The Performance and Mathematical Attitude of Analytic and Global Learners: A Comparative Study

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Abstract This study was conducted to identify performance and attitude of analytic and global learners towards mathematics. Performances in a research-made Achievement Test were determined according to their mean and standard deviation scores. Mean attitudes were interpreted as very positive, generally positive, neutral, slightly positive, and negative using the Fennema-Sherman Attitude Scale. On the basis of the mean and standard deviation score, it was found out that the global learners have slightly higher performance than the analytic learners. Their attitudes were both generally positive. However, it was observed that some analytic learners' attitudes towards mathematics were very positive. There is a significant difference in the performance and attitude towards mathematics of analytic and global learners. Moreover, the significant relationship existed between analytic students' performance and attitude towards mathematics. This is also true among global learners.

Keywords: performance, mathematical attitude, global and analytic learners, Fennema-Sherma Attitude Scale

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1. Introduction

Change is always a part of anybody's life. In this world of change, we may realize that mathematics is significant. Mathematics is present in many things and situations that we experience every day. We may also find mathematics in relation with these changes, which could influence us at any extent.

New trends and practices have been developed nowadays like methods and strategies in teaching which have been explored. These are used as tools in education, especially in teaching mathematics. On the part of the learners, effective learning does not solely depend upon these methods and strategies in teaching. The learners as individuals differ from each other must be considered for they are the center of the teaching-learning situation. Through their individual differences we can find answers on how to make the teaching-learning environment very effective by using appropriate teaching methods and strategies that best fit to these individual differences and eventually break the barriers for effective learning. It is in this view that change can be adopted, specifically in mathematics classes.

Students differ in their learning preferences. One dimension of learning style involves determining whether a child thinks more analytically or more globally. Some students, when studying, learn properly when they are alone in a quiet and brightly illuminated environment and doing one task at a time. These students are called analytic learners. Analytic learners tend to perceive things sequentially, that is, from specific ideas to a general idea. They work at a task until they have learned what they need and want or have accomplished what they set out to do. On the other hand, some students learn properly when studying with others in a softly illuminated environment while listening to the music and doing multiple tasks at a time. These students are called the global learners. Global learners tend to perceive things conceptually, that is, from general idea to specific ideas (Whitefield, 1995). They do take many breaks but, eventually, focus on the most salient points and get the task done.

Different concepts and ideas have been introduced in mathematics, which are particular or new to us. The way individuals apply these concepts in solving problems in mathematics depends upon how they perceive these concepts, associate these concepts to other ideas and relate these to their own experiences. Particular attention was given to identifying students as global or analytic and comparing their attitudes and performances in mathematics.

2. Statement of the Problem

This study aimed to compare the performance and attitude of analytic and global learners. Specifically, this study sought to answer the following questions.

1. What are the performances of analytic learners and global learners in the achievement test on circles?

2. What are the attitudes of analytic learners and global learners towards mathematics?
3. Is there a significant difference in the performance of analytic learners and global learners?
4. Is there a significant difference in the attitude of analytic learners and global learners?
5. Is there a significant relationship between the attitudes and performance of analytic learners and global learners?
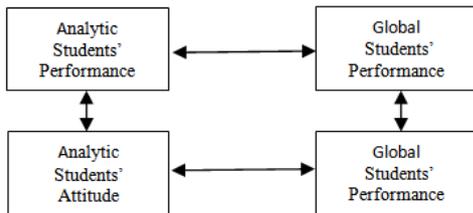
3. Conceptual Framework

Figure 1. Conceptual Paradigm of the Study

In order to identify the students as global or analytic learners, the researchers used the Brain Dominance Test, a revision of Luciano Mariani (1996). After identifying the students as analytic and global learners, the researchers measured their attitudes towards mathematics with the use of Fennema-Sherman Attitude Scale. The performances of global and analytic learners are compared as well as their attitudes in order to find out if there is a significant relationship between the performance and attitude of both learners.

4. Null Hypotheses

On the basis of the statements of the problem, this study attempted to test the following hypotheses at 0.05 level of significance.

H_{01}: There is no significant difference in the performance of analytic learners and global learners in the achievement test.

H_{02}: There is no significant difference in the attitude of analytic learners and global learners towards mathematics.

H_{03}: There is no significant relationship between the performance in the achievement test and attitude of analytic learner towards mathematics.

H_{04}: There is no significant relationship between the performance in the achievement test and the attitude and global learners towards mathematics.

