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Learning Engagement in Mathematics during the Post-Pandemic Transition

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A B S T R A C T

The post-pandemic transition has had a significant impact on learning engagement in mathematics, raising concerns about student achievement. This quantitative research study aimed to explore the affective, behavioral, and cognitive engagement of students in mathematics, as well as their mathematics achievement. The study used a correlational design and administered a questionnaire to a sample of students. The findings revealed a negative correlation between age and grade level with engagement levels, highlighting the need for teachers and parents to find ways to keep older and higher-grade students engaged in math. The study also found a significant association between the occupation of the mother and affective engagement, emphasizing the importance of supporting working mothers and providing resources that can help them stay involved in their children's education. While the study did not find a significant relationship between students' engagement and their mathematics achievement, the study's recommendations include exploring other factors that may affect math achievement, such as teaching strategies, student motivation, and socio-economic status. This research provides important insights for policymakers, educators, and researchers working to support student engagement and mathematics achievement during the post-pandemic transition.

Keywords: mathematics achievement, students' engagement, affective, behavioral, cognitive

1. INTRODUCTION

Mathematics is an essential subject for students, but their level of involvement in the subject has declined since the COVID-19 pandemic was declared a global emergency by the World Health Organization on January 30, 2020. The pandemic led to the closure of many schools and universities, which impacted students academically. According to studies cited by Gasse (2014), students' engagement in school (including their affective, behavioral, and cognitive involvement) was already declining before the pandemic, and this trend continued through their education, with the largest drop seen when they moved from primary school to middle and high school, often resulting in dropout. Students' engagement worsened during a pandemic, when every school closed and every student was forced to study online. It is also when students relied heavily on modular modes of learning and stopped attending school. Teachers could not guarantee that students were truly doing their studies at home since some students may have taken it seriously while others may have simply relied on their elders or guardians to answer their modules. As far as pedagogy is concerned, parents are not experts; they only use their authority to comply with the requirements, even when no learning is occurring at all (Luaña, 2021). This highlights the importance of providing resources and support for parents to ensure that their children are engaged in meaningful learning during this time. In the current pandemic, schools are slowly transitioning from online to limited face-to-face classes where students are more engaged than during the COVID-19 pandemic outbreak. In the transition of classes into face-to-face, there is this called asynchronous classes where it is up to the teacher whether his/her subject will have face-to-face or modular classes depending on the situation and topics.

According to Trowler (2010) as cited by Alrajeh & Shindel (2020) student engagement is defined as their willingness and effort to participate in learning activities in a way that leads to success. Students' engagement might have changed in the current face-to-face classes since they study online for the past two years. A research study conducted by Baysal & Ocak (2021) revealed that when compared to face-to-face instruction, student misbehaviors changed. However, in the opinion of the teachers, these may be fixed by taking a few precautions. Therefore, the researchers want to describe the current students' engagement and how does these aspects predict their mathematics learning performances. Many previous studies have confirmed student engagement as well as its dimensions as positive predictors of mathematics learning. Thus, if the engagement of students at school decreases their mathematics learning will also be affected. The three kinds of student engagement are behavioral, cognitive, and emotional engagement (Alangari, 2020). Based on the previous research, highly motivated students tend to have greater academic achievement (Fung, Tan, & Chen, 2018). In other words, students who are engaged in their learning tend to perform better academically.

This research aimed to explore the concept of student engagement, with a specific focus on the three key dimensions of engagement: cognitive, behavioral, and affective. By investigating these three areas, the study aimed to identify any areas where students may have lacked engagement, as a lack of engagement in one or more of these areas can have had a significant impact on a student's overall performance and academic achievement.

2. STATEMENT OF THE PROBLEM

The objective of the study is to investigate the relationship between student profiles, students' engagement, and mathematics achievement.

It aims to answer the following specific research questions:

1. How may profile of the respondent be described in terms of:
    1.1) sex;
    1.2) age;
    1.3) educational attainment of parents;
    1.4) occupation of parents; and
    1.5) year level
2. How may the student engagement be described in terms of;
    2.1) affective;
    2.2) behavioral; and
    2.3) cognitive
3. How may the student's mathematics achievement be described?
4. Is there a significant relationship between the profile of respondents and their:
    4.1) Engagement
    4.2) Mathematics Achievement
5. Does the students' engagement such as affective, behavioral, and cognitive predictors significantly explain the variance in mathematics achievement?

3. RESEARCH HYPOTHESIS

The following research hypotheses were formulated and were tested at a 0.05 level of significance:

H1. There is no significant relationship between the profile of students and their engagement.

H2. There is no significant relationship between the profile of respondents and their mathematics achievement.

H3. Students' engagement does not significantly predict mathematics performance.

4. CONCEPTUAL FRAMEWORK

This study examined the impact of students' profiles and engagements on their own mathematics achievement. The student profile included the student's age, sex, and grade level, as well as their parents' educational attainment and occupation. The three types of student engagement were affective, behavioral, and cognitive engagements.

