

Pre-service Early Childhood Teachers' Attitude Towards Mathematics: A Jamaican Inquiry

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The purpose of the study was to evaluate Jamaican early childhood pre-service teachers' attitudes towards mathematics. The study is designed according to the quantitative survey model in the descriptive type. In this study, a modified version of the Fennema-Sherman mathematics attitude scale was used to measure the mathematics attitude of 144 early childhood pre-service teachers in four different categories of the attitude scale (mathematics usefulness, confidence in learning mathematics, mathematics anxiety, and mathematics motivation). The data were collected from participants in the five teachers' colleges that offer the early childhood education program in Jamaica. The findings revealed that Jamaican early childhood pre-service teachers generally have a more positive attitude towards mathematics. A comparison among the different year groups revealed that a significantly greater percentage of the Year two group of participants possessed a more positive mathematics attitude than the other year groups. A significantly higher percentage of the Year three group indicated that they do not want to teach the subject in the future. The findings have implications for the teaching and learning of mathematics in the early childhood education program in Jamaica and, by extension, the teaching and learning of mathematics at the early childhood level of the education system.

Keywords: attitude towards mathematics, early childhood pre-service teachers, mathematics attitude scales

Introduction and Literature Review

In recent years, policymakers in the education circle have begun to show a significant growing interest in teacher qualifications to improve school quality and students' learning outcomes (Organization for Economic Co-operation and Development [OECD], 2016). In Jamaica, it was not until recent years that the decision was made to have early childhood trainee teachers acquire additional mathematics courses in their training. This came as a result of policymakers recognizing the need for early childhood teachers to be more knowledgeable in mathematics in order for them to better educate the nation's children at that level of the education system. According to Guerriero (2014), the most crucial indicator of teacher qualification is their pedagogical knowledge. It has become necessary, however, not only to consider teachers' pedagogical content knowledge, but it has also been accepted that teachers' attitudes towards their subject area is an important determinant for the teacher qualification (McLeod, 1992). The aim of this study was to evaluate Jamaican early childhood

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pre-service teachers' attitudes towards mathematics and mathematics teaching. Among the research on the affective domain, teachers' mathematics attitude has perhaps the longest history and the highest popularity in mathematics education (Zan, Brown, Evans, & Hannula, 2006). According to Ma and Kishor (1997), many researchers have shown that students' attitude towards mathematics is one of the most important factors relating to their achievement in the subject. Teachers' attitude towards mathematics and the teaching of mathematics is considered to be very important, because there is a relationship between their practice in the teaching and learning process and their attitude towards the subject (Ernest, 2004). A number of studies have reported that the mental, physical, and social development of children can be quite rapid during their early years of development. As a result, the development during early childhood and primary education period is particularly important for the future of the children. It is for these reasons that Frakes and Kline (2000) made the point that teachers who teach in the early years of schooling have a powerful impact on the mathematics achievement of children. The quality of teaching in mathematics and the nature of teachers' attitudes towards the subject seem to have a direct influence on students' attitude towards the subject and eventually also on their achievement. Yara (2009) confirmed that teachers with positive attitudes towards the subject stimulate favorable attitudes in their students. Earlier, Henderson and Rodriques (2008) regarded the main source of negative students' attitudes towards mathematics as inappropriate teaching practices and teacher attitudes. Ma and Wilkins (2002) put the vital role of teacher attitudes into perspective, by stating that students who believe that teachers have high expectations of them tend to have a more positive attitude towards mathematics. Pre-service teachers' attitudes towards mathematics influence their approach to their own teaching (during training), how they might teach during their first few years as teachers, as well as the nature of the initial teaching and learning culture in the classroom (Amato, 2004). Measuring students' or pre-service teachers' mathematics attitude is not the solution of the problem of underachievement in the subject. In addition to measuring attitudes towards mathematics, the factors that influence attitudes towards mathematics should also be investigated. If the main idea is to change attitude towards mathematics in a positive direction, it is necessary to know the influencing factors on attitude. According to Nicolaidou and Philippou (2003), these manipulative factors is identified under three main groups: factors related to personal characteristics, factors related to the school environment, and the home environmental factors and society. Considering the research literature about the attitude towards mathematics, mentioned above, the purpose of the research was to evaluate Jamaican early childhood pre-service teachers' attitudes towards mathematics. For this purpose, the following research questions are determined:

1. What is Jamaican pre-service early childhood teachers' overall attitudes toward mathematics?
2. Are there significant differences among the categories of the mathematics attitude for Jamaican pre-service early childhood teachers?
3. Are there significant differences in the mathematics attitude among the different year groups of Jamaican pre-service early childhood teachers?

