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Determinants of Success in Foundation Mathematics: Examining Demographic and Academic Influences on Pre-trained Teachers' Performance

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Abstract: ***This study investigated demographic, academic, and instructional factors associated with pre-trained teachers' performance in Foundation Mathematics at a teachers' college in Jamaica. A quantitative survey design was used with 35 participants, and data were collected using a structured questionnaire. Associations between age, gender, prior mathematical knowledge, and examination performance were examined using cross-tabulations and chi-square tests, while students' perceptions of teaching methods were summarized descriptively. Age and gender were not significantly associated with performance, whereas prior mathematical knowledge, measured by CSEC Mathematics grades, showed a significant association with Foundation Mathematics performance. Participants expressed strong preferences for cooperative learning activities, worksheets, problem-solving activities, and direct discovery. The findings support continued use of these instructional approaches together with appropriate guidance, mentoring, and time-management support for new cohorts of pre-trained teachers. The findings should be interpreted within the context of the small, single-institution sample.***

Keywords: performance of pre-trained teachers, Foundation Mathematics, age, gender, prior mathematical knowledge, teaching methods

1. Introduction

Effective mathematics teaching has been the subject of many discussions considering the underperformance of students in Mathematics at various levels of the educational system in Jamaica. In the Caribbean Secondary Education Certificate (CSEC), mathematics examination of May 2025, it is reported that 44% of Jamaican students in public schools, who sat the examination, were successful [1]. In 2024, the pass rate was 38.9% [2]. A similar pass rate was seen in 2022 with 37.3% [2]. In 2023, due to discrepancies with the examination, only paper 1 and the School Based Assessment (SBA) grades were used. This resulted in a pass rate of 45% as published by the Ministry of Education, Skills, Youth & Information, Jamaica [3]. There have been many initiatives that have been implemented or will be implemented by the education ministry in Jamaica, different agencies or organizations, with a view of improving the mathematics educational outcomes. In 2021, the Mathematics Enhancement Programme (MEP) was introduced to two primary schools who had students who were underperforming in Mathematics and had no mathematics coaches [4]. The result of this intervention was that "the implementation of the MEP has had a substantial positive impact on students' attainment in Mathematics" [4]. The Reskilling Teachers Using Artificial Intelligence (AI) in STEM Education (RAISE) is the latest such initiative by the MoESYI. This pilot project will be implemented in both primary and secondary schools and will involve infusing Science Technology Engineering Art Mathematics (STEAM) methodologies into the classroom setting [5].

Teacher education in Jamaica is guided by both the MoESYI, the Joint Board of Teacher Education (JBTE) and the Teachers Colleges across the island. There is also a consortium of the eight teachers' colleges in Jamaica, called the Teachers' Colleges of Jamaica (TCJ), which, in addition to other roles, plans and executes competitions among the teachers' colleges. These organizations set the parameters of governance for the teachers' colleges. According to 'The National Mathematics Policy Guidelines' set by the MoESYI, teachers of mathematics at the primary level of the education system as well as at the secondary level should have "a sound understanding of the mathematical content needed to teach at the level to which they are assigned" [6].

Foundation Mathematics is a compulsory first year course pursued by all students in the Bachelor of Education secondary double and single option mathematics course at one of the Teachers' Colleges across Jamaica. This course is a pre-requisite for all other mathematics courses and in particular, College Algebra, Statistics and Probability 1 and Pre-Calculus. Hence, Foundation Mathematics is taught in the first semester of first year for all secondary mathematics double option or single option students. The content of this course includes topics in the CXC CSEC syllabus as well as topics in the CXC Caribbean Advanced Proficiency Examination (CAPE) syllabus. As the name suggests, Foundation Mathematics provides a solid ground or base on which students will build their knowledge and skills for the future. This will ensure that, the students who enter the teacher training institution with a CSEC grade of one or two, and who will be teaching at grades seven to eleven in the future, are equipped with "a sound understanding of the

mathematical content needed to teach at the level to which they are assigned" [6]. Additionally, the course introduces students to some of the methodologies of teaching mathematics. These include the constructivist approach, the discovery learning approach and the cooperative learning approach. Foundation Mathematics sets the foundation for higher mathematics. Failure in this course will, in the long term, lead to students not being allowed to complete the Bachelor of Education mathematics degree programme. However, failure in the short term, will not prevent students from moving to the next year as re-sit, another opportunity to do the course again, is available in the summer or the following academic year. Nevertheless, student teachers begin their teaching practicum in semester two of year one. In this practicum, student teachers will be interacting with adolescent children aged twelve to eighteen. Although the student teachers are required to observe a classroom setting with student-teacher interactions, at times they are required to either teach a lesson, assist in teaching a lesson or mark students' homework. . This then augurs well for these student teachers to be fully prepared while on practicum. The pass rates for Foundation Mathematics have fluctuated over the years. What factors have caused this fluctuation in the pass rates over these years? According to Mazana et al. [7], there are many factors that can influence mathematics pass rates in students. These include teacher, school and student factors. Among the student factors is the students' attitude towards learning mathematics. Saha [8] also suggested that self-motivation is a critical determination of student success in mathematics. Mazana et al. [7] further states that the effect of attitude can be positive or negative. Teacher factors such as teacher characteristics and teaching methods [9], teacher-student relationship [10], competency and teaching approaches and demographic factors such as age and gender can also affect students' performances [11].

