 results is given by

Table 4.1 Summary results between measurable variable (average results) and predictor variables

Variables		Frequency	Percent	Correlation coefficient(r)
Sex	Male	218	58.1	-0.024
	Female	157	41.9	
	Below 15	34	9.1	0.118
Age	Between 15-16	188	50.1	
	16-18	122	32.5	
	18-20	31	8.3	
Marital status	Single	339	90.4	0.087
	Married	35	9.3	
	Divorced	1	0.3	
	Widowed	0	0	
Grade level	Grade 9	245	65.3	0.188
	Grade 10	130	34.7	
Economic status	Low	157	41.9	0.077
	Middle	217	57.9	
	High	1	0.3	
Father education background	Illiterate	184	49.1	-0.056
	Diploma	90	24.0	
	Degree	98	26.1	
	Above degree	3	0.8	
Mother education background	Illiterate	170	45.3	-0.070
	Elementary	82	21.9	
	High school	92	24.5	
	Above diploma	31	8.3	
Math's remedial test	Yes	181	48.3	-0.125
	No	194	51.7	
Classroom instruction	Yes	323	86.6	0.007
	No	50	13.4	
Method of teaching mathematics	Students center	81	21.6	-0.033
	Lecture method	213	56.8	
	Group discussion	66	17.6	
	Any other	15	4.0	

Summary results of continuous variables

Variables	Mean	Std. Deviation
Distance	3.38	2.929
Average scores	60.87	10.922

Table 4.2. Collinearity information of predictor variables

Variable	VIF
Sex	0.839
Age	0.706
Marital status	0.750
Grade level	0.749
Economic status	0.545
Father educational level	0.586
Mother educational level	0.658
Mathematics remedial test	0.806
Class room instruction	0.784
Method of teaching	0.819
Distance	0.864

Table 4.3. Results of Multiple Linear regression Model

Coefficients						
Variables		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	17.576	11.633		1.511	.132
	Age	.637	.813	.045	.783	.434
	Sex	-.736	1.154	-.033	-.638	.524
	Marital status	3.283	1.967	.092	1.669	.096
	Grade level	5.066	1.263	.221	4.010	.000
	Economic status	4.837	1.424	.221	3.397	.001
	Fathereducation	-2.977	.795	-.235	-3.746	.000
	Mothereducation	-.889	.638	-.083	-1.395	.164
	Mathematics remedial test	-2.655	1.166	-.122	-2.277	.023
	Classroominstruction	-1.571	1.736	-.049	-.905	.366
	Methodsthattheteacheruse	.444	.669	.035	.663	.507
	Distancefromschool	-1.034	.191	-.277	-5.409	.000

a. Dependent Variable: averagescore

Table 4.4 Model summary for regression model

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.407[a]	.166	.140	10.126

ANOVA[b]						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7388.713	11	671.701	6.551	.000[a]
	Residual	37222.620	363	102.542		
	Total	44611.333	374			

a. Predictors: (Constant), distance from school, martial, mother education, grade, methods that the teacher use, Sex, mathematics remedial test, classroom instruction, father education, Age, economic
b. Dependent Variable: average score

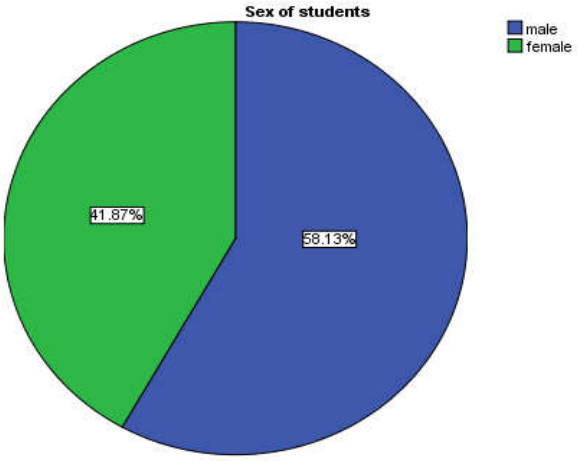

Figure 4.1. Pie chart for sex of students

Y(average score results of students)=$17.576 + 0.6371age - 0.736sex + 3.283maritul + 5.066grade + 4.837\ economicstatus - 2.977father\ educ - 0.889mother\ educ - 2.655maths - 1.571classroom + 0.444\ methods - 1.034\ distance + \varepsilon i.$

From the fitted MLRM (Multiple linear regression model) there is also positive relationship between age, marital status, grade level, economic status, and methods of teaching with performance of students (average results). Based on the results given in this table 4.3, eleven (11) of the six explanatory variables considered in this study were found statistically negatively associated with performance of students towards mathematics (average score). They are sex of students, father educational, mother education, Mathematics remedial test, class room instruction and distance of school.