Study Design

The present study is a quantitative study using the survey design. The survey design enables the quantitative or numerical description of data in a population by studying a sample selected within the population (Creswell, 2014).

Participants

The study measured the mathematics attitude of 144 pre-service early childhood teachers from the five teacher training colleges in Jamaica that offer the early childhood education program. The 144 pre-service early childhood teachers ages ranged from 17 to 40 years old and accounted for approximately 90% of all the pre-service teachers from four different year groups (Years one to four).

Instruments, Reliability, and Data Analysis

The data used in this study were collected using a modified version of the Fennema-Sherman Mathematics Attitude Scale (FSMAS). The original version of the FSMAS (Fennema & Sherman, 1976) comprises of nine subscales of 12 items each (making 108 items in total). These subscales assess:

- (1) attitudes towards success in mathematics;
- (2) mathematics as a male domain;
- (3) confidence in learning mathematics;
- (4) mathematics anxiety;
- (5) effectance motivation;
- (6) usefulness of mathematics;
- (7) mother perception;
- (8) father perception;
- (9) teacher perception.

On the other hand, the modified version consists of four out of these nine subscales. They are:

- (1) confidence in learning mathematics scale;
- (2) usefulness of mathematics scale;
- (3) mathematics as a male domain scale;
- (4) teacher perception scale.

The modified instrument used in this study (see Appendix) consists of 40 statements and was divided into four categories—usefulness of mathematics, confidence in learning mathematics, mathematics anxiety, and mathematics motivation. Each category of the attitude scale consisted of 10 statements. The SPSS software was used to determine the reliability of the instrument. Table 1 shows the reliability measures of the instrument used in the study.

Table 1

Cronbach Alpha Reliability Coefficients for the Mathematics Attitudes Scale

Categories of Attitude	Coefficients
Overall Coefficient (40 items)	0.90
Mathematics usefulness (10 items)	0.71
Confidence in learning mathematics (10 items)	0.74
Mathematics anxiety (10 items)	0.75
Mathematics motivation (10 items)	0.82

Results

The results of this study are presented and discussed based on the research questions.

Results Based on Research Question 1

The first research question speaks to the overall mathematics attitude of Jamaican pre-service early childhood teachers. Table 2 shows the overall measures of the mathematics attitude for Jamaican pre-service early childhood teachers. The results revealed that 74% of Jamaican pre-service early childhood teachers have a positive to very positive attitude towards mathematics. The majority of pre-service early childhood teachers in Jamaica indicated a positive attitude towards mathematics.

Table 2

Overall Mathematics Attitude of Jamaican Pre-service Early Childhood Teachers

Mathematics attitude measures	Percentage (%) of Jamaican pre-service early childhood teachers
Positive to very positive mathematics attitude	74
Negative to very negative mathematics attitude	26

Results Based on Research Question 2

The second research question speaks to the differences among the categories of pre-service early childhood teachers' attitudes towards mathematics. As was explained earlier, the mathematics attitude scale consisted of four categories of attitude—mathematics usefulness, confidence in learning mathematics, mathematics anxiety, and mathematics motivation.

Testing for Significant Differences Among the Categories of Attitude

As part of the analysis of the data in relation to Research Question 2, the data were first examined to determine if they were normally distributed. The Kolmogorov-Smirnov Test (K-S) was used to test for the normality of the data. The results showed that the K-S $Z = 0.95$ with Significance = 0.063. This indicated that the data were normally distributed. As a result of the data being normally distributed, the paired sample t-test (at $p < .05$) was used to determine whether the mean scores in each category of the attitude scale differed significantly among each other. The results showed that there was a significant difference in the scores between the Mathematics Usefulness category and the category of Confidence in Learning Mathematics ($t = 15.314$, $p = 0.01$, $p < 0.05$). The mean score for the Mathematics Usefulness category = 42.3 and the mean score the Confidence in Learning Mathematics = 32.9. The t-test results were similar consistently when the Mathematics Usefulness category was compared with all the other categories of the scale. The results showed no significant difference among the categories of Confidence in Learning Mathematics, the Mathematics anxiety, and the Mathematics motivation

Table 3

Mathematics Attitude for Jamaican Pre-service Early Childhood Teachers in Each Category of the Attitude Scale

Categories of mathematics attitude	Percentage (%) of Jamaican pre-service early childhood teachers with positive attitude
Mathematics usefulness	99.7
Confidence in learning mathematics	69
Mathematics anxiety	60
Mathematics motivation	65

Table 3 shows the measures of attitude for Jamaican pre-service early childhood teachers in each category of the attitude scale. The results in Table 3 revealed that 99.7% of the pre-service teachers have a positive to very positive attitude towards the usefulness of mathematics. This is significantly higher in relation to the measure of their attitude in all the other categories. The results for the other three categories are not alarmingly

different from each other, with the percentage of participants having a positive attitude towards each of the category ranging from 60% to 69%.

