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Pedagogical Perspective

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Perception of secondary school students towards learning mathematics and its effect on academic performance: In case of Kaffa Zone Gimbo secondary school[1]

Tekle Kochito Yesho[2] and Yunatan Lute[2]

[2] Department of Mathematics, Bonga College of Education, Bonga, Ethiopia.

Abstract

The perception of students in learning mathematics at secondary schools has persistently been negative. The students with a higher perception of learning were associated with better academic performance. Students' academic performance in mathematics reflects their ability to handle the academic series taken during secondary school. This study sought to investigate students' perceptions of learning mathematics and its effects on academic performance at Kaffa Zone Gimbo Secondary School. The target groups for this study were 555 students from grades 9-12. This group was sampled using stratified sampling techniques, with a sample size of 250 students. The data was collected using a questionnaire. The collected data were analysed using descriptive statistics and multiple linear regression analysis by using the Statistical Package for the Social Sciences (SPSS version 20). The finding of this study shows that students' perception of learning mathematics was a mean Likert scale value of 2.4264, which is low and indicates a negative perception. Furthermore, from multiple linear regression analysis, all the components of perceptions were statistically significant, which means the p-value is less than 0.05. From the independent sample t-test, the perception of male and female students is not statistically significant. This indicates that gender difference does not affect the perception of learning in mathematics. Generally, the study concluded that students' academic performance in mathematics is significantly influenced by their perception of learning mathematics. The study recommended that the concerned bodies consider counselling students to foster positive thinking about mathematics learning and high performance in mathematics.

Keywords: Learning mathematics, beliefs in learning, confidence in learning, motivation in learning, difficulties in learning.

Introduction

Background of the study

Mathematics is the art of creating new knowledge from old using deductive logic and abstraction (Wilkinson, 2021). The knowledge of mathematics includes the topics of numbers, formulas and related structures, shapes and the spaces, in which they are contained, and quantities and their

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Corresponding Author: kochtekle@gmail.com
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changes (Hadzieva, 2022). The systematic teaching of mathematics began in the third millennium in the states of Mesopotamia. Scribal schools, known as edubba, or houses of tablets, prepared scribes who worked for the state administration and were required to master writing and accounting techniques. Mathematics became a subject of general education for the first time in the city-states of Greece when a new class of free citizens emerged to govern their state. This form of general education practised two distinct patterns. The first is rhetoric and dialectic as qualifications for political activity, and the second is mathematics as a complement. This two-sided general education became later conceptualised as the trivium and the quadrivium, together constituting the septem artes liberales, which became a characteristic of the general education in Europe (Schubring & Karp, 2020). The philosophy of teaching mathematics aims at developing the skills, competencies and knowledge that could propel every individual into science, technology and innovation. Teaching mathematics can help develop students' problem-solving skills and quick decision-making abilities (Kunwar, 2021). Teaching mathematics has come under heavy criticism from experts claiming that it leaves students unprepared for innovation and entrepreneurship development (Olaniyan & Ezekiel, 2019). However, modern civilisation is increasingly dominated by individuals ready to solve the main socio-economic problems for the benefit and sake of humanity through mathematics. Mathematics today is a diverse discipline that deals with data, measurements and observations from science, with inference, deduction, and proof; and with mathematical models of natural phenomena, of human behaviour, and of social systems (Yadav, 2019).

On other concern, mathematics is the foundation for nation building, since the level of mathematics skills and competences go a long way to determine the level of science and technological components of any nation, which is a basic requirement for its development (Jayanthi, 2019) In every country, mathematics is one of the core disciplines that form the basic ingredient in the understanding of science and technology (Abd & Algani, 2022). People who create new algorithms or designs need some ability to apply mathematical techniques independently. At the high-math end of the spectrum, those who conduct research in an area need a profound ability to work with its mathematics. Computer science, like the physical sciences and traditional engineering fields, widely uses mathematics to model the phenomena it studies. Furthermore, computational and mathematical reasoning are closely connected (Baldwin et al., 2013). Learning mathematics is an obligation for all students, in the hope of continuing their academic success to the next level. In addition, mathematics is used as one of the subjects tested in the national exam. The national exam is a benchmark or determinant of whether or not a student passes their education. However, the real purpose of learning mathematics in school is to prepare students to deal with the changing circumstances that occur in their lives (Fitriya et al., 2023).