Interpretation of the final regression model for significant variables: For measuring the performance of students towards mathematics using explanatory variables, the stepwise discriminate analysis results presented in Table 4.3.

The final multiple regression model using significant variables is given by

Y(average score results of students)=$17.576 + 5.066grade + 4.837economicstatus - 2.977father\ educ - 2.655mathemathicsremedialtest - 1.571classroom - 1.034distance + \varepsilon i.$

For every unit increase in grade level of students (grade 9 and 10), the average score of students increased by5.066, holding all other independent variables constant and there is also positive relationship between grade level and average score results. The overall average score of students would be 17.576 keeping other variables are constant. If the economic status of students will increases by one unit the average score of students by 4.837and keeping other independent variables constant. If the number of father education increases by one unit the average score of students will be decreased by 2.997 and keeping all other independent variables constant. If mathematics remedial test increases by one unit average score of students decreased by 2.655.Finally, if the distance of school will increases by one unit keeping other predictor variables are constant, the average score of students will decreases by 1.034.The remaining variables are non-significant since p-value is greater than the default value (alpha =0.05).

Appropriateness of the regression model: From the above table 4.4 coefficient of determination (R^2=16.6%) the goodness of the fitted model approximately poor model. But, note that small and large value of coefficient of determination does not tell us the model is good or poor model. Usually we saw the model is poor model. From table 4.4 indicate that the overall significance of the regression parameter is statistically significant since p-value (0.000) is less than 5%

Conclusion and Recommendation

Conclusion

This study analyzes the effect of age, sex of students, marital status, economic status, grade level, distance of school, class room instruction, mathematics remedial lesson, method of teaching mathematics, mother and father Education background on average score results of students in Illubabor

and Bunobedele zone. In this study, the average score results for students during the study period is about 60.9 and the standard deviation is about 10.9.Therefore,this implies that there is no absence of moderate variations among the values of average score across the performance of students towards mathematics. As illustrated in the correlation analysis of performance of students indicate that, there is statistically and significantly positive correlation between age, marital status, grade level, economic status and classroom instruction with average score of student's results. This means that as these variables increases average score results of students also will increase and vice versa. In this study, the researcher applied multiple linear regression analysis to these factors that are expected to facilitate the average score results of students. The results of multiple linear regression analysis, showed that grade level, economic status, father education ,mathematics remedial test, and distance from school have statistically significant effects on the average score results.

Finally, the average score results related factors studied through the multiple regression analysis revealed that factors such as grade level, economic status, father education, mathematics remedial test, and distance from school were found the major contributors in Illubabor and Bunobedele zone during the study period. Moreover, the factors were ranked based on their importance to the discrimination of the average score results of students. Accordingly, in grade level, distance of school and father education was first ranked followed by economic status, and mathematics remedial test. In this study, grade level, distance of school and father education was found the most important factor in aggravating average score results.

Recommendation

Based on the result of the study researcher forward some recommendations. Based on the findings of our study different factors were identified for average score results of students.

- It is recommended that Mathematics teachers to make an ongoing evaluation and give continuous feedback for inappropriate behaviors developed by the students so that appropriate measure will be taken on time. In this case, the class size should get in to consideration and it should be reduced to an optimum number of students as far the teacher manages.
- Government should allocate sufficient budget for secondary and preparatory schools for instructional materials such as computers and mathematics reference books in the library in addition to the text books and teachers guide.
- Future researchers should focus on important risk factors that affect the average score results of students at regional level that would provide better insights for both management and regulatory bodies.
- Finally, this study was limited to eight secondary schools and it might be a pointer in such directions. It would have been comprehensive. Therefore, in order to see examining the performance of secondary school students towards mathematics in its deepest level, the government should conduct an impact assessment study at a country level.

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