Problem Statement

Foundation Mathematics is a course offered across the teachers' colleges which hopes to extend students' knowledge of the fundamentals or concepts in mathematics, by capturing previous CXC, CSEC and CAPE mathematical knowledge and making connections to more advanced formal mathematics. It is, therefore, a critical course which students must succeed in to receive a Bachelor of Education degree in Mathematics Education. Currently the percentage of students passing Foundation Mathematics is 73%. The problem is increasing the pass rate of Foundation Mathematics to 85% in the next academic year.

Purpose of the Study

The purpose of this study was to investigate pre-trained teachers' performance in Foundation Mathematics. Specifically, the study will ascertain the role that age, gender and prior mathematical knowledge, in the form of students' CSEC and/or CAPE mathematics grade, have on their overall performance in Foundation Mathematics. Additionally, the study aims to determine if students' preference for specific methods of teaching impact their overall performance in Foundation Mathematics.

Significance of the Study

This knowledge will be beneficial to teacher educators as it will identify those teaching strategies that student teachers prefer to aid their understanding of the concepts in Foundation Mathematics. Additionally, administrators of the Teachers' Colleges will benefit from this knowledge as it will help to make decisions concerning eligible students to enter the undergraduate programmes with mathematics as an option. Furthermore, this research will help address the dearth of literature on the issues that affect student teacher performance in Mathematics.

Research Questions

This study considered the following research questions:

1) To what extent are demographic factors (age, gender, prior mathematical knowledge) associated with pre-trained teachers' performance in Foundation Mathematics?
2) How do students perceive the use of different teaching methods in learning concepts in Foundation Mathematics?

Hypotheses for Research Question 1

H_0: Demographic factors (age, gender, prior mathematical knowledge) have no significant association with student teachers' performance in Foundation Mathematics.

H_1: Demographic factors (age, gender, prior mathematical knowledge) have a significant association with student teachers' performance in Foundation Mathematics.

Limitations

One limitation of the study is that the size of the population is small. The population is thirty-five students. This is so as only first year students of Mathematics do the course Foundation Mathematics. This small number may limit statistical power and the generalizability of the study as well as limit external validity. A second limitation was that the reliability and validity of the questionnaire was not tested beyond that of a pilot test, content validity check and ethics review.

Definition of Terms

1) ***Pre-trained teacher:*** A teacher who does not have the requisite teaching skills and knowledge to be considered qualified to give instruction.
2) ***Prior mathematical background:*** A pre-trained teacher's previous knowledge or prerequisites in Mathematics in the form of their CXC, CSEC or CAPE Mathematics grade.

2. Literature Review

This section critically reviews existing literature on the influence of demographic characteristics and instructional strategies on the performance of pre-trained teachers in Foundation Mathematics. Specifically, the review examines how factors such as age, gender and prior mathematical knowledge are associated with or have an impact on mathematics achievement. Additionally, this literature review will explore the role of pedagogical approaches that have been linked to improved learning outcomes. By synthesizing research across these domains, this study seeks to identify patterns, inconsistencies, and gaps within the literature that inform understanding of mathematics achievement among pre-trained teachers. This review provides the conceptual and empirical foundation for the

present study by situating it within broader discussions on equity, pedagogy, and teacher preparation in mathematics education. This section is organized around five key areas, namely: factors that influence mathematics achievement; the relationship between demographic factors and mathematics achievement; teaching strategies associated with improved mathematics outcomes; policy shifts affecting mathematics requirements for teachers; and a synthesis of the literature highlighting existing research gaps.

Factors that influence mathematics achievement

Mathematics has traditionally been seen as a subject that is difficult to grasp and understand by both young and adult learners. In Jamaica, 44% of the students who sat the CXC, CSEC Mathematics Examination in 2025, got a passing grade [12]. This was a slight improvement from 2024 which saw 39% of the students who sat the examination gaining a passing grade. However, the percentage pass rates at the Teachers' Colleges in this study are significantly higher. In the 2024 sitting for Foundation Mathematics the pass rate was 66%. Tetteh and Agyei [13] found that pre-service teachers demonstrated below-average performance in Algebra 1, a foundational first-year mathematics course. Additionally, the study suggested that although the programme of study changed from a Diploma to a Bachelor in Basic Education, there was no improvement in the performance of the students. There are factors that have been investigated to determine their effects on mathematics performance of pre-service teachers. In one such study, five categories of factors were investigated. These included student factors, such as qualification and motivation; socioeconomic factors, such as the money earned by the family of the student; school-based factors, such as teacher quality and performance which includes teaching approaches used; environmental factors, such as in the home or school [13]. The results showed that there was a strong association between mathematics performance and environment (teaching-learning and health, well-being and safety) as well as student factors (motivation). In another study done by Mensah et al. [14], it was discovered that cognitive factors, namely problem solving ability, previous knowledge and the ability to retain information, impacted mathematics performance. Furthermore, Agormor et al [15] agrees that there is a positive relationship between prior mathematics knowledge and geometry and trigonometry scores. Additionally, similar studies including Collins et al. [16], Facey et al. [17], and Samuels [18] provide Jamaican evidence on the positive influence of instructional strategies used by teachers on enhancing mathematics achievement and/or error reduction.