Mathematical power is an important basic thing for each person who is going to learn mathematics. This statement is because mathematical power influences how students process and learn results to gain knowledge, skills, and stances that will be reflected in daily life (Kusmaryono, 2014). In the Ethiopian context, the majority of the students could not understand the role of mathematics in real life. Misunderstanding the use of mathematics in real life leads students to have less cognitive awareness about learning mathematics. The teaching and learning of mathematics in Ethiopia is proceeding with a low level of students' mathematics background and participation in activities (Walde, 2019). Studying the perception of students and

academic performance at secondary school was very crucial as their future careers depend on academic success in mathematics and science subjects. Moreover, academic performance is influenced by many interrelated variables. A key among them is the students' efforts, teachers' inputs, the school environment and students' perceptions. Despite various efforts to improve academic performance, some schools continue to perform miserably in national examinations, and therefore most students from such schools fail to join higher learning institutions. There are several suggestions that, aside from school-related factors, students' academic performance is influenced by perceptions that they pay little attention to mathematics. This study explores the influence of students' perceptions on mathematics performance at Kaffa Zone Gimbo Secondary School.

Statement of the problem

Students' perceptions about mathematics are related to their perceptions of learning mathematics. Mathematics perception is defined as how students personally view mathematics as a subject, and how they feel and think about teaching it (Daud et al., 2020). The students' perceptions of mathematics and mathematics teaching have been considered a significant factor underlying their school experiences and academic performance. Academic performance could be defined as the display of knowledge attained or skills developed in school subjects, as designated by test and examination scores or marks assigned by the subjects' teachers. Students' low or high performance is due to their personality factors; the more students improve their self-concepts, determination, and interest, the better their performance in mathematics (Ali, 2013). Mathematics educators and mathematicians mention that the poor performance of students globally in mathematics is mainly linked to perception rather than any other variable (Hagan et al., 2020). Students' poor academic performance in mathematics is not just a concern for particular countries, but has become a global concern over the years (Chand et al., 2021). This study will investigate students' perceptions of mathematics and its effects on their overall academic performance in school and, later, in their future careers, focusing on Kaffa Zone Gimbo Secondary School. The investigation into students' perceptions of learning mathematics and its effects on academic performance was addressed by raising the following fundamental research questions.

1. What is the perception of secondary school students towards learning mathematics?
2. To what extent does students' perception of mathematics affect secondary school students' academic performance in mathematics?
3. How does gender difference affect students' perception of mathematics?
4. What is the relationship between secondary school students' perception and their academic performance in mathematics?

Objectives of the study

General objectives of the study

The main objective of this study is to investigate the perception of Gimbo secondary school students towards learning mathematics and its effects on academic performance.

Specific objectives of the study

The specific objective of this study is:

- To find out students' perceptions towards learning mathematics.
- To determine the influence of perception on secondary school students' academic performance in mathematics.
- To find out the gender difference in students ' perception of mathematics.
- To find out the relation between secondary school students' perception of mathematics and their academic performance in mathematics.

Research Hypothesis

This study proposed the following hypothesis to be tested by the study

H_0: There is no statistically significant relationship between perceptions of mathematics and the academic performance of students in mathematics.

H_1: There is a statistically significant relationship between perceptions of mathematics and the academic performance of students in mathematics.

H_0: There is no significant difference between perceptions of male and female students in mathematics.

H_1: There is a significant difference between perceptions of male and female students in mathematics.

Significance of the study

The expected output of this study would be helpful in designing strategies that might help increase students' perception and performance in learning mathematics.

Methodology

This section of the study presents the methodology used by the researchers to achieve the stated objectives, research questions, and hypotheses.

Research design

The researchers used a descriptive survey research design to explain and understand the relationship between students' perceptions and their effect on academic performance in mathematics. The perception has six components, which act as independent variables, and the academic performance is the dependent variable. These independent variables are: students' interest in learning mathematics, their beliefs about learning mathematics, their self-confidence in learning mathematics, their motivation to learn mathematics, teachers' teaching strategies, and the difficulties students face in learning mathematics. The survey research design was primarily used based on study variables and is a popular approach in education. It includes quantitative and qualitative research, where investigators administer a survey to a sample to describe the attitudes, opinions, behaviour, or characteristics of the population (Creswell, 2012). Descriptive research design helps to describe the perception of students in learning mathematics and its effect on the academic performance of students in Gimbo Secondary School.