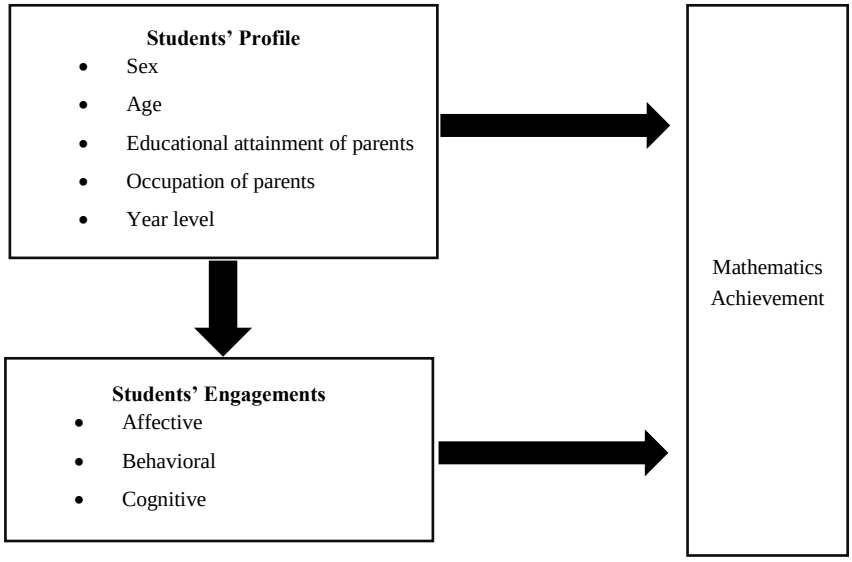

Fig. 1 Research Paradigm

Figure 1 shows the students' profiles after their data had been obtained, including their sex, age, parents' educational attainment, and occupation. Moreover, after collecting the students' questionnaire responses, the student engagement was interpreted. The study aimed to determine whether there was a relationship between the students' profiles and their engagement. Additionally, the researchers aimed to describe the significance of the student's profile and engagement in mathematics learning.

5. SIGNIFICANCE OF THE STUDY

The researchers believed that this study would benefit many individuals and groups of people. This study will benefit the following groups or individuals:

Administrators – the results may provide administrators with valuable insights into the challenges and opportunities that have arisen during the transition to remote or online learning, as well as strategies that can be used to promote engagement in mathematics. This study can be used for the development of policies and practices that support students during the post-pandemic transition.

Mathematics Teachers – the results may provide mathematics teachers with a better understanding of the factors that influence students' engagement in mathematics during the post-pandemic transition. By identifying strategies that can be used to promote engagement, the study can help teachers to adapt their teaching methods and create interactive, hands-on activities that are engaging for students.

Parents – The results may provide parents with an understanding of how the transition to remote or online learning has affected their children's engagement in mathematics. This information can be used to support their children's learning at home and to communicate with teachers about strategies that can be used to promote engagement.

Students – The results may provide students with a better understanding of the factors that influence their engagement in mathematics during the post-pandemic transition, and may help them to take more active role in their learning process.

Future researchers – The results may serve as a reference for future researchers in the field of education, providing a foundation for further research on student engagement in mathematics during and after pandemic. The study can also inform the development of educational policies and practices that promote student engagement and success in mathematics.

6. SCOPE AND DELIMITATION

The study is limited to three dimensions of students' engagement, specifically affective, behavioral, and cognitive. This study focuses on learning engagement in mathematics during the post-pandemic transition in Junior High School at Nueva Ecija University of Science and Technology's Gabaldon Campus. The sample size for this study will be limited to 151 respondents out of 247, and will be conducted during the months of January to March of the academic year 2022-2023.

7. DEFINITION OF TERMS

This part of the study used operational definitions to clearly define and measure the key variables being studied.

Mathematics Achievement - the scores on a standardized mathematics test administered at the end of the school year. Specifically, their average grade that is possible to cover during the conduct of the study (pertains to the finished quarter).

Students' Engagement - the percentage of class time spent actively participating in class discussions and completing in-class mathematics activities.

Affective Engagement – the students' self-reported levels of interest, enjoyment, and motivation towards mathematics.

Behavioral Engagement – the specific behaviors such as asking questions, participating in class discussions, and completing homework assignments as recorded by the teacher.

Cognitive Engagement – the level of cognitive processing and critical thinking demonstrated by students during class discussions and on assessments, as assessed by the teacher.

8. LITERATURE REVIEW

Mathematics Learning

A student's skill in mathematics is referred to as mathematical achievement or learning. It is the culmination of knowledge or information gained, comprehension, talents, and strategies developed at a certain level in the subject of mathematics. The results of the mathematics learning exam serve as its measurement (Pandey, 2017). According to Finn & Rock (1997); Fredricks et al., (2004); Upadyaya & Salmela-Aro, (2013) as cited by A lrashidi (2016) that standardized test scores, performance test results, academic grades, and GPA (Grade Point Average) have historically been used to measure students' academic success.

Students' Engagement

The quality of students' engagement or connection, as well as the initiation of effort, action, and persistence in schoolwork, as well as their emotional states throughout learning activities, are all indicators of engagement (Skinner, Kindermann, & Furrer 2009; Skinner, Wellborn, & Connell 1990) as cited by (Alrashidi, 2016). According to Kuh (2003) Students' engagement is the amount of time and effort a student invests in engaging in educationally relevant activities outside of class as well as inside of it, along with the practices and rules that educational institutions employ to motivate students to engage in these activities.