Demographic factors and mathematics achievement

Historically, it is believed that male students perform better at Mathematics than female students. However, studies have shown that this gender gap has changed and is changing. In an article by Brunner et, al. [19], there is a slight difference in performance of male students and female students at the high school level. Boys did better at specialized mathematics ability questions while the girls performed better at mathematical reasoning. Another study by Ortega et al. (2018) as cited in Maamin et al. [20], found that teacher gender and years of teaching experience, among other factors do have a significant influence on mathematics achievement. On the other hand, Josiah & Adejoke [21] explored the effect of age, gender and mathematics anxiety on mathematics achievement. In the results of both age and gender, it was revealed that age has no significant effect on mathematics achievement in Algebra and similarly, gender has no significant effect on mathematics achievement in Algebra. This concurs with a study by Abubakar & Bada [22] in which age and gender do not significantly impact mathematics achievement. A study conducted by Deeken et al. [23] speaks to the prerequisites for STEM University programmes. It mentions mathematical content such as "fractions, proportionality, equations and systems of equations…", (p. 34), abstract thinking, problem solving ability and experiences with proofs as necessary prerequisites for success in mathematics courses at STEM universities. Additionally, a study by McIntosh Henry et al. [24] revealed that pre-service teachers' mathematics attitudes are directly proportional to their content delivery and students' experiences.

Teaching strategies, learning theories and mathematics achievement

The National Mathematics Policy Guidelines, 2013, have suggested that teaching methodologies should allow pre-trained teachers to not only be instructed in the 5E's constructivist lesson plan guide but be allowed to observe teaching taking place. Additionally, the guidelines also recommend that lecturers employ methods of teaching that allow students to gain conceptual understanding, procedural fluency and critical thinking and problem- solving skills. Studies have shown that the teacher education programmes, for mathematics pre-trained teachers, focused more on content acquisition than on engaging in the teaching and learning processes [25]. There are several theories relevant to mathematics acquisition. These include constructivism, sociocultural theory, cognitive load theory, and situated learning theory. Constructivism involves active involvement of students in the learning process whereby new knowledge is formed through adaptation of existing knowledge. This is important as it suggests that prior mathematical background will enhance learning. According to the sociocultural theory, developed by Lev Vygotsky [26], it proposes that learning takes place through social interaction and culture. This suggests that the method of teaching mathematics should involve collaborative learning and culturally significant situations. Similarly, the situated learning theory reasons that learning requires participation and is situational [27]. This also suggests that collaborative learning will help in solving problems [28]. This is endorsed by Richards & Samuels [29] and Jacobs & Samuels [30] who identified that teaching strategies including cooperative learning, problem-solving, and direct discovery not only encourage situational learning but enhance their ability to solve tasks in a wider community as they learn to work with their peers. The cognitive load theory, suggests that overloading of the short term memory will reduce learning. Hence, methods of teaching should involve a breaking down of complex problems to smaller steps to achieve the same goal of solving the problems. Hence, a problem-solving method such as Polya's [28] Problem Solving model can help students take a step-by-step approach to solving problems. Additionally, Fisher-Howe & Samuels [31] noted that the curriculum quality and teaching methods not only affect

students' mathematics achievement but their decisions as whether or not they pursue mathematics-based degree programmes in the future.

Policy shifts affecting mathematics requirements for teachers

The National Mathematics Policy Guidelines, 2013, have recommended that pre-trained teachers have knowledge that is two grade levels above that which they are going to teach. Furthermore, to receive a passing grade for any mathematics course, a pre-trained teacher must gain a pass in both coursework and the examination. These guidelines also suggest that besides gaining a grade of CXC, CSEC Mathematics 1 or 2, a pre-trained teacher should possess a pass in Additional Mathematics. Failing this, however, a qualifying course of study, designed by the teacher training college, should be pursued by pre-trained teachers before embarking on the degree programme. Foundation Mathematics can be viewed as a qualifying course.

Foundation Mathematics was introduced to the courses taught in the Bachelor of Education degree programme in 1999. The aims of the course suggests that pre-trained teachers will understand the importance of Mathematics in human mind development. Additionally, the course will allow pre-trained teachers to "develop an appreciation for critical thinking and problem solving using basic mathematical tools and operations" [32].

Summary of Literature and Research Gaps

Having reviewed several aspects of factors affecting mathematics achievement for students, there is a noticeable dearth of studies related to factors affecting teacher education and success of pre-trained teachers in mathematics courses. This research study will attempt bridge a gap in the literature on determinants of success in Foundation Mathematics by examining demographic and academic influences on pre-trained teachers' performance.

3. Methodology

This section gives a description of the type of research design that was used in the study along with the methodology, methods of data collection and the population.

3.1 Research Design

This study employed a survey research design which was purely quantitative. This design was chosen as it allowed for the investigation of attitudes, preferences, beliefs, opinions and behaviours. Furthermore, according to Cohen et al. [33], factual information can also be gathered using a survey.

3.2 The Participants

The target population was thirty-five year one pre-trained teachers, at a Teachers' College pursuing a Bachelor of Education degree in Mathematics Education and who are pursuing the course Foundation Mathematics. These participants were placed in two groups. Group A consisted of pre-trained teachers taught by a colleague named Mr. X and group B consisted of pre-trained teachers taught by the researcher. All pre-trained teachers were legally adults who came from a wide cross-section of Jamaica and as such were a good representation of the views of pre-trained teachers. They also came from parishes in all three counties of Cornwall, Middlesex and Surrey. These sets of pre-trained teachers were chosen as they are the set of students who do mathematics as a double option major, (mathematics and mathematics), as a single option major, (mathematics major and science minor) or as a single option minor (mathematics minor and physical education major). They were also chosen as Foundation Mathematics is only offered in the first year of the degree programme and is pursued by all secondary mathematics students. Furthermore, this course is a pre-requisite for all other mathematics courses to be pursued by the pre-trained teachers and other mathematics students.