Participants and procedure

The participants of this study were Kaffa zone Gimbo secondary school students of grades 9th - 12th. In line with the objectives of this study, primary data have been collected from all sampled students of these grades. From a total of 555 students at Gimbo Secondary School, 250 students were selected as the sample size for this study. The sample students were drawn using a proportionate stratified sampling method by considering grade 9 - 12 students as strata. The primary purpose of stratification was to reduce sampling error. Moreover, stratified sampling is a technique that uses any relevant information available to increase efficiency. A sufficient number of components from the population to ensure that findings from analysis of the sample extrapolated to the population were stratified sampling (Oribhabor & Anyanwu, 2019). As a result, a representative sample size was determined from the target population using the simple random formula (Soler et al., 2008). An acceptable margin of error used for most survey researchers typically falls between 4% and 8% at the 95% confidence level. The precision level for this study was 4.68% at the 95% confidence level. So, the sample size was calculated as:

$$\boldsymbol{n = \frac{N}{1 + Ne^2}}$$

Where $n =$ sample size, $N =$ the target population and $e =$ the precision level taking as 0.0468

Table 1 Demographic characteristics of the participants of Gimbo secondary school students

Variable	Category	frequency	%
Grade Level	9th	75	30.0
	10th	52	20.8
	11th	75	30.0
	12th	48	19.2
Gender	Female	113	45.2
	Male	137	54.8
Age in Year	Blow 20	224	89.6
	20-25	25	10.0
	Above 25	1	0.4
Father's Educational Background	Not educated	38	15.2
	Elementary	104	41.6
	High school	44	17.6
	College & above	64	25.6
Mother's Educational Background	Not educated	52	20.8
	Elementary	107	42.8
	High school	46	18.4
	College & above	45	18.0

From Table 1, 30% of respondents were in grade 9; 20.8% were from grade 10; 30% were from grade 11; and 19.2% were from grade 12. Furthermore, 45.2% of respondents were males and 54.8% of respondents were females. In Gimbo secondary school, 89.6% of students were under 20 years old; 10% were between 20 and 25, and 0.4% were over 25 years old. Moreover, 15.2% of students' fathers were not educated; 41.6% had attended elementary school; 17.6% had attended high school; and 25.6% had attended college or higher. Moreover, 20.8% of students' mothers were not educated; 42.8% had attended elementary school; 18.4% had attended high school, and 18% had attended college.

Data collection

Data collection instruments are the fundamental tools used to gather data and explore potential solutions to the research problem. In this study, the researchers used questionnaires to ensure the validity of the findings. Questionnaires contained the same questions for all individuals in the sample. The respondents can complete the questionnaires at their convenience, in any order,

and take more than one sitting to finish them. They can also make marginal comments or skip questions (Turner, 2010). To accomplish this duty, questionnaires contained mainly closed-ended items. While distributing the questionnaires, the researchers gave a brief orientation on the purpose of the study and how to respond to them. The questionnaires were implemented with a five-point Likert scale. These were strongly agree, agree, undecided, disagree and strongly disagree. Generally, the respondents felt free to share their opinions or information openly, increasing the credibility of the information gathered.

Data analysis

Descriptive and inferential statistics were used to analyse the data for this study. The organised data would be analysed using SPSS version 20. The majority of the questionnaire items were closed-ended and required scores between 1 and 5 on the Likert scale. The correlation analysis displays the degree of association between variables but does not allow the researcher to conclude a causal link between them. Therefore, to explain the effect of perception on students' academic performance, the researchers used a multiple linear regression model analysis.

Validity and reliability

Validity

Validity is how much outcomes obtained from the investigation of the information really address the peculiarity under review (Wekesa, 2013). Validity tests have been directed to choose and survey the final items of the construct that are ultimately utilised for statistical testing. Among a few, two kinds of validity tests in particular, content and criterion-related validity tests. The content validity test was utilised for this review. The content validity builds on how much the action traverses the space of the developer's hypothetical definition. It represents the adequacy with which a particular domain of construct was sampled.