According to Fredricks et al. (2004) as cited by (Alrashidi, 2016) that students' engagement has three dimensions those are the affective, behavioral, and cognitive engagement. The findings in a study by Maamin , Maat, & Iksan, (2022) indicates that *there is significant relationship between students' engagement (affective, behavioral, and cognitive) and mathematics achievement of the students. It is also supported by the study conducted by Delfino (2019) that the three components of student engagement—behavioral, emotional, and cognitive—were all significantly correlated with the students' academic achievement. For depth understanding of students' engagement, below are the discussion of its three different dimensions and their relation with mathematics learning sythesized from various studies:

Affective Engagement

Affective engagement is the same as emotional engagement in that it refers to both positive and negative emotional responses that students have to their teachers, classmates, academic work, and school in general (Fredricks et al., 2004). Indicators includes the existence of interest and happiness as well as the absence of boredom, stress, and sadness are included (Alrashidi, 2016). According to Skinner & Pitzer (2012), affective engagement involves the desire to participate in courses, motivation, attitudes toward teacher and peer relationships, and emotions (Bingham & Okagaki, 2012) as cited by (Sen, 2022). Affective engagement refers to the emotional components that influence students' learning, including their attitudes toward and comfort level with mathematics.

In a study by Khine, Afari, & Mutawah (2015) it is stated that there is positive correlation and associationin affective engagement components to mathematics achivement of the students, those components includes the interest, valuing, as well as their confidence. This also supports by the study conducted by Lim & Chapman (2013) where self-confidence is one of the strongest predictor of a student's achievement substatiated by the past studies (e.g. Goldberg & Cornell, 1998; Ma & Kishor, 1997).

In a multiple regression analysis, it is showed that the major individual predictor of the final scores was self-efficacy (b = 0.45, p 0.01). However, self-efficacy did not successfully predict student accomplishment on its own, as they discovered when achievement emotions were included in the analysis, the percentage of variation in student performance that can be predicted rise. Studying emotions might be "an empowering source of knowledge about how to affect motivational patterns" as suggests from the findings (Kim, Park, & Cozart, 2014). A study by Kim et. al. (2014) also shows that anger is the strongest individual predictor of student achievement among emotion, enjoyment, and boredom. Given that the mean age of the participants was about 16, this result may be explained by the particularities of adolescence (eg, La Greca & Lopez, 1998). Both ease and anxiety with mathematics and concern over it appeared as significant correlations for both genders within the construct of anxiety. However, for males, comfort with mathematics was a stronger predictor of mathematics success, but for females, anxiety with mathematics was a stronger predictor. Also, in a study by García, Rodríguez, Betts, Areces, & González-Castro (2016) that affective motivational variables were significantly correlated with the mathematics achievement and are significant predictors as well together with the variables age, enjoyment, and surface approach to learning. In particular, achievement grew in tandem with students' growing enjoyment of mathematics.

Behavioral Engagement

There are three ways used to define behavioral engagement here as follows. The first method emphasizes good behavior, including observing classroom standards, abiding with the law, and avoiding disruptive behaviors (e.g., being troublesome or skipping school). The second method relates to engagement in academic and learning-related tasks and includes actions like contributing to discussions, asking questions, paying attention, concentrating, showing persistence, and exerting effort. The third and last method is participating in school-related activities, such as school government and athletics (Fredricks et al., 2004; Finn 1993; Finn, Pannozzo, & Voelkl, 1995; Finn & Rock, 1997; Skinner & Belmont, 1993; Rumberger 2004; Finn & Rock, 1997) as cited by (Alrashidi, 2016). The interaction, focus, and participation of the students inside the classroom are generally considered to represent behavioral engagement (Lo & Hew, 2021).

When students engage in math-related extracurricular activities, such as math competitions, or any other inside- or outside-of-school activities, their actions may have an impact on their mathematical learning or achievement. Another factor is the student's compliance with school rules. Certain students skip class and miss some math lessons, which has an effect on their learning and those who did not cut gains more knowledge and improves performance in mathematics. When it comes to taking notes in math class, some students are incredibly committed, while others just listen to what the teacher says without practicing core concepts. This means that the behavioral engagement of the students can adversely affect their mathematics performance.

In a study conducted by Flores, Tamban, Lacuarin, Bando, & Cortezano (2021) it is evidenced that performance in mathematics and behavioral engagement had a moderately positive relationship. First-year college students who fall into the 18 and above age range have a high level of behavioral engagement in mathematics while having average affective and cognitive engagement (Marpa, 2016). As the student grows, their level of engaging with mathemathics rose in terms of behavioral, cognitive, and affective. But it was also observed their study that the young ones are more engaged in their mathematics subject which means that youngsters are more open to change than older generations. The behavioral engagement factor of students' engagement, which has the highest mean of all the dimensions, indicates that most students work hard to earn good grades, which they attained by concentrating and paying attention to the lesson (Delfino, 2019). According to a research by Iji & Abah (2018), adoption of educational cloud services by students studying mathematics has a significant influence on the students' behavioral engagement. The results of several research have demonstrated that behavioral engagement greatly predicts students' academic success, particularly in the area of mathematics.