Results Based on Research Question 3

The third and final research question addressed the differences in the mathematics attitude among the different year groups of pre-service early childhood teachers. Figure 1 shows the mathematics attitude results each year group of Jamaican pre-service early childhood teachers. The results in Figure 1 speak specifically to those pre-service teachers with a positive attitude towards mathematics. The results show that the Year two group of pre-service teachers has a significantly greater percentage of teachers with a positive attitude towards mathematics compared to the other year groups. The results showed no significant difference among Years one, three, and four groups.

To determine whether the mean mathematics attitude scores differed significantly among the different year groups of pre-service teachers, the independent sample t-test (at $p < .05$) was used to analyse the data. The results showed that there was a significant difference in the mathematics attitude scores between the Year two and the Year one group of pre-service early childhood teachers ($t = 2.415$, $p = 0.024$, $p < 0.05$). The mean score for the Year two group = 145.9 and the mean score the Year one = 137.4. The t-test results were consistently similar when the mean scores of the Year two group was compared with all the other year groups. Further analysis using the t-test showed no significant difference among Years one, three, and four scores based on their responses to the mathematics attitude scale.

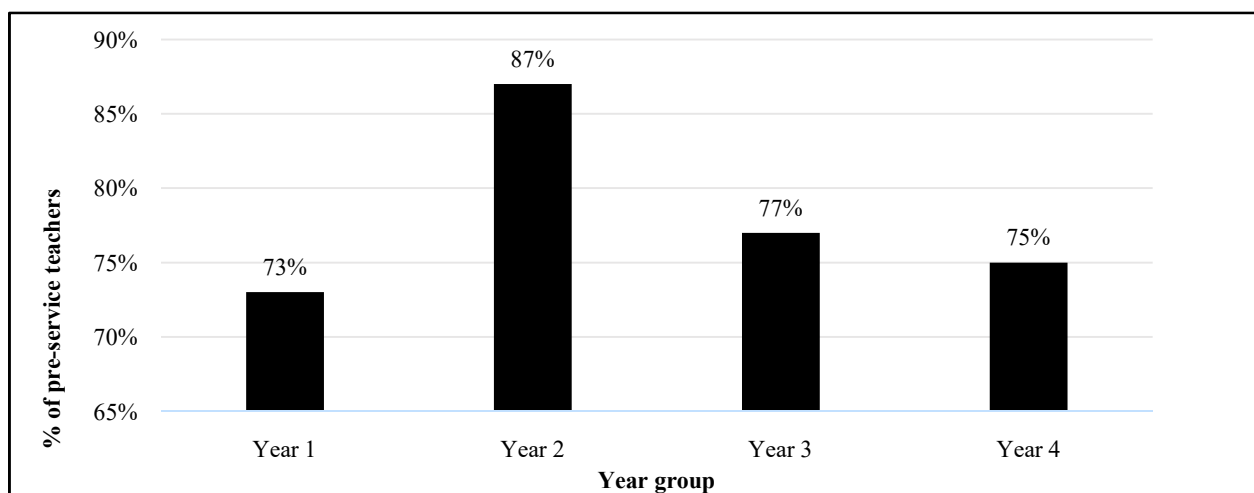


Figure 1. Comparison of Jamaican pre-service early childhood teachers' mathematics attitude by year groups.

Categories of Attitude

A comparison was also made among the different categories of attitude, based on the responses from the different year groups of pre-service teachers. Table 4 shows the percentage of pre-service early childhood teachers in the different year groups having a positive attitude in the different categories of the attitude scale. A comparison among the different year groups reveals that there is no notable difference among the different year groups in their attitude towards the usefulness of mathematics. The statistics in Table 4 shows that practically all the pre-service teachers in each year group possess a positive attitude towards the usefulness of mathematics.

With regards to the category of confidence in mathematics, the measure of attitude for the Year one group is comparatively different from the other year groups. A much lower percentage of the Year one group of

pre-service teachers are confident in learning mathematics compared to the other year groups. There is no major difference among the Years two, three, and four groups of pre-service teachers in terms of their confidence in learning mathematics.