3.3 Data Collection and Data Analysis

The researcher used one (1) data collection instrument, a structured questionnaire. The questionnaire consisted of two sections. Section A contained five multiple choice items, which collected demographic information from the participants. This was their gender, age and prior mathematical knowledge (CXC, CSEC and CAPE grades). Section B contained six multiple choice items and one short answer item. These collected information on the preference for a particular method of teaching and the final examination grade respectively. The questionnaire was first pilot tested on five students who have already done Foundation mathematics. Content validity was reviewed by expert personnel and adjustments made to the rating scale items. Changes were also made to the document following the recommendations given by the team of professionals on the Ethics committee. The pre-trained teachers were given the questionnaire at the end of the Foundation Mathematics course and after the Foundation Mathematics' final examination. The pre-trained teachers required ten minutes to answer the questions. The researcher asked a colleague, who is not familiar with the participants, to administer the questionnaire. Prior to administering the questionnaire, a counting number, from one (1) to thirty-five (35) was assigned to each participant. This number was written on the questionnaire. This number was used to represent a pre-trained teacher. For example pre-trained teacher 1, pre-trained teacher 2. The information gathered from the questionnaire was recorded and stored in an excel document which was only accessible by the researcher. The questionnaires were also stored securely in a locked cabinet which was only accessible by the researcher. The data on the questionnaire was stored for the length of the Master of Science in Mathematics Teaching degree programme and will be disposed of after graduation from the programme. Additionally, the outcome of the research was shared with the participants.

The first research question was analyzed by correlation. The dependent variable was the performance in Foundation Mathematics (summative examination grade) and the independent variables were the age, gender and prior mathematical knowledge (CXC, CSEC grade). These variables were coded in the Statistical Package for the Social Sciences (SPSS) software. All variables used in the analysis were classified as categorical (nominal). Each variable was coded and labels attached to each code. A variable called

'agegroup' was introduced into the analysis. From this variable the participants' age group was coded. There were two categories of age group, '15-24' and '25 and above'. (see Table 4). This was reduced to two categories to reduce the number of cells with the age group '15-24' was coded as '1' (one), '25 and above was coded as '2'(two). For gender, male was coded as '1' (one) and female coded as '2' (two). Similarly, prior mathematical knowledge was coded as '1' (one) for a CXC, CSEC grade of 1 (one) and '2' (two) for a CXC, CSEC grade of 2 (two). The dependent variable, performance in Foundation Mathematics, named 'FM exam grade' was recoded as 'grades' and changed to a range (group) variable to match the age group. The codes were one (1) for '90-100', two (2) for '80-89', three (3) for '70-79', four (4) for '60-69', five (5) for '50-59' and six (6) for '49 and below'. A cross tabulation of the three independent variables, 'agegroup', 'gender' and 'csec' with the dependent variable, 'grades' was done. A cross tabulation is a form of presentation of data which shows how one variable is related to another using counts and percentages [33]. A chi-square test was also done alongside the cross tabulation. This test was used to determine if there is a relationship or association between the categorical variables given. The null hypothesis of 'demographic factors (age, gender, prior mathematical knowledge) have no significant association with student teachers' performance in Foundation Mathematics' will then be accepted or rejected. A bar chart and histogram were used to present categorical data of gender and age group respectively. Frequency tables were also used to display the frequencies of the CXC, CSEC and CAPE grades. The trends observed in the cross tabulations and charts were examined and noted and further explained in the presentation and analysis of data. The second research question was analysed using descriptive statistics. Bar charts and Pie charts were used to present the ordinal data. From these displays, interpretations and conclusions were drawn.

4. Results

The data collected was analysed according to each research question which is presented below.

4.1 Results Based on Research Question 1

To what extent are demographic factors (age, gender, prior mathematical knowledge) associated with pre-trained teachers' performance in Foundation Mathematics?

This question explored the extent to which age, gender and prior mathematical knowledge are associated with the performance of pre-trained teachers in Foundation Mathematics. To determine the extent to which demographic factors (age, gender, prior mathematical knowledge) are associated with pre-trained teachers' performance in Foundation Mathematics, a cross tabulation of the three independent variables: 'agegroup', 'gender' and 'csec' with the dependent variable: 'grades' was done. A chi-square test and a Fischer's exact test were done alongside the cross tabulation (Table 1). These tests were used to determine if there is a relationship or association between the categorical variables given. The Fischer's exact test was used as the population was small and the expected cell counts for some cells were less than 5 (five). These results are shown in tables. Additionally, the percentage of pre-trained teachers for each 'agegroup', 'gender' and 'csec' grades are shown in figures. The first correlation test was between the independent variable 'agegroup' and the dependent variable 'grades'.

Table 1: SPSS output for 'Age group' and 'grades' cross tabulation for pre-trained teachers

Chi-Square Tests			
	Value	df	Exact Sig. (2-sided)
Pearson Chi-Square	3.663[a]	3	0.326
Likelihood Ratio	3.642	3	0.48
Fisher's Exact Test	3.598		0.295
Linear-by-Linear Association	2.048[b]	1	0.164
N of Valid Cases	35		
a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is 1.20.			

The Fischer's significance value (p-value) is 0.295 and the. This value is more than 0.05 which suggests that the null hypothesis will be accepted, hence, age has no significant association with pre-trained teachers' performance in Foundation Mathematics. This is also evident in Table 2 as there is no significant pattern to suggest that age impacts grades. In the 60-69 grade range, at least one pre-trained teacher from each age group had passing grades in this range. Additionally, approximately ninety-two percent (91.7%) or eleven (11) of the pre-trained teachers who received grades in the 70-79 grades range were aged 15-24. Furthermore, approximately eight percent (8.3%) or one (1) of the pre-trained teachers who received grades in the same range was aged 25 and above. These findings indicate no statistically significant association between age group and performance in this sample.