Cognitive Engagement

The cognitive engagement dimension measures how invested students are in their learning and includes elements like their readiness and consideration to put in the effort necessary to comprehend and master challenging tasks, their use of effective learning strategies (such as their preference for elaboration over memorization), their preference for challenges, and their self-control (Fredricks et al., 2004) as cited by (Alrashidi, 2016). In short, it concerns students' grasp of mathematics in particular. In short, it concerns students' learning of mathematics in particular (Lo & Hew, 2021). Cognitively engaged behaviors include asking more questions, taking on difficult tasks, reviewing previously learned material, looking for additional information, and employing techniques. Students who are more cognitively engaged put more effort into learning challenging material (Finn & Zimmer, 2012) as cited by (Sen, 2022).

Students who are actively engaged in cognitive put more effort into studying. By spending a lot of time self-studying, it is predicted that the student's grades will be higher (Bonsaksen, Brown, Hua Beng, & Kenneth, 2017). Hence, if the time spent studying mathematics is higher, then their grades will be high. With more knowledge about mathematics, students' performance in terms of mathematics will improve. Thus, cognitive engagement adversely affects the mathematics performance of the students.

According to Francis, Yong, & Chen (2018), compare in all of the engagements, cognitive engagement has the strongest positive association with academic performance. Parallel to this result, the study conducted by Lacuarin, Flores, Lacuarin, Bandoy, & Cortezano (2021) shows that there is a positive relationship between cognitive engagement and the academic performance of the students. In addition, the findings from the study conducted by Maamin, Maat, & Iksan (2021), the result shows that there is a significant relationship between cognitive engagement and mathematical achievement.

Since cognitive engagement and academic performance correlate with each other, therefore, in accordance with the study conducted by Doğan (2015) the results show that cognitive engagement predicts academic performance.

Overall, affective, behavioral, and cognitive engagement are important factors in students' engagement in mathematics and should be taken into consideration in educational practices.

9. METHODOLOGY

The research approach that was used for the study was thoroughly described in this chapter. The chapter was divided into a number of sections that served as a foundation for outlining the research plan. The specific research questions that served as a guide for the techniques of data collecting and analysis were presented after a description of the study's goal. Prior to outlining a thorough study strategy, special consideration was paid to the researchers' roles.

5.1 Research Design

This study utilized quantitative research. It entailed studying and quantifying variables to obtain findings. It was often referred to as a technique for analyzing data in numerical form to explain a problem or phenomena (Apuke, 2017). Descriptive research design was used to describe the profiles and

engagement (affective, behavioral, and cognitive) of the respondents. The goal of descriptive research was to precisely and methodically characterize a population, circumstance, or phenomena (McCombes, 2019).

This included correlational design to determine if there was a significant relationship between the profiles of the respondents with their mathematics achievement; significant relationship between the profiles of the respondents with their mathematics engagement; and if students' engagement significantly predicted mathematics achievement. In a correlational research, relationships between two or more variables were determined.

Researchers could assess if two variables changed together and to what extent by using correlational study results (Tan, 2014). Since the study had three sub-variables under the students' engagement, the researchers decided to use multi-regression analysis to see if the independent variables significantly predicted the mathematics achievement of students. A statistical study known as regression analysis was used to determine the relationship between variables that had a connection to both cause and effect. It was done to utilize those correlations to create predictions about the subject (Uyanık & Güler, 2013).

5.2 Research Locale

This study took place in Junior High School at Nueva Ecija University of Science and Technology (Gabaldon Campus), formerly Sabani Estate Agricultural College (SEAC), in North Poblacion, Gabaldon, Nueva Ecija.

Fig. 1 Location Map

5.3 The Samples and Sampling Technique

Junior high school students from Nueva Ecija University of Science and Technology (Gabaldon Campus) made up the study's population. Using stratified sampling, students from grade 7, grade 8, grade 9, and grade 10 were chosen to be the respondents. Stratified random sampling splits a population into strata, and random samples are chosen from each stratum in proportion to the population. The technique is used to guarantee that the clusters in the population and its distribution are properly represented.

Table 1: The Distribution of Respondents

GRADE LEVEL	TOTAL NUMBER OF MALE	PERCENTAGE (61%)	TOTAL NUMBER OF FEMALE	PERCENTAGE (61%)	TOTAL	PERCENTAGE (61%)
GRADE 7	26	16	31	19	57	35
GRADE 8	20	12	35	21	55	33
GRADE 9	10	6	28	17	38	23
GRADE 10	14	9	36	22	50	31
A & B	22	14	25	15	47	29
TOTAL	**92**	**56**	**155**	**94**	**247**	**151**

Table 1 shows the records of students' population in each section as of the Academic Year 2022-2023. Calculation of the sample sized is made with the use of Raosoft. After getting the recommended sample size which is 151 in total, the researchers computed sampling proportion which is equal to 61% so as to distribute the number of samples systematically. The researchers did not round-off the values but 1 is added the row with highest sum of decimal to get the exact number of sample size.