5. Significance of the Study

To the students and teachers, this study is significant as this would bring them the awareness of the two kinds of learning preferences. This would lead them identify themselves whether analytic or global learners that would eventually guide them on improving their study habits. In addition, this study would also guide teachers on what strategies and methods of teaching to use in the class to balance effective learning for both analytic and global students. Also, this would make administrators aware that there exist students who are global learners and analytic learners. This serves as basis for teachers in undergoing training and workshop on teaching-learning strategies in mathematics classes.

6. Scope and Limitation of the Study

The study focused on identifying global and analytic students through the Brain Dominance Test, a revision of Luciano Mariani (1996) and on comparing their performance and attitude towards mathematics specifically on circles in geometry taught to Third Year (Grade 9) students of Iligan City National High School. The instruments used in this study were the Fennema-Sherman Attitude Scale that measures the attitude of students towards mathematics, the Brain Dominance Test and Achievement Test made by researchers which measures the students' performance.

7. Research Methodology

7.1 Subjects of the Study

The respondents of this study are the select section Dalton-28 students and section Rutherford- 24 students of the Science Curriculum in Iligan City National High School. Upon administering the Brain-Dominance Test to the two sections, there were only 12 global students identified. Since the researchers considered the comparison of performance and attitude of analytic students and global students, analytic learners were paired with the global learners through the scores they obtained, their gender, and section they belong. Lottery was done among the many possible analytical counterparts to choose the analytic student to be paired with the global student. Thus, there were also analytic students included in the study.

7.2. Research Design

The comparative research design is used in this study. The performance and attitude of global learners were compared to the performance and attitude of the analytic learners.

7.3. Instrument Used

There were three sets of questionnaires used in this study. First, the Brain Dominance Questionnaire that is slightly modified by the researchers. Second, the 32 -Item Achievement Test which measures the performance of the students. Third, the modified attitude scale adopted from the Fennema -Sherman's Attitude Scale which measures the attitude of respondents towards mathematics.

7.4. Statistical Tools

The Kolmogorov-Smirnov two-sample test was used in determining the significant difference of the performance and attitude of global and analytic learners. It is denoted by the formula:

$$D = \text{maximum}\left[\text{Sn1}(X) - \text{Sn2}(X)\right] \quad (1)$$

where

$S_{n1}(X)$ = proportion of the global student's performance
$S_{n2}(X)$ = proportion of the analytic student's performance

In finding the mean attitude rating (MR) of analytic and global learners.

$$\text{Mean Rating} = \frac{Ps + Ns}{2}. \quad (2)$$

For positive statements (P_s):

$$Ps = \frac{f_A(5) + f_B(4) + f_C(3) + f_D(2) + f_E(1)}{f_A + f_B + f_C + f_D + f_E} \quad (3)$$

where 5 is the numerical value for Strongly A, 4 for B, 3 for C, 2 for D, and 1 for E.

For negative statements:

$$Ns = \frac{f_A(1) + f_B(2) + f_C(3) + f_D(4) + f_E(5)}{f_A + f_B + f_C + f_D + f_E} \quad (4)$$

where 1 is the numerical value for A, 2 for B, 3 for C, 4 for D and 5 for E.

Below is the numerical scale table of the mean rating of the attitudes of analytic and global learners.

Table 1. Numerical Scale and Its Description

Interval	Description
4.20 – 5.00	Very Positive
3.40 – 4.19	Generally Positive
2.60 – 2.59	Neutral
1.80 – 2.59	Slightly Positive
1.00 – 1.79	Negative

In determining the relationship between the attitudes and performance of analytic learners and global learners, the Spearman Rank Correlation (r_s) is used.

$$r_s = 1 - \left[\frac{6\sum_{i=1}^{} d_i^2}{N^3 - N}\right]. \quad (4)$$

The interpretation of correlation coefficient r_s is as follows.

r_s	Interpretation
0.8 and above	High
0.31- 0.79	Moderate
0.3 and below	Low

The t- test is also used to determine the significance of r_s.

$$t = r_s \sqrt{\frac{N-2}{1-r_s^2}}. \quad (5)$$

8. Results and Discussions

The discussions that follow deal with the presentation, analysis and interpretation of the results gathered. The results are shown in tables followed by discussions and interpretation based on the statements of the problem.