Table 2: 'Agegroup' and 'grades' crosstabulation percentages within 'grades' for pre-trained teachers

	Agegroup		
Grades	15-24	25 and above	Total
80-89	88.9% (8)	11.1% (1)	100.0% (9)
70-79	91.7% (11)	8.3% (1)	100.0% (12)
60-69	62.5% (5)	37.5% (3)	100.0% (8)
49 and below	66.7% (4)	33.3% (2)	100.0% (6)
Total	80.0% (28)	20% (7)	100.0% (35)

In Table 3 below, approximately fourteen percent (14.3%) or four (4) pre-trained teachers in the 15-24 age group received grades of 49% and below. Additionally, approximately twenty-nine percent (28.6%) or two (2) pre-trained teachers in the 25 and above age group received grades of 49% and below. Hence, if age was a factor the number of pre-trained teachers in the 25 and above age group failing Foundation Mathematics should be more.

Table 3: 'Age group' and 'grades' cross tabulation percentages within 'age group' for pre-trained teachers

	Age group	
Grades	15-24	25 and above
80-89	28.6% (8)	14.3% (1)
70-79	39.3% (11)	14.3% (1)
60-69	17.9% (5)	42.9% (3)
49 and below	14.3% (4)	28.6% (2)
Total	100.0% (28)	100.0% (7)

The ages of the pre-trained teachers ranged from eighteen to fifty-four years (18 to 54) with twenty-eight (28) of them or

eighty percent (80%) falling in the 15-24 age group. Approximately fourteen percent (14%) or five (5) of the participants fell within the 25-34 age group and only two (2) persons or approximately six percent (6%) of the participants had ages ranging from 35-54 years. There were no pre-trained teachers in the age group 55-64 years. The data was skewed towards pre-trained teachers in the younger age group. Please see Figure 1 and Table 4.

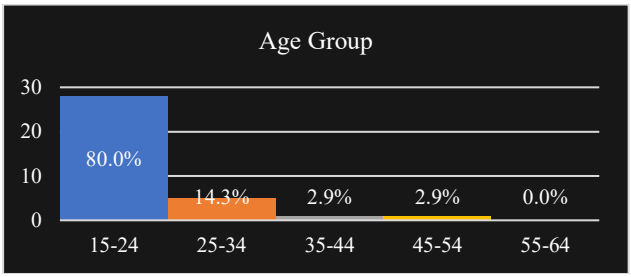

Figure 1: Age group of pre-trained teachers

Table 4: Age group of pre-trained teachers

Age group	Number of pre-trained teachers	Percentage (%) of pre-trained teachers
15-24	28	80.0
25 and over	7	20.0
Total	35	100.0

The second correlation test was between the independent variable 'gender' and the dependent variable 'grades'. The result of the Fischer's exact test is shown in Table 5.

Table 5: SPSS output for 'Gender' and 'grades' cross tabulation for pre-trained teachers

Chi-Square Tests				
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	4.307[a]	3	0.23	0.276
Likelihood Ratio	4.274	3	0.233	0.339
Fisher's Exact Test	3.746			0.307
N of Valid Cases	35			
a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is 1.71.				

The Fischer's significance value (p-value) is 0.307. This value is more than 0.05 which suggests that the null hypothesis will be accepted, hence, gender has no significant association with pre-trained teachers' performance in Foundation Mathematics. This is also evidenced in Table 6 below.

Table 6: 'Gender' and 'grades' cross tabulation percentages within 'grades' for pre-trained teachers

	Gender		
Grades	Female	Male	Total
80-89	77.8% (7)	22.2% (2)	100.0% (9)
70-79	50.0% (6)	50.0% (6)	100.0% (12)
60-69	87.5% (7)	12.5% (1)	100.0% (8)
50-59	0.0% (0)	0.0% (0)	0.0% (0)
49 and below	83.3% (5)	16.7% (1)	100.0% (6)
Total	71.4% (25)	28.6% (10)	100.0% (35)

According to Table 6, of the nine (9) pre-trained teachers who received grades in the range 80-89, approximately seventy-eight percent (78%) or seven (7) of them were females. Similarly in the 60-69 age range, approximately eighty-eight percent (87.5%) or seven (7) of the pre-trained teachers were females. However, the same number of females and males pre-trained teachers received grades in the range 70-79. That is, six (6) or fifty percent (50%) of the twelve (12) pre-trained teachers receiving grades in this range were females and the same were for males. Furthermore, of the six (6) pre-trained teachers who received grades in the 49 and below range, five (5) of them or approximately eighty-three percent (83.3%) were females. If there was an association between gender and grades, then fewer males, as suggested by the percentages of grades ranges 80-89 and 60-69, would be present in the 70-79 grades range. Similarly, more males would be in the 49 and below grades range than females.

The number of participants in this study was thirty-five (35). Of this number, there were twenty-five (25) females representing approximately seventy-one percent (71%) of the total population and ten (10) males representing approximately twenty-nine percent (29%) of the population. Please see Figure 1.

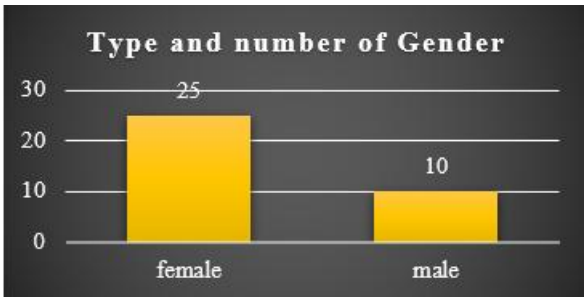

Figure 2: Gender of pre-trained teachers in the study

Prior mathematical knowledge was measured using the CXC, CSEC and CAPE grades of the participants. Approximately thirty-seven percent (37.1%) or thirteen pre-trained teachers received a grade one (1) in their CXC, CSEC mathematics examination. Approximately sixty-three percent (62.9%) or twenty-two (22) pre-trained teachers received a grade two (2) in their CXC, CSEC mathematics examination. See Table 7 below.