5.4 The Research Instruments

The researchers used questionnaires to collect data from the students. A questionnaire is a list of written questions that may be created for scientific research to obtain data about people's beliefs, preferences, experiences, intentions, and behavior (Mahmoud, 2022). The questionnaire was divided into two sections. The first section included questions for the students' profiles, while the second section included questions for analyzing the students' engagement. Since there were three types of student engagement, the second section of the questionnaire had three subparts: affective, behavioral, and cognitive engagement. A questionnaire is a valid and helpful instrument in conducting research that has evident advantages in describing and exploring variables and constructs of interest (Ponto, 2015).

The questionnaire was reconstructed and adopted from the studies conducted by Flores, Tamban, Lacuarin, M., & Cortezano (2021) and (Nazamud-din, Harriz Zaini, & Mohd Jamil, 2020) as they were reliable and relevant to this study. However, since their q uestions were mixed with negative and positive thoughts, the researchers decided to revise them into fully positive by inverting negative sentences.

The results of the reliability testing (Cronbach's alpha) indicate that the Affective Engagement scale has good reliability (0.839), the Behavioral Engagement scale has acceptable reliability (0.730), and the Cognitive Engagement scale has good reliability (0.812). This means that all the descriptive survey in each dimensions of engagement are reliable.

5.5 Procedure of the Study

The researchers followed a systematic procedure to gather and interpret the data that was collected. They requested permission to conduct the study at Nueva Ecija University of Science and Technology in Gabaldon, Nueva Ecija, and also requested to obtain the quarter grades of the junior high school students. After being granted permission, the researchers distributed a copy of the questionnaire to the respondents. The students were given the option to withdraw from answering the questionnaire, so the researchers asked for volunteers from a specific grade to achieve the necessary number of respondents. After the questionnaires were submitted, the researchers interpreted the collected data, including the quarter grades, using different statistical tools.

5.6 Ethical Considerations

The study's potential for damage to anybody engaged was carefully considered by the researchers, and they respected the rights of the subjects. An article by Dooly, Moore, & Vallejo, (2017) stated that the ethical considerations of a study had to be taken very seriously by the researchers at every level. The researcher always obtained consent from the parties involved prior to the conduct of research. Each institution's representatives signed a compliance agreement between the parties (researcher and/or research team and informant) (e.g., head researcher, head of school). The educational institution granted parental authorization for research to be conducted in the facility if it involved respondents under the age of 18 and was done in partnership with schools. All study subjects, including data derived from systematic reviews of documents that may be deemed sensitive owing to racial, ethnic, religious, political, health, or sexual orientation, were kept confidential by the researcher. When collecting personal information from respondents, it was only utilized to further the research and wasn't used for any other reason. No more personal information that was not necessary for the research was collected.

Respondents were not forced to participate in the study since it was voluntary, and it was possible for respondents to opt out of providing their voluntarily provided responses. The researchers prevented information fraud and plagiarism by citing all the sources utilized for the study.

5.7 Statistical Analysis of Data

The data collected in this study underwent quantitative and statistical analysis. To present the quantitative data obtained from student surveys, descriptive analysis was employed. The normality test was used to determine the appropriate test for significance. Since the data met the assumption of normality, the Pearson r and Chi-Square tests were chosen. Additionally, multiple regression analysis was conducted to examine how a set of predictor variables accounted for the variation in the dependent variable.

These are the following statistical analysis used in each number from Statement of the Problem:

1. The statistical analysis used for this item was frequency to determine the profile of the students.
2. The statistical analyses used for this item were weighted mean and descriptive statistics to describe the students' engagement. The research utilized a five-point scale, where each point represented a Likert item.

Table 2: Likert Scale

Point	Scale	Verbal Interpretation
5	4.21 – 5.00	Strongly Agree
4	3.41 – 4.2	Agree
3	2.61 – 3.4	Neutral
2	1.81 – 2.6	Disagree
1	1.00 – 1.8	Strongly Disagree

3. The statistical analysis used for this item was frequency to describe the students' mathematics achievements. The students' mathematics achievement was determined based on their quarter grades, and the study utilized the grading scale provided by the Department of Education (DepEd) as the basis for scaling the students' mathematics achievement.

Table 3: Deped Grading Scale

DESCRIPTOR	GRADING SCALE	REMARKS
Outstanding	90 – 100	Passed
Very Satisfactory	85 – 89	Passed
Satisfactory	80 – 84	Passed
Fairly Satisfactory	75 – 79	Passed
Did Not Meet Expectations	Below 75	Failed

(Policy guidelines on classroom assessment f or the K to 12 basic education program, 2015)

4. The statistical analyses used were chi-square and Pearson correlation to determine the relationship between the students' profile, their engagements, and mathematics achievement.

5. The statistical analysis used was regression analysis to determine whether the students' engagement significantly predicted mathematics achievement.

All computations were performed using Microsoft Excel and the Statistical Package for Social Sciences (SPSS).