Reliability

According to various researchers, a reliability test is essential to ensure the consistency of estimating instruments used to quantify the intended purpose of the research (Baharin et al., 2015). In this research, the value of Cronbach‘s alpha has been computed separately to assess the reliability of the scales adopted on the students' questionnaire. Cronbach‘s alpha was used in his research reliability test by providing a better rule, so-called Cronbach's alpha, with standard values of 0.9-1.0 being excellent, 0.8-0.89 being perfect, 0.7-0.79 being acceptable, 0.6-0.69 being questionable, 0.59 being poor, and less than 0.5 being unacceptable.

Table 2 Cronbach’s alpha coefficient

Variables	Number of items	Cronbach’s Alpha
Interest of students in learning mathematics	9	0.844
Beliefs about earning mathematics	10	0.798
Self-confidence in learning mathematics	9	0.830
Motivation of students in learning mathematics	5	0.878
Teachers' teaching strategy of mathematics	10	0.970
Difficulties in learning mathematics	9	0.947

In this research, all the values of Cronbach‘s alpha were above the accepted value. This indicates that all dimensions of the construct significantly contribute to the consistency.

Findings

The collected data were analysed, presented and interpreted in this section regarding the effect of perception on the academic performance of students in mathematics. The collected data were input into the Statistical Package for the Social Sciences version 20 and analysed using descriptive statistics and multiple regression analysis.

Descriptive analysis of the perception of students towards learning mathematics

Table 3 Descriptive statistics of components of perception

Components of perception	N	Mean	Std. Deviation
Interest of students in learning mathematics.	250	2.6702	0.71986
Beliefs about learning mathematics	250	2.2290	0.70564
Self-confidence in learning mathematics	250	2.6486	0.81873
Motivation of students in learning mathematics	250	2.0953	0.77036
Teachers' teaching strategy of mathematics	250	2.4328	0.64755
Difficulties in learning mathematics	250	2.4841	0.73865
Valid N (listwise)	250		

Table 3 presents the analysis of the mean score from the Likert scale regarding the perception of students in Gimbo secondary schools. The items filled by the students on the interest of the students in learning mathematics were focused on the interest of the subject mathematics; liking or disliking of the subject mathematics; happiness in mathematics period than any other subjects period; interest to develop their mathematics skills and study the subject more; the interest of solving new prblems in their own; the interest and willingness to use mathematics out side of the school and intest to acquire further knowledges on mathematics. The interpretation of the mean score value for interest in learning mathematics was 2.67, indicating that this interest was medium. Beliefs in learning mathematics refer to students' perspectives about mathematics and its learning. The items filled by the students on the beliefs about mathematics were; mathematics helps the students to understand other subjects; helps to keep brain active and health; its learning is an essential, inate, ongoing and lifelong process; it is a foundation for many other subjects; beliefs on nothing creativity mathematic; strengthen reasoning skills critical thinking; provides a foundation for applied science and it is a subject with high abilities. The Likert scale mean for these items is 2.229. The questionnaire item completed by the students regarding self-confidence in mathematics focused on the following concepts. These concepts were confidence in solving their own problems; confidence to ask a question during mathematics lessons; confidence to reject frustration in group discussions and assessment time; confidence to score the highest marks; and confidence to help friends in problem solving. The Likert scale mean for self-confidence was 2.64, which was in a medium interval. For this study, the motivation of students in learning mathematics, the items filled by the students were the motivation of teachers that the students to work hard in mathematics problems; the students to do well in mathematics; the students them to promote self confidence in mathematics; the students to study all times and the students them to motivate them selves by solving a prblems with them selves. The Likert scale mean for the motivation of students in learning mathematics was 2.09. The items filled by the students on the teachers teaching strategy of mathematics was on the concept of teachers involvment of learners with their level of thinking; promoting of peer learning and creating synergy; helping students who learn well by modeling for others; using different

learning resources and and teaching aids; providing opportunities for targeted questions; fostering independent learning; allowing the students to progress at their own rates and checking their works and giving the feed backs and the likert scale mean was 2.43. For the perception of students in difficulties of learning mathematics, the items filled by the students was on the concept of difficultiness of mathematics in nature; the feeling of students when learning mathematics; difficulties in understanding the language of mathematics, such as remembering math facts, concepts, rules, formulas, sequences and procedures; and lack of patience in learning and studying mathematics. The interpretation of the Likert scale mean value for difficulties in learning mathematics was 2.484