Table 7: CSEC grades of pre-trained teachers in the study

CSEC Mathematics grade	Number of pre-trained teachers	Percentage (%) of pre-trained teachers
1	13	37.1
2	22	62.9
Total	35	100.0

Only a few pre-trained teachers had CXC, CAPE grades. Approximately seventeen percent (17.1%) of the thirty-five (35) pre-trained teachers had CXC, CAPE qualifications. The grades ranged from a low of four (4) to a high of two (2). See Table 8.

Table 8: CAPE grades of pre-trained teachers

CAPE Mathematics grade	Number of pre-trained teachers	Percentage (%) of pre-trained teachers
1	0	0.0
2	3	8.6
3	2	5.7
4	1	2.9
5	0	0.0

6	0	0.0
Not applicable	29	82.9
Total	35	100.0

The third correlation test was between the independent variable 'prior mathematical knowledge' and the dependent variable 'grades'. The prior mathematical knowledge was measured using the CXC, CSEC mathematics grade. The result of the chi-square test is shown in Table 9.

Table 9: SPSS output for 'CSEC' and 'grades' cross tabulation for pre-trained teachers

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	8.706[a]	3	0.033	0.03
Likelihood Ratio	8.745	3	0.033	0.056
Fisher's Exact Test	7.876			0.045
Linear-by-Linear Association	4.584[b]	1	0.032	0.037
N of Valid Cases	35			
a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is 2.23.				
b. The standardized statistic is 2.141.				

The Fischer's significance value (p-value) is 0.045. This value. This value is less than 0.05 which suggests that the null hypothesis will be rejected and the alternative accepted, hence, prior mathematical knowledge (CXC, CSEC grades) has a significant association with pre-trained teachers' performance in Foundation Mathematics. This would suggest that pre-trained teachers who have higher CXC, CSEC mathematics grades would perform better in Foundation Mathematics. This is evident from Figure 3 and Table 10 below.

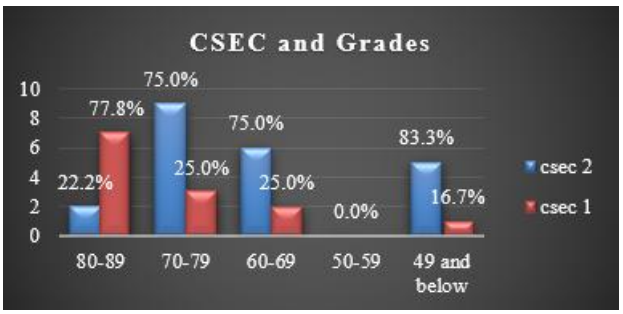

Figure 3: CSEC and grades (performance in Foundation Mathematics)

There is a pattern that can be observed in Figure 3. As the grades (performance in Foundation Mathematics) decrease the percentage of pre-trained teachers receiving that grade also decreases. This has occurred for both CSEC 1 and CSEC 2. Approximately seventy-eight percent (77.8%) or seven of the pre-trained teachers receiving grades from 80-89, had CSEC 1. This percentage was reduced to twenty-five percent (25.0%) which represented three (3) of the pre-trained teachers who had CSEC 1 and receiving grades from 70-79. A further reduction was evident as of the eight (8) pre-trained teachers who received grades from 60-69, only two (2) or twenty-five percent (25%) of them had CSEC 1. One student who had CSEC 1 received a grade in the range 49 and below. Generally, the students who received CSEC 1 performed well in Foundation Mathematics. Approximately, sixty-three percent (62.9%) of the total number of pre-trained teachers had CSEC 2 (see table 7). These teachers performed fairly well. Approximately twenty-two percent (22.2%) or two of the pre-trained teachers receiving grades from 80-89, had CSEC 2. This number increased to nine which represented seventy-five percent (75.0%) of the total number receiving grades in the range 70-79. A similar pattern for CSEC 1 emerged for CSEC 2. The number of pre-trained teachers who had CSEC 2 receiving grades in the range 60-69 was reduced. A further reduction was shown, albeit in the failing range (see Figure 3).

Table 10: 'CSEC' and 'grades' cross tabulation percentages within 'csec' for pre-trained teachers

	CSEC		
Grades	CSEC 1	CSEC 2	Total
80-89	53.8% (7)	9.1% (2)	25.7% (9)
70-79	23.1% (3)	40.9% (9)	34.3% (12)
60-69	15.4% (2)	27.3% (6)	22.9% (8)
50-59	0.0% (0)	0.0% (0)	0.0% (0)
49 and below	7.7% (1)	22.7% (5)	17.1% (6)
Total	100.0% (13)	100.0% (22)	100.0% (35)

Of the number of pre-trained teachers with CSEC 1 approximately fifty-four percent (53.8%) or seven (7) of them scored the range 80-89 (see table 10). Approximately thirty-four percent (34.3%) or twelve (12) pre-trained teachers, with CSEC 1 and CSEC 2 received grades in the grade range 70-79 (see table 10).

4.2 Results Based on Research Question 2

How do students perceive the use of different teaching methods in learning concepts in Foundation Mathematics?