10. RESULTS AND DISCUSSION

10.1 Students' Sex

Table 10.1 shows the distribution among 151 students according to sex. The data present that majority of 62.3% with the corresponding number of 94 students were females while 37.7% with the number of 57 were males.

This finding is consistent with previous research on gender distribution in education, which has shown that females tend to be overrepresented in academic settings, particularly in secondary.

Table 10.1: Students' Sex

	N	%
Male	57	37.7%
Female	94	62.3%
TOTAL	151	100%

10.2 Students' Age

The age distribution of the students shows that the largest proportion of respondents was 15 years old, comprising 39.1% of the sample. This was followed by participants who were 13 years old (21.2%), 12 years old (13.9%), 14 years old (17.2%), 16 years old (7.9%), and 11 years old (0.7%).
The high percentage of 15-year-old participants in this sample may reflect the fact that this age group is typically in the middle of their secondary school education and may be more likely to participate in research studies. Furthermore, it could indicate that more people were born during a specific year or time period, which is known as a cohort effect.

Table 10.2: Students' Age

	N	%
11 years old	1	0.7%
12 years old	21	13.9%
13 years old	32	21.2%
14 years old	26	17.2%
15 years old	59	39.1%
16 years old	12	7.9%

10.3 Educational Attainment of Father

Table 10.3 shows the educational attainment of fathers in the study, with a total sample size of 151. The highest frequency of educational attainment is College Graduate with 57 respondents, comprising 37.7% of the total sample. This is followed by High School Graduate with 50 respondents, comprising 33.1% of the total sample. College Undergraduate has a frequency of 12 respondents or 7.9% of the total sample. The frequency for High School Undergraduate, Elementary Graduate, Deceased, Post Graduate, and Vocational Course are 8 (5.3%), 5 (3.3%), 7 (4.6%), 4 (2.6%), and 4 (2.6%) respectively. The educational attainment with the lowest frequency is Elementary Undergraduate with only 4 respondents, comprising 2.6% of the total sample.

Table 10.3: Educational Attainment of Father

	N	%
Elementary Undergraduate	4	2.6%
Elementary Graduate	5	3.3%
High School Undergraduate	8	5.3%
High School Graduate	50	33.1%
College Undergraduate	12	7.9%
College Graduate	57	37.7%
Post Graduate	4	2.6%
Vocational Course	4	2.6%
Deceased	7	4.6%

10.4 Educational Attainment of Mother

Table 10.4 shows the educational attainment of the mothers of the respondents, presented in descending order from the highest frequency to the lowest frequency. A total of 151 respondents participated in the study. The most common educational attainment among mothers is college graduate, with a frequency of 75, which accounts for 49.7% of the total respondents. The second most common is high school graduate with a frequency of 38, or 25.2% of the total respondents. The third most common is college undergraduate with a frequency of 15, or 9.9% of the total respondents. The least common educational attainment is post-graduate and elementary undergraduate with a frequency of 3 each, which account for 2.0% of the total respondents each. The table also includes the frequency and percentage of respondents for each educational attainment category.

Table 10.4: Educational Attainment of Mother

	N	%
Elementary Undergraduate	4	2.6%
Elementary Graduate	3	2.0%
High School Undergraduate	9	6.0%
High School Graduate	38	25.2%
College Undergraduate	15	9.9%
College Graduate	75	49.7%
Post Graduate	3	2.0%
Vocational Course	4	2.6%

10.5 Occupation of Father

Table 10.5 shows the frequency and percentage distribution of the occupation of fathers in the study population. The most common occupation is farming, with a frequency of 41, accounting for 27.2% of the total population. The second most common occupation is business proprietor/self-employed, with a frequency of 23, representing 15.2% of the total population. Government employee and company employee are also common occupations, with frequencies of 21 and 24, respectively, accounting for 13.9% and 15.9% of the total population. The least common occupation is deceased, with a frequency of 7, representing 4.6% of the total population.

Table 10.5: Occupation of Father

	N	%
Farming (crop, poultry, piggery, agroforestry, fishery, etc...)	41	27.2%
Business Proprietor/Self-employed	23	15.2%

Government Employee	21	13.9%
Company Employee	24	15.9%
OFW (any job abroad, professional or domestic helper)	11	7.3%
Laborer/ Wage Earner	13	8.6%
Unemployed	11	7.3%
Deceased	7	4.6%

10.6 Occupation of Mother

Table 10.6 shows the frequency and percentage distribution of the occupation of mothers. The most common occupation is government employee, with a frequency of 42, accounting for 27.8% of the total population. The second most common occupation is business proprietor/self-employed, with a frequency of 26, representing 17.2% of the total population. OFW (any job abroad, professional or domestic helper) and farming are also common occupations, with frequencies of 18 and 16, respectively, accounting for 11.9% and 10.6% of the total population. The least common occupation is laborer/wage earner, with a frequency of 3, representing 2.0% of the total population.