Correlation analysis between perception and academic performance

To check the relationship between perception components and academic performance, Pearson's correlation coefficient (r) is used. This measures the strength and direct linear relationship between two variables. Values of Pearson's correlation coefficient are always between -1 and 1. A correlation coefficient of +1 indicates that each variable is perfectly related in a positive sense; a correlation coefficient of -1 indicates that each variables are perfectly related in a negative sense, and a correlation coefficient of 0 indicates that there is no linear relationship between each variable.

Table 4 Correlation analysis

		Inter	Bel	SCon	MOT	TESTR	DIFF	Fresult
Inter	Pearson Correlation	1						
	Sig. (2-tailed)							
	N	250						
Bel	Pearson Correlation	.170**	1					
	Sig. (2-tailed)	.007						
	N	250	250					
SCon	Pearson Correlation	.055	.194**	1				
	Sig. (2-tailed)	.384	.002					
	N	250	250	250				
MOT	Pearson Correlation	.220**	.426**	.286**	1			
	Sig. (2-tailed)	.000	.000	.000				
	N	250	250	250	250			
TEST	Pearson Correlation	.614**	.148*	.091	.266**	1		
	Sig. (2-tailed)	.000	.019	.150	.000			
	N	250	250	250	250	250		
DIFF	Pearson Correlation	-.055	.085	.238**	.170**	.013	1	
	Sig. (2-tailed)	.388	.182	.000	.007	.834		
	N	250	250	250	250	250	250	
Apscor	Pearson Correlation	-.157*	.443**	.505**	.436**	-.098	.457**	1
	Sig. (2-tailed)	.013	.000	.000	.000	.124	.000	
	N	250	250	250	250	250	250	250

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

From Table 4, the correlation coefficient is between -1 and 1. When the correlation coefficient is -0.25 and +0.25, the relationship among the variables is relatively weak. When the correlation coefficient is between -0.5 and -0.25 or between +0.25 and +0.5, the relationship among the variables is considered medium. The correlation coefficient ranges from -1 to -0.5, and from +0.5 to +1. The relationship among the variables is strongly correlated. Moreover, the direction of the dependent variable's change depends on the sign of the coefficient. When the coefficient is a positive number, the dependent variable will move in the same direction as the independent variable; when the coefficient is negative, the dependent variable will move in the opposite

direction from the independent variable. Generally, there is a relationship between the independent variables and the dependent variables.

Multiple linear regression analysis

The multiple linear regression models are an extension of a simple linear regression model to incorporate two or more explanatory variables in a prediction equation for a response variable. Multiple linear regression modelling is now a mainstay of statistical analysis in most fields because of its power and flexibility (Baharin & Azizan, 2015). The tests of assumptions used for this research were the normality test, the multicollinearity test and the model fit.

The test of normality depends on the skewness and kurtosis of the dependent variables. The dependent variable for this study was the students' academic performance scores.

Table 5 Skewness and kurtosis of academic performance scores

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Academic performnce	250	-.186	.154	-.891	.307
Valid N (listwise)	250				

From Table 5, the skewness or kurtosis of the dependent variable is -0.186 and -0.891, respectively. Multi-collinearity, also called multicollinearity, is a phenomenon in which two or more predictor variables in a multiple regression model are highly correlated, meaning that one can be linearly predicted from the others with a substantial degree of accuracy. Multi-co linearity occurs when several independent variables correlate at high levels with one another, or when one independent variable is a near linear combination of other independent variables.

Table 6 Multi-co linearity test

Model		Correlations			Collinearity Statistics	
		Zero-order	Partial	Part	Tolerance	VIF
1	Inter	-.157	-.217	-.144	.610	1.639
	Bel	.443	.389	.273	.806	1.240
	SCon	.505	.429	.307	.875	1.143
	MOT	.436	.297	.201	.728	1.373
	TeST	-.098	-.150	-.098	.604	1.656
	DIFF	.457	.413	.293	.923	1.083

Table 6 shows that the findings of the multi-collinearity test and the Variance Inflation Factor (VIF) are between 1.00 and 2.00

The following table shows the multiple linear regression model fitness.