The preference for PowerPoint presentations and how useful they were in helping the pre-trained teachers to understand the content of Foundation Mathematics was varied. The majority of the pre-trained teachers, approximately forty-six percent (45.7%) were undecided (neutral) on its impact. A few pre-trained teachers, three (3) or approximately nine percent (8.6%) disagreed with its impact. Sixteen (16) pre-trained teachers, which is approximately forty-six percent (45.6%) of the total, either agreed or strongly agreed with the impact of PowerPoint presentations. (See Figure 4).

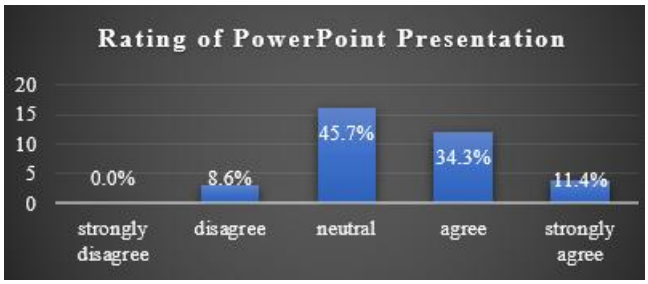

Figure 4: Preference rating of pre-trained teachers for PowerPoint presentations

The preference for cooperative learning activities and how they helped the pre-trained teachers learn the concepts in Foundation Mathematics, from their classmates, is shown in Figure 5. Approximately eighty-nine percent (88.6%) or thirty-one (31) of the pre-trained teachers agreed or strongly agreed with the statement 'cooperative learning activities helped me learn from my classmates'. A small percentage of pre-trained teachers, approximately nine percent (9%) or

three (3) were undecided about how useful the cooperative learning activities were. Similarly, approximately three percent (3%) or one (1) pre-trained teacher did not agree that cooperative learning activities helped with learning the concepts in Foundation Mathematics.

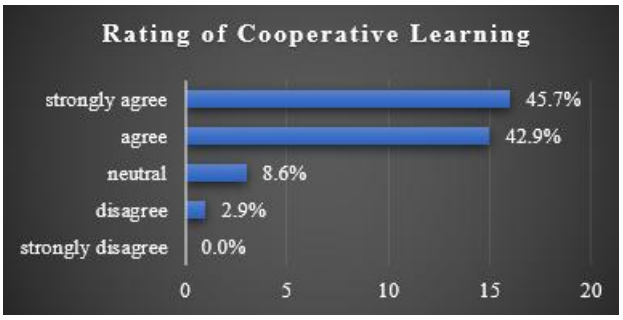

Figure 5: Preference rating of pre-trained teachers for cooperative learning activities

The preference for completing worksheets and it improving understanding of the concepts in Foundation Mathematics is shown in Figure 6. Approximately ninety-four percent (94%) or thirty-three (33) of the participants agreed or strongly agreed with the statement '*completing worksheets improved my understanding of the subject matter'*. Approximately three percent (3%) each or one (1) each of the pre-trained teachers either were undecided or disagreed strongly that worksheets improved their understanding of the content in Foundation Mathematics.

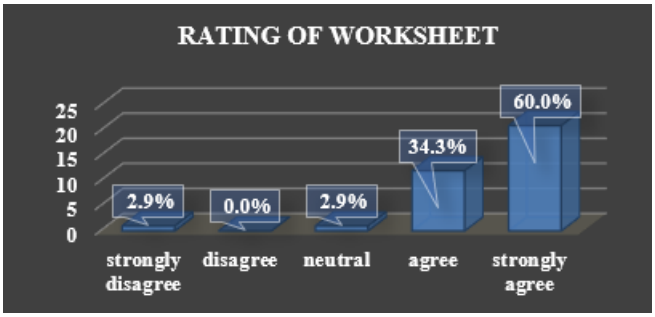

Figure 6: Preference rating of pre-trained teachers for worksheets

The preference for engaging in problem solving activities that may help pre-trained teachers think critically and solve problems on their own is shown in Figure 7 below. Approximately eighty-six percent (86%) or thirty of the participants agreed or strongly agreed with the statement '*Problem-solving activities helped me think critically and solve problems on my own'*. A small percentage of pre-trained teachers, approximately eleven percent (11%) or four (4) persons were undecided about the impact of problem solving activities. Only one (1) pre-trained teacher strongly disagreed with the impact of problem-solving activities.

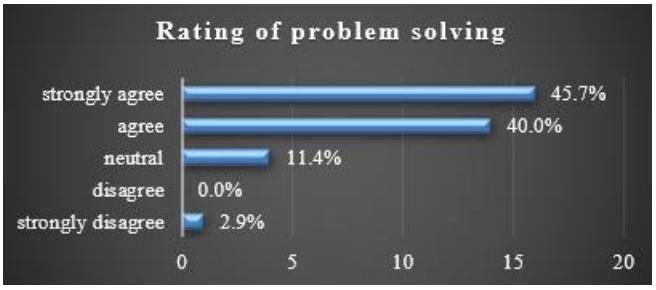

Figure 7: Preference rating of pre-trained teachers for problem-solving activities

The preference for the direct discovery strategy and it helping pre-trained teachers to understand the content and remember the concepts of Foundation Mathematics easier is shown in Figure 8. Of the thirty-five participants, approximately sixty-nine percent (69%) or twenty-four persons agreed or strongly agreed that direct discovery helped them to understand and remember content and concepts respectively. Approximately thirty-one percent (31%) or eleven (11) participants were undecided on the impact of the direct discovery strategy. No pre-trained teacher disagreed or strongly disagreed with the direct discovery strategy and its impact.