The performance of analytic and global learners in the Achievement test is shown in Table 2. The perfect score in the Achievement test 32. The mean performance of analytic learners is 20.25 with a standard deviation of 2.57. On the other hand, the mean performance of global learners is 23.83 with a standard deviation of 1.85. It implies that the global learners have slightly higher mean performance than the analytic learners. Also, the standard deviation of the global learners pointed out that their performances do not vary very much compared to the performances of analytic learners, which means that global learners are grouped homogeneously as compared to the analytic group of learners.

Table 2. Performance of Analytic and Global Learners in the Achievement Test

Student's Pair Number	Performance in the Achievement Test	
	Analytic	Global
1	21	26
2	20	21
3	23	22
4	22	26
5	20	23
6	20	25
7	19	24
8	26	24
9	17	25
10	18	26
11	17	21
12	20	23
Mean	20.25	23.83
Standard Deviation	2.57	1.85

Table 3. Attitude Ratings of Analytic and Global Learners

Pair Number	Respondents' Attitude Rating with Equivalent Interpretation			
	Analytic	Interpretation	Global	Interpretation
1	3.73	Generally Positive	3.31	Generally Positive
2	4.14	Generally Positive	3.42	Generally Positive
3	3.97	Generally Positive	3.64	Generally Positive
4	3.84	Generally Positive	3.64	Generally Positive
5	3.50	Neutral	3.20	Neutral
6	4.61	Very Positive	3.53	Generally Positive
7	4.00	Generally Positive	3.50	Generally Positive
8	4.69	Very Positive	3.42	Generally Positive
9	4.59	Generally Positive	3.45	Generally Positive
10	3.64	Generally Positive	4.00	Generally Positive
11	3.53	Generally Positive	4.14	Generally Positive
12	4.25	Very Positive	3.53	Generally Positive
Mean	3.93	Generally Positive	3.56	Generally Positive
Standard Deviation	0.43		0.27	

In Table 3, the attitudes of both global and analytic respondents are generally positive towards mathematics. Moreover, it can be noted that 25% of the analytic respondents have very positive attitude towards mathematics. One-sixth of the global respondents have neutral attitude towards mathematics.

Table 4. Comparison of the Analytic and Global Performances in the Achievement Test

Interval of Performance	Observed Cumulative Performance		Cumulative Absolute Difference
	Analytic	Global	
17 – 18	3/12	0/12	3/12
19 – 20	8/12	0/12	8/12
21 – 22	10/12	3/12	7/12
23 – 24	11/12	7/12	4/12
25 – 26	12/12	12/12	0/12

Kolmogorov- Smirnov Test `
      Computed value (mnDm, n)   = 96*
      Critical value at 0.05 level of significance = 84
            where n = m = 12

H_{01}: There is no significant difference in the performance of analytic and global learners in the achievement test

Table 4 shows the comparison of performances of analytic and global learners. The Kolmogorov- Smirnov test was used for comparison since there were only 12 analytic and 12 global respondents identified and these numbers are less than 25. The largest cumulative difference (Dm, n) as indicated in the table is 0.67. The observed or computed Kolmogorov value in (mnDm, n) is equal to 96. The critical value at 0.05 level of significance is 84. At 5% level of significance, the critical value of 84 is less than the computed value of 96. At this level of significance, the null hypothesis of no significant difference is rejected. This means that there is a significant difference in the performance of global and analytic respondents.

Table 5. Comparison of Attitudes of the Analytic and Global learners towards mathematics

Interval of Rating	Observed Cumulative Ratings		Cumulative Absolute Difference
	Analytic	Global	
3.195 – 3.445	1/12	5/12	4/12
3.446 – 3.695	4/12	10/12	6/12
3.696 – 3.945	6/12	0/12	6/12
3.946 – 4.195	9/12	12/12	3/12
4.196 – 4.445	10/12	0/12	10/12
4.446 – 4.695	12/12	0/12	12/12

Kolmogorov- Smirnov Test
      Computed value (mnDm, n)   = 144*
      Critical value at 0.05 level of significance = 84
            where n = m = 12

H_{02}: There is no significant difference in the attitudes of analytic and global learners towards mathematics.

Table 5 presents the comparison between the attitudes of analytic and global learners towards mathematics as measured by using the Fennema and Sherman Attitude Scale. Upon application of Kolmogorov-Smirnov test, the

maximum or largest difference between the observed cumulative ratings in (Dm, n) is equal to 12/12 or 1. Thus, (mnDm, n) is equal to 144 since m = n = 12 (the number of analytic learners is equal to the number of global learners). It reveals that the critical value is 84 at 0.05 level of significance. Since the observed value is 144 which exceeds the critical value, the null hypothesis of no significant difference in the attitudes of analytic and global learners towards mathematics is rejected. This implies that the attitude of analytic learners is significantly different from the attitude of the global learners.