Table 7 Multiple regression between dependent and independent variables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.764[a]	.583	.573	5.952

a. Predictors: (Constant), DIFF, TeSTM, Bel, SCon, MOT, Inter

Table 7 shows that the findings of the multiple regression coefficient, using all the predictors simultaneously, were R = .764 with an R-squared value of .583, and the adjusted R-squared is .573.

Table 8 ANOVA Results of multiple regressions between dependent and Independent variables

Model	Sum of Squares	Df	Mean Square	F	Sig.

1	Regression	12032.684	6	2005.447	56.607	.000[b]
	Residual	8608.916	243	35.428		
	Total	20641.600	249			

a. Dependent Variable: Academic performance, b. Predictors: (Constant), DIFF, TESTR, Bel, Con, MOT, Inter.

From Table 8 of the ANOVA result of the multiple regression output, the researchers have found that. F = 56.607 and p<.05, which confirms that independent variables have a significant effect on the academic performance of students.

Table 9 Regression output of academic performance and predictors

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	23.426	2.331		10.049	.000
	Interest in learning mathematics	-2.326	.671	-.184	-3.466	.001
	Belief about learning mathematics	3.920	.595	.304	6.584	.000
	Confidence in learning mathematics	3.646	.493	.328	7.402	.000
	Motivation in learning mathematics	2.778	.574	.235	4.842	.000
	Teachers teaching strategy of mathematics	-1.775	.750	-.126	-2.368	.019
	Difficulties in learning mathematics	3.755	.531	.305	7.066	.000

a. Dependent Variable: Academic performance

Table 9 shows the regression coefficients, which indicate the standardised beta coefficients and unstandardised coefficients. The researchers constructed a regression equation by using the unstandardized coefficient value of β. The regression findings revealed that, with all other independent variables set to zero, a unit increase in the predictor variables would lead to improved academic performance, as indicated by the unstandardized coefficient value of β. In this case, the researchers were interested in comparing the contribution of each independent variable; therefore, the researchers used the beta values. The statistical model of academic performance was calculated as:

$$Y = a + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6$$

$$= 23.426 - 2.326Int + 3.920Bel + 3.646\text{Conf} + 2.778\text{Mot} - 1.775\text{TeTS} + 3.755\text{Diff}$$

Where, Int = Interest in learning mathematics, Bel= Belief about learning mathematics

SConf = Confidence in learning mathematics, Mot = Motivation in learning mathematics

TeTS = Teachers teaching strategy of mathematics and Diff= Difficulties in learning mathematics

For the formulated hypothesis one,

H_0: There is no statistically significant relationship between perception of mathematics and academic performance of students in mathematics.

H_1: There is a statistically significant relationship between perception of mathematics and academic performance of students in mathematics.

From the analysis, the hypothesis formulated on the relationship between students' perception of mathematics and academic performance was found to be positive and statistically significant. That is, the p-value of interest in learning mathematics, belief about learning mathematics, confidence in learning mathematics, motivation in learning mathematics, teachers' teaching

strategy of mathematics and difficulties in learning mathematics was less than 0.05. All perception components were statistically significant.

Independent sample T-test

The independent sample t-test is used to test whether population mean are significantly different from each other, using the means from randomly drawn samples. In this study, the perceptions of male and female students could be tested by an independent sample t-test. The assumptions of group independence for the independent t-test should be checked.

Table 10 Independent sample t-test output

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed	Mean Difference	Std. Error Difference
Perception	Equal variances assumed	.049	.825	-2.949	248	.003	-.15525	.0526
	Equal variances not assumed			-2.944	237.26	.004	-.15525	.05274

Table 10 shows that the p-value for Levene's test is greater than 0.05, so the variances are not significantly different from each other. That is, the homogeneity assumption of the variance is met. Moreover, for the data results associated with the assumed equal variance, the researchers used the top line of the t-test for equality of means results and ignored the bottom line.