Table 10.6: Occupation of Mother

	N	%
Farming (crop, poultry, piggery, agroforestry, fishery, etc...)	16	10.6%
Business Proprietor/Self-employed	26	17.2%
Government Employee	42	27.8%
Company Employee	5	3.3%
OFW (any job abroad, professional or domestic helper)	18	11.9%
Laborer/ Wage Earner	3	2.0%
Unemployed	41	27.2%

10.7 Grade Level of Students

Table 10.7 presents the frequency and percentage distribution of the grade level of students in the study population. The most represented grade level is Grade 10, with a frequency of 60, accounting for 39.7% of the total population. Grade 7 and Grade 8 follow closely, with frequencies of 35 and 33, respectively, representing 23.2% and 21.9% of the total population. Grade 9 is the least represented grade level, with a frequency of 23, accounting for 15.2% of the total population.

Table 10.7: Grade Level of Students

	N	%
Grade 7	35	23.2%
Grade 8	33	21.9%
Grade 9	23	15.2%
Grade 10	60	39.7%

10.8.1 Affective Engagement of Students

Table **10.8.1** represents the results of a survey on affective engagement in math among students. The data shows that the highest mean score is for the statement **"I am interested in learning new things in math"** with a score of **4.0066**, followed by **"I like attending math classes"** with a score of **3.7881**, and **"Learning math is fun"** with a score of **3.7616**. All three statements have a verbal interpretation of **"Agree"** based on the Likert scale used.

The next highest mean scores are for **"I feel more attentive when I'm studying math"** and **"I keep track of my progress while studying math,"** both with a mean score of **3.7219**, which also fall under the **"Agree"**. **"I want to spend more time solving math problems"** has the lowest mean score among the statements that still have an **"Agree"** verbal interpretation at **3.4437.**

The statement **"I like to study Math rather than any subjects"** falls under the **"Neutral"** verbal interpretation with a mean score of **3.1126**, while **"Time passes very quickly when I study math"** has a mean score of **3.3775**, which also falls under the **"Neutral"** category.

Overall, the general weighted mean for all statements combined is **3.5742**, which has an **"Agree"** verbal interpretation based on the Likert scale. This suggests that students have a positive affective engagement with math as a subject.

Affective engagement is considered crucial for achieving positive academic outcomes, including participation and involvement in academic activities, and enjoyment of the subject, such as mathematics. Moreover, strategies such as allowing students to take ownership of their learning by becoming

experts, using visual cues to indicate students' understanding, and establishing peer review norms and expectations can improve students' affective engagement and overall academic performance in math (Taplin, 2019). Therefore, it is reasonable to suggest that students have a positive affective engagement with math as a subject.

Table 10.8.1: Affective Engagement of Students

	Mean	Verbal Interpretation
1. I am interested in learning new things in math.	4.0066	Agree
2. I like attending math classes.	3.7881	Agree
3. Learning math is fun.	3.7616	Agree
4. I feel excited when I study in Math class.	3.5762	Agree
5. I feel more attentive when I'm studying math.	3.6026	Agree
6. I am excited about solving difficult Math problems.	3.3510	Agree
7. I like to study Math rather than any subjects.	3.1126	Neutral
8. Time passes very quickly when I study math.	3.3775	Neutral
9. I keep track of my progress while studying math.	3.7219	Agree
10. I want to spend more time solving math problems.	3.4437	Agree
General Weighted Mean	**3.5742**	**Agree**

10.8.2 Behavioral Engagement of Students

Table 10.8.2 shows the results of a survey on behavioral engagement in math among students. The highest mean score is for the statement **"I follow my teacher's directions in Math class"** with a score of **4.2583**, which has a **"Strongly Agree"** verbal interpretation. This is followed by **"I listen to my teacher in my Math class"** with a score of **4.2781** and **"I am continuously working to improve and correct any errors in my Mathematics work"** with a score of 4.0861, both falling under the **"Agree"** category. The next highest mean scores are for **"I work hard in Math class"** with a mean score of **3.9735** and **"I am trying to work on difficult problems"** with a mean score of **3.8344**, both also under the **"Agree"** verbal interpretation. **"I'm asking for help as I'm willing to learn more in Math problems"** has the second highest mean score with a **"Strongly Agree"** verbal interpretation of **4.2119.**

"I participate in the discussion in Math class" and **"I'm always attentive in studying Math class"** fall under the **"Agree"** verbal interpretation with mean scores of **3.8940** and **3.8609**, respectively. **"At home I review Math problems"** has a mean score of **3.5894**, which also falls under the **"Agree"** category. The statement **"I do not get easily distracted in Math class"** has the lowest mean score among the statements with an **"Agree"** verbal interpretation at **3.4106.**

Overall, the general weighted mean for all statements combined is **3.9397**, which has an **"Agree"** verbal interpretation. This suggests that students have a positive behavioral engagement in math as a subject.

Research from Digitale (2018) suggests that students can have a positive behavioral engagement in math as a subject. A study conducted by researchers at the Stanford University School of Medicine found that having a positive attitude toward math was connected to better function of the hippocampus, a memory center in the brain, during performance of arithmetic problems. Taplin (2019) added that positive behavior strategies can promote engaging and effective instruction, benefitting all students, including those with learning and attention issues.