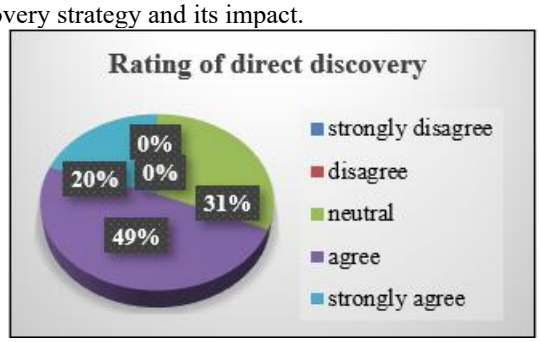

Figure 8: Preference rating of pre-trained teachers for the direct discovery strategy

4.3 Further Discussions

Research Question 1 examined the extent to which age, gender and prior mathematical knowledge are associated with the performance of pre-trained teachers in Foundation Mathematics. Null (H0) and alternate (H1) hypotheses were used to state a conclusion. The first set of results have shown that age has no significant (p=0.295) association with pre-trained teachers' performance in Foundation Mathematics. Literature is sparse on the effect of age on pre-trained teachers' performance in mathematics courses. Additionally, some of the studies that have been examined are not current. However, in a study by Pranoto et al. [34], age of teachers did not show any correlation with teacher performance. Additionally, Pranoto et al. [34] posits that age will eventually affect how a teacher operates within the classroom, but this can be mitigated with opportunities for in-service education and training. The second set of results have shown that gender has no significant (p=0.307) association with pre-trained teachers' performance in Foundation Mathematics. This concurs with a study by Josiah & Adejoke [21] which explored the effect of age, gender and mathematics anxiety on mathematics achievement. In the results of both age and gender, it was revealed that age has no significant effect on mathematics achievement in Algebra and similarly, gender has no

significant effect on mathematics achievement in Algebra. In another study by Abubakar & Bada [22], a similar conclusion was made that age and gender do not significantly impact mathematics achievement. However, it was revealed that age contributed more to this mathematics achievement. The third set of results have shown that prior mathematical knowledge (CXC, CSEC grades) has a significant association with ($p=0.045$) student teachers' performance in Foundation Mathematics. Mensah et al. [14] agree with this discovery as their research revealed that cognitive factors, namely problem solving ability, previous knowledge and the ability to retain information, impacted mathematics performance. Additionally, Agormor et al. [15] also revealed that there is a positive relationship between prior mathematics knowledge and geometry and trigonometry scores. This suggests that pre-trained teachers who have prior mathematical knowledge of CXC, CSEC grades of one (1) or two (2) will influence their performance in Foundation Mathematics. However, pre-trained teachers who have CXC, CSEC one (1) as their prior mathematical knowledge will perform better in Foundation Mathematics.

Research Question 2 measured how students perceived the use of different teaching methods in learning concepts in Foundation Mathematics. The preference for the use of PowerPoint presentations and how useful they were in helping the pre-trained teachers to understand the content of Foundation Mathematics saw the majority of the pre-trained teachers, approximately forty-six percent (45.7%) being undecided (neutral) on its impact. The use of the PowerPoint presentations was to cater to the visual learners, however, this did not make as great an impact as the other teaching strategies and techniques used. As such approximately eighty-nine percent (88.6%) of the pre-trained teachers agreed or strongly agreed with the use of cooperative learning activities and it helping them to learn from their classmates. Constructivism and sociocultural theory support cooperative learning as students' learning will take place through active involvement and social interaction and culture. The study also revealed that, approximately ninety-four (94.3%) of the pre-trained teachers found that completing worksheets had improved their understanding of the concepts in Foundation Mathematics. Furthermore, approximately eighty-six percent (86%) of the pre-trained teachers benefitted from problem-solving activities as these helped them to think critically and solve problems on their own. Szabo et al. [35] supports this view by agreeing that teaching should produce citizens who are not only able to think on their own but to think critically and be able to solve problems they will encounter in their lives. The preference for the direct discovery strategy and it helping the pre-trained teachers to understand as well as remember the concepts in Foundation Mathematics, saw a majority of sixty-nine percent (69%) finding it useful. No pre-trained teacher disagreed or strongly disagreed with the positive impact of the direct discovery strategy.

5. Conclusion

This study examined demographic and academic factors associated with Foundation Mathematics performance and students' perceptions of selected teaching methods among 35 pre-trained teachers at one teachers' college. Within this sample, age and gender were not significantly associated with Foundation Mathematics performance, while prior mathematical knowledge, represented by CSEC Mathematics grades, showed a significant association with performance. Students reported favorable perceptions of cooperative learning activities, worksheets, problem-solving activities, and direct discovery. These findings suggest that prior mathematical preparation deserves attention when supporting new students and that the positively perceived instructional approaches may remain useful components of Foundation Mathematics teaching. Because the study involved a small sample from one institution, the findings should not be generalized beyond the study context without further research.

6. Recommendations

The recommendations given here will only apply to the participants in the study but may also be applied to a new cohort that will enter the teachers' college in September of the academic year 2026/2027. One notable recommendation to the administrators of the teachers' college is providing the pre-trained teachers with guidance and mentoring to help students achieve more. This is recommended as approximately seventeen percent (17.1%) or six (6) pre-trained teachers fell in the grade range of 49% and below. Foundation Mathematics is a first year course so pre-trained teachers may need assistance in managing their time properly. Lastly, the use of cooperative learning activities, worksheets and problem solving activities may prove useful in ensuring that pre-trained teachers succeed in Foundation Mathematics.

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