Table 11 Gender vs. perception of students

	Gender	N	Mean	Std. Deviation	Std. Error Mean	T	df	Sig. (2-tailed)
Perception	Male	113	2.3416	.41859	.03938	-2.949	248	.003
	Female	137	2.4968	.41064	.03508			

Formulated hypothesis test

H_0: There is no significant difference between the perception of male and female students in mathematics.

H_1: There is a significant difference between the perception of male and female students in mathematics.

From table 4.10, the reduction of the T-statistic value, and a significant reduction in the degree of freedom (df) indicate that the effect of increasing p-value, above the critical significance level of 0.05

Discussion

From the findings of descriptive statistics, developing a problem-solving process will enable individuals to gain both problem-solving skills and approaches to the events surrounding them (Aydogdu & Ayaz, 2008). In reality, students interested in learning mathematics can deal with the subject matter better than those who are not. The highest interest in a particular subject influences students' achievement levels and encourages them to study in depth. The interpretation of the mean Likert five-point scale value for interest in learning mathematics was 2.67, indicating that the interest was medium. According to the review literature, the

interpretation of the Likert scale mean values: between 1.00 and 1.80 was very low, between 1.81 and 2.60 was low, between 2.61 and 3.40 was medium, between 3.41 and 4.20 was high, and the scores between 4.21 and 5.00 were very high (Mohammad et al., 2019). From this perspective, the students of Gimbo Secondary School have a moderate interest in learning mathematics.

Beliefs in learning mathematics refer to students' perspectives about mathematics and its learning. The Likert scale mean for beliefs in learning mathematics was 2.229. According to the review of the mean score interval, students' beliefs about learning mathematics were low. Mathematics does not give pleasure and enjoyment in learning (Pair & Dinh, 2022). These lead learners to believe that mathematics is naturally difficult (Tahie & Chirche, 2013). From this point of view, the students' perception towards learning mathematics was negative. Thus, it can be concluded that students who perceive mathematics as a difficult or negative subject tend to be lower achievers in mathematics. This indicates the negative belief of students towards learning mathematics.

Self-confidence in mathematics reflects a growth mindset, perseverance, a positive attitude toward mistakes, a willingness to take risks, and self-reliance. In this context, self-confidence in mathematics refers to perceptions about students' skills and abilities in learning mathematics. Mathematics confidence is a student's perception of their ability to attain good results and their assurance that they can handle difficulties in mathematics, essentially representing self-efficacy in math (Pierce et al., 2007). The Likert scale mean for self-confidence was 2.64, which was in a medium interval. An individual with problem-solving skills grows up to be self-confident, able to think creatively and independently (Amran et al., 2019). This indicates that Gimbo Secondary School students have a medium level of self-confidence in learning mathematics. From this concept, the researchers conclude that students' perception of learning mathematics was neutral.

Motivation is one of the aspects of learning mathematics. Motivating students to be receptive is one of the most important aspects of mathematics instruction, as highlighted by the creative and calm elements of the Common Core State Standards (Alfred, 2015). The Likert scale mean for the motivation of students in learning mathematics was 2.09, indicating that their motivation was low. From this, students' perception of learning mathematics was negative.

The role of teachers should be to guide and facilitate the teaching-learning process rather than provide ready-made knowledge. For this teacher's mathematics teaching strategy, the Likert scale score was 2.43, which was in the lowest interval of the scales. Learners usually work together in small groups on a shared activity. With a common goal, this approach has been widely recommended in recent times as a strategy to enhance mathematics learning for all students (Barnes et al., 2000). Therefore, the teachers' minimal attention to the teaching strategy of mathematics leads students to a negative perception of learning mathematics.

Thinking that the difficulty of mathematics influences the academic performance of students and classroom learning (Pair & Dinh, 2022). Most students believe that mathematics is naturally difficult (Tahie & Chirche, 2013). The interpretation of the Likert scale mean value for difficulties in learning mathematics was 2.484, which was at the lowest interval of the scale. The lowest mean score indicates that the students have difficulties in learning mathematics. Therefore, the difficulties of learning mathematics lead students to a negative perception of the subject.

Generally, the Likert scale mean for students' perception of learning mathematics was 2.4264,

with the standard deviation not provided (deviation 0.4206). This scale value was between 1.81 and 2.60, which was at the lowest interval. The perception of high-performing students towards mathematics is more positive, while low-performing students perceive it negatively. Therefore, the students of Gimbo Secondary School have a negative perception towards learning mathematics.