Table 6. Relationship Between the Performance Scores and Attitude Ratings of Analytic Learners

Analytic Learners	Performance		Attitude	
	Scores	Rank	Ratings	Rank
1	21	9	3.73	5
2	20	6.5	4.14	9
3	23	11	3.97	7
4	22	10	3.84	6
5	20	6.5	3.50	1
6	20	6.5	4.61	11
7	19	4	4.00	8
8	26	12	4.69	12
9	17	1.5	3.59	3
10	18	3	3.64	4
11	17	1.5	3.53	2
12	20	6.5	4.25	10

Spearman Rank Order Correlation Coefficient
      Computed r_s value   = 0.513*
      Critical value at 0.05 level of significance = 0.576

Ho_3: There is no significant relationship between the performance in the achievement test and the attitude of analytic learners towards mathematics

The association between the performance and attitude of analytic learners is shown in table 6. Upon application of Spearman Rank Order Correlation Coefficient, the computed r_s value is 0. 513. This shows moderate positive relationship (Downie and Health, 1974. P.97) exists between the performance score and attitude ratings of analytic learners. The moderate association, however, is not significant at 5% level since the computed r_s value of 0.513 is lesser than the critical value of 0.576. Thus, the performance scores of the analytic learners have moderate relationship with their attitude towards mathematics; however, this relationship is not significant at 0.05 level.

H_{o4}: There is no significant relationship between the performance in the achievement test and the attitude of global learners towards mathematics

The relationship between global learners' attitude towards mathematics and performance in the achievement test is presented in Table 7. The computed Spearman Rank Order Correlation Coefficient is -0.021. This means that the performance of the global respondents in the achievement test is slightly and negatively related to the attitude towards mathematics. Moreover, the relationship is not significant at 5% level. This further implies that global learners in this study achieved high even if some have neutral (passive) attitude towards mathematics.

Table 7. Relationship Between the Performance Scores and Attitude Ratings of Global Learners

Analytic Learners	Performance		Attitude	
	Scores	Rank	Ratings	Rank
1	26	11	3.31	2
2	21	1.5	3.42	4
3	22	3	3.64	9.5
4	26	11	3.64	9.5
5	23	4.5	3.20	1
6	25	8.5	3.53	7.5
7	24	6.5	3.50	6
8	24	6.5	3.42	3
9	25	8.5	3.45	5
10	26	11	4.00	11
11	21	1.5	4.14	12
12	23	4.5	3.53	7.5

Spearman Rank Order Correlation Coefficient
Computed r_s value $= -0.021*$
Critical value at 0.05 level of significance $= 0.576$

9. Findings and Conclusions

Based on the analysis of the data gathered, the following findings and conclusions were drawn.

1. The global learners have slightly higher performance in the achievement test than the analytic learners.
2. Both the analytic and global learners have generally positive attitude towards mathematics. 25% of analytic learners have very positive attitude towards mathematics while 17% of global learners are neutral.
3. There is a significant difference in the performance of analytic and global learners.
4. There is a significant difference in the attitude of analytic and global learners.
5. There is a significant relationship between the attitude and performance of analytic learners however, the relationship is moderately positive. On the other hand, the performance of global learners in the achievement test is negatively related to their attitude, which implies that the global learners achieved high but have neutral attitude towards mathematics.

10. Recommendations

1. The results of the study revealed that the global learners have slightly higher performance than the analytic learners. It is recommended that a future study be made to look into the factors that have brought about the slightly significant difference, like, guidelines or techniques for teaching the analytic and global learners.

2. This study showed that some global learners have neutral attitude towards mathematics. It is recommended that teachers of these learners provide ways of modifying these neutral attitudes to positive ones.
3. There is a negative relationship between the achievement and attitude towards mathematics among global learners. Thus, it is recommended that a follow-up study should be done to determine reasons or causes for such negative relationship.
4. It is also recommended for the teachers to determine the individual differences of students through a Brain-Dominance Test in order to plan teaching strategies and teaching materials that help enhance the learning capacity of the students in mathematics.
5. Moreover, a wider scope of study to be conducted in all year levels to verify Whitefield statement regarding the percentage growth of analytic students as the year level progresses is recommended.
6. Finally, it is recommended that some poor and fair items be subjected to revisions before they any further study on achievement test be conducted.

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