The mathematics anxiety category shows a similar pattern as that of confidence in mathematics. A comparatively higher percentage of the Year one group of pre-service teachers (53%) are anxious about mathematics, relative to the other year groups. There is, however, no major difference among the Years two, three, and four group of pre-service teachers in terms of their anxiety about mathematics.

As to the level of motivation among the different year groups, Table 4 shows that a comparatively higher percentage of Jamaican pre-service teachers in the Year two group are motivated in learning mathematics relative to the other year groups. Note is also taken of the fact that a much lower percentage of the Year four group (50%) of pre-service teachers are motivated about mathematics relative to the other year groups.

Table 4

Comparison of the Different Categories of Mathematics Attitude Among Different Year Groups of Jamaican Pre-Service Early Childhood Teachers

Categories of attitude	Year one (%)	Year two (%)	Year three (%)	Year four (%)
Mathematics usefulness	100	98	100	100
Confidence in learning mathematics	57	77	77	75
Mathematics anxiety	47	70	66	60
Mathematics motivation	67	79	65	50

Analysis of a Specific Items Relating to Jamaican Pre-Service Early Childhood Teachers' Mathematics Attitude

The study conducted a further analysis with two items on the mathematics attitude scale. One such item is Item 39 and was measured under the motivation category. The statement was: "I am interested and willing to acquire further knowledge of mathematics".

The overall results based on all the pre-service teachers' responses to this item showed that 17% are not interested and willing to acquire further knowledge of mathematics, 15% of them are undecided, and 68% are interested and willing to acquire further knowledge of mathematics. In addition to the overall results, the study also analyzed the responses to the statement for each year group of pre-service teachers. Table 5 shows the responses of pre-service teachers for each year group in the study. A comparison among the different year groups shows that a comparatively higher percentage of the Year four group of pre-service teachers are not interested and willing to acquire further knowledge of mathematics.

Table 5

Jamaican Pre-service Early Childhood Teachers' Response Result for the Statement: I Am Interested And Willing to Acquire Further Knowledge of Mathematics

Year groups	Strongly agree/Agree (%)	Undecided (%)	Strong disagree/Disagree (%)
Year one	78	6	16
Year two	70	16	14
Year three	61	27	12
Year four	45	20	35

Another of the items analysed from the mathematics attitude scale was: “I do not want to teach mathematics in the future”. The overall results based on all the pre-service teachers’ responses to this item showed that 36% do not want to teach mathematics, 20% of them are undecided, and 44% responded that they want to teach the subject in the future. Three percent of the teachers did not respond to the item. In addition to the overall results, the study also analyzed the responses to the statement for each year group of pre-service teachers. Table 5 shows the responses of pre-service teachers for each year group in the study. A comparison among the different year groups shows that a significantly higher percentage of the Year one and Year three groups of pre-service teachers do not want to teach mathematics in the future.

Table 5

Jamaican Pre-service Early Childhood Teachers’ Response Result for the Statement: I Do Not Want to Teach Mathematics in the Future

Year groups	Strongly agree/Agree (%)	Undecided (%)	Strong disagree/Disagree (%)
Year one	45	13	42
Year two	28	17	55
Year three	42	8	50
Year four	30	30	40

Conclusions

The following conclusions were made based on the findings of the study:

1. A comparatively higher percentage of Jamaican pre-service early childhood teachers have a positive to very positive attitude towards mathematics.
2. A comparatively higher percentage of Year two pre-service early childhood teachers have a positive attitude towards mathematics compared to all other year groups.
4. The Year one group of pre-service early childhood teachers are the least confident and the most anxious in terms of the teaching and learning of mathematics.
5. A considerable percentage of Jamaican pre-service early childhood teachers do not want to teach mathematics in the future.