From multiple linear regression analysis, the normal distribution of the dependent variable was between -3.29 and +3.29, with a skewness or kurtosis indicating a normal distribution (Tabochnick & Fidell, 2007). Therefore, the normality assumption was satisfied. From a multi-linear assumption, when a predictor variable has a strong linear association with other predictor variables, the associated VIF is large, indicating multicollinearity. When VIF is less than 10, there is no problem of multicollinearity (Keith, 2019). Therefore, the non-multi-collinearity assumption is met.

From the model summary, the R value indicates that students' perceptions of learning mathematics can explain changes in academic performance. The R-squared value, 0.583, indicates that there is a 58.3% relationship between the dependent variable and the independent variables. The adjusted R-squared value is found to be 57.3%. This value represents the strength of the regression model. As the p-value is significant for the multiple variables regression model, a larger regression coefficient results in a greater change in R-squared, a commonly used statistic to evaluate model fit. From the ANOVA result of the multiple regression output, the researchers have found that $F = 56.607$ and $p<.05$, which confirms that independent variables have a significant effect on the academic performance of students.

From the regression output of academic performance and predictors, the standardised coefficient values of beta are 0.328, 0.305, 0.304, and 0.235, which indicate that confidence in learning mathematics, difficulties in learning mathematics, belief about learning mathematics, and motivation in learning mathematics, respectively, have the highest effect on academic performance of students in mathematics. Moreover, the standardised coefficient values of beta, -0.184 and -0.126, which indicate interest in learning mathematics and teachers' teaching strategy of mathematics, respectively, negatively affect students' academic performance in mathematics. Moreover, the p-value of interest in learning mathematics, belief about learning mathematics, confidence in learning mathematics, motivation in learning mathematics, teachers' teaching strategy of mathematics and difficulties in learning mathematics was less than 0.05. All perception components were statistically significant.

Therefore, the formulated hypothesis stated that there is no statistically significant relationship between students' perception of mathematics and their academic performance in mathematics. This hypothesis was rejected, and the alternative hypothesis, which states that there is a statistically significant relationship, was accepted.

The independent sample T-test indicates that the selection of male and female samples from the population demonstrates their independence. That is, selecting females from one group does not influence the selection of males from another group. The data should have independence of observation. Moreover, a test of homogeneity compares the proportions of responses from two or more populations concerning variables with more than two outcomes. To test homogeneity, Levene's F test could be used. When the test for Levene's homogeneity of variance provides an F-statistic and a significant value greater than 0.05, the group variances can be treated as equal.

However, when the p-value is less than 0.05, the null hypothesis is rejected. Equal variances are not assumed, and the assumption of homogeneity of variances is violated. When the result of Levene's test for equality of variances becomes significant, the null hypothesis would be rejected, and the alternative hypothesis would be accepted. When the result of Levene's test for equality of variances is not significant, the null hypothesis is accepted and the alternative hypothesis is rejected (Field, 2016). In this case, the researchers do not accept the alternative hypothesis and accept the null hypothesis. Gender difference does not affect variation in mathematics (Manoah et al., 2011). Therefore, there is no statistically significant difference between the perceptions of male and female students.

Conclusion

Based on the findings of the study, the researchers concluded that students' perceptions influenced their academic performance. These perception elements were interest in learning mathematics, beliefs about learning mathematics, confidence in learning mathematics, motivation of students in learning mathematics, teachers' teaching strategy and difficulties in learning mathematics. The Likert mean score value of these elements was the lowest among the mean scale intervals. This indicated that students' perception of learning mathematics was negative. Moreover, the constraints were statistically significant and showed that 58.3% of the relationship between the perception of students and their academic performance was explained. The findings also show no statistically significant difference between the perceptions of male and female students. This indicated that both male and female students in this study have the same perception of learning mathematics.

6. Statement of Researchers

In this section, we are expected to declare the information regarding the titles given below.

Researchers' contribution rate statement:

Both authors have the same contribution to the preparation of this research.

Conflict statement

The authors confirm that there are no conflicts of interest. Furthermore, they have the publication rights to this article in the Pedagogical Perspective Journal.

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