Further Discussion and Implications The findings of the study showed that the greater majority of Jamaican pre-service early childhood generally have a positive to very positive attitude towards mathematics. There is, however, still a concerning percentage of the pre-service teachers who have a negative to very negative attitude towards the subject. When the various categories of the mathematics attitude scale are analysed, the findings revealed that most of the pre-service teachers are of the view that mathematics is a useful subject. However, an average of approximately 35% of the teachers have a negative to a very negative view based on their responses to the items measuring their confidence in learning mathematics, their mathematics anxiety, and how motivated they are to learn and teach the subject. The analysis of some specific items on the mathematics attitude scale provided more precise information on Jamaican pre-service early childhood attitude towards mathematics. The study revealed that a concerning percentage (35%) of Jamaican year four pre-service early childhood teachers are not interested in acquiring further knowledge in mathematics. This is coupled with the findings that 42% of year three, and 30% of year four of Jamaican pre-service early childhood teachers do not want to teach the subject after completing their training. The findings of this study could have far reaching

implications for the teaching and learning of mathematics in Jamaica. A number of possible implications based on the findings of the study are listed below:

1. A positive attitude towards mathematics has been proven to be good for the teaching and learning for the subject. Teachers with a positive attitude towards the teaching and learning of mathematics are better able to positively impact students' learning outcome. While there is a concerning percentage of Jamaican early childhood pre-service teachers who presently have a negative to very negative attitude towards mathematics, a greater percentage generally have a positive attitude towards. It is the hope that can positively impact learning and performance in the future.

2. There are greater concerns for per-service teachers with a negative attitude towards the subject. A negative attitude towards the teaching and learning of mathematics, especially at the early childhood or primary stage could adversely effects mathematics learning at that level. Any negative experience at that stage of children's learning are sometimes carried on into the future. A negative attitude on the part of the teacher can result in a negative attitude on the part of the students.

3. The study revealed a concerning number of pre-service teachers who are reluctant to teach the subject after they have completed their training. It is quite possible that if these teachers enter the profession with this view about the teaching of mathematics at the early childhood level, they may indeed teach very little or nothing in the that subject. There is a serious risk of some children being deprived of the mathematics learning experience that they need at that early and critical level of their education. This could pose further problems for mathematics learning in their future life.

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Appendix

The Mathematics Attitude Scale

Instructions

Place a tick in the appropriate box below.

Year: 1 ☐ 2 ☐ 3 ☐ 4 ☐

Gender: Male ☐ Female ☐

Age Group: 16-25 ☐ 26-35 ☐ 36-45 ☐

This Mathematics Attitude Scale consists of 50 statements about how you feel or think about the teaching and learning of mathematics. If you Strongly Agree with a statement, place a tick under SA; if you just Agree, place a tick under A; if you are Undecided, place a tick under U; if you Disagree, place a tick under D; if you Strongly Disagree, place a tick under SD. Do not write your name.

No.	Item	SA	A	U	D	SD
1	Knowing mathematics will help me earn a living.					
2	Math will not be important to me in my life's work.					
3	I will not need mathematics for my future work.					
4	I do not expect to use much math when I get out of college.					
5	Math is a worthwhile, necessary subject.					
6	Taking math is a waste of time.					
7	I will use mathematics in many ways as an adult.					
8	Doing well in math is not important for my future.					
9	I study math because I know how useful it is.					
10	Mathematics teaches a person how to think.					
11	I am sure that I can learn math.					
12	I do not think I could do advanced math.					
13	I am sure of myself when I do math.					
14	Math has been my worst subject.					
15	I think I could handle more difficult math.					
16	Most subjects I can handle, but I just cannot do a good job with math.					
17	I can get good grades in math.					
18	I know I cannot do well in math.					
19	I am sure I could do advanced work in math.					

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- 20 I'm no good in math.
- 21 The fear of mathematics makes me not want to attend or participate in class.
- 22 I do not feel nervous when learning mathematics because it will help in dealing with daily situations.
- 23 Mathematics makes me feel nervous.
- 24 Mathematics is one of my most feared subjects.
- 25 I do not get frustrated when trying to do mathematics.
- 26 I have usually been at ease during math courses.
- 27 I get a sinking feeling when I think of trying hard math problems.
- 28 I am frequently lost and have trouble keeping up in my math classes.
- 29 My mind goes blank and I am unable to think clearly when doing mathematics.
- 30 I generally have had difficulty relating new mathematical concepts to those I had previously learned.
- 31 I do not want to teach mathematics in the future.
- 32 It would not bother me at all to take more math courses.
- 33 I look forward to teaching mathematics in the future.
- 34 When I had trouble with a concept I usually gave up and stopped trying.
- 35 I enjoy going beyond the assigned work and trying to solve new problems in math.
- 36 Mathematics is enjoyable and stimulating to me.
- 37 I have never liked mathematics, and it is my most dreaded subject.
- 38 Mathematics is dull and boring because it leaves no room for personal opinion.
- 39 I am interested and willing to acquire further knowledge of mathematics.
- 40 There is nothing creative about mathematics; it is just memorizing formulas and things.
-