Table 10.8.2: Behavioral Engagement of Students

	Mean	Verbal Interpretation
1. I listen to my teacher in my Math class.	4.2781	Strongly Agree
2. I participate in the discussion in Math class.	3.8940	Agree
3. I do not get easily distracted in Math class.	3.4106	Agree
4. I work hard in Math class.	3.9735	Agree
5. At home I review Math problems.	3.5894	Agree
6. I am trying to work on difficult problems.	3.8344	Agree
7. I am continuously working to improve and correct any errors in my Mathematics work.	4.0861	Agree
8. I follow my teacher's directions in Math class.	4.2583	Strongly Agree
9. I'm always attentive in studying Math class.	3.8609	Agree
10. I'm asking for help as I'm willing to learn more in Math problems.	4.2119	Strongly Agree
General Weighted Mean	**3.9397**	**Agree**

10.8.3 Cognitive Engagement of Students

Table 6.8.3 shows the results of cognitive engagement in math among students. The data shows that the highest mean score is for the statement **"I memorize important facts to understand Math better"** with a score of **3.9603**, followed by **"I am able to apply critical thinking skills to solve a Math problem"** with a score of **3.7947**, and **"I ask myself questions to make sure I understand math correctly while studying"** with a score of **3.8079**. All three statements have a verbal interpretation of **"Agree"** based on the Likert scale used. The next highest mean scores are for **"I set goal for myself when I study math"** with a mean score of **3.7881**, and **"I try to think different ways to solve Math problems"** with a mean score of **3.8278**, both falling under the **"Agree"** verbal interpretation. **"I try to connect Math to real-life situations"** has a mean score of **3.5166**, which also falls under the **"Agree"** category, while **"I try to change my strategy in order to solve a Math problem"** and **"At home I think about what I learned in Math class"** have mean scores of **3.6093** and **3.6887**, respectively, also falling under the **"Agree"** category.

Overall, the general weighted mean for all statements combined is **3.7503**, which has an **"Agree"** verbal interpretation based on the Likert scale. This suggests that students have a positive cognitive engagement with math as a subject, as they are able to apply critical thinking skills, set goals, and develop their own strategies to solve math problems. Students who engage in meaningful and active learning experiences tend to be more cognitively engaged in the subject. This can involve setting goals, planning steps, monitoring progress, solving problems, and reflecting on their learning (Joshi, Adhikari, Khanal, & Belbase, 2022). In an article by Taplin (2019), when students are able to apply critical thinking skills and develop their own strategies to solve math problems, they become more confident and motivated learners, leading to a positive cognitive engagement with the subject. For instance, by encouraging student-led discussions and allowing them to explain their own solutions to problems, teachers can enhance students' cognitive engagement with math and boost their confidence.

Table 10.8.3: Cognitive Engagement of Students

	Mean	Verbal Interpretation
1. I am able to apply critical thinking skills to solve a Math problem.	3.7947	Agree
2. I ask myself questions to make sure I understand math correctly while studying.	3.8079	Agree
3. I try to connect Math to real life situations.	3.5166	Agree
4. I try to think different ways to solve Math problems.	3.8278	Agree
5. I try to develop my own strategy when I solve math problems.	3.6490	Agree
6. I set goal for myself when I study math.	3.7881	Agree
7. I try to change my strategy in order to solve a Math problem.	3.6093	Agree
8. At home I think about what I learned in Math class.	3.6887	Agree
9. I am focused when I study Math.	3.8609	Agree
10. I memorize important facts to understand Math better.	3.9603	Agree
General Weighted Mean	**3.7503**	**Agree**

10.9 Mathematics Grades of Students

Based on the grading scale provided, the crosstab data shows that out of the **35 students** in **Grade 7**, **3 students** received a grade of **Fairly Satisfactory (75-79), 9 students** received a grade of **Satisfactory (80-84), 15 students** received a grade of **Very Satisfactory (85-89),** and **8 students** received an **Outstanding grade (90-100)**. Therefore, all **35 students** in **Grade 7** passed the Math subject.

For **Grade 8**, out of the **33 students**, **0 students** received a grade of **Fairly Satisfactory (75-79)**, **10 students** received a grade of **Satisfactory (80-84)**, **10 students** received a grade of **Very Satisfactory (85-89)**, and **13 students** received a grade of **Outstanding (90-10)**. Therefore, all **33 students** in **Grade 8** passed the Math subject.

For **Grade 9**, out of the **23 students**, **5 students** received a grade of **Fairly Satisfactory (75-79)**, **11 students** received a grade of **Satisfactory (80-84)**, **3 students** received a grade of **Very Satisfactory (85-89)**, and **4 students** received an **Outstanding grade (90-100)**. Therefore, all **23 students** in **Grade 9** passed the Math subject.

For **Grade 10**, out of the **60 students**, **2 students** received a grade of **Fairly Satisfactory (75-79)**, **13 students** received a grade of **Satisfactory (80-84)**, **26 students** received a grade of **Very Satisfactory (85-89)**, and **19 students** received a grade of **Outstanding (90-100)**. Therefore, all **60 students** in **Grade 10** passed the Math subject.

Overall, out of the **151 students**, **44 students** received an **Outstanding grade**, **54 students** received a grade of **Very Satisfactory**, **43 students** received a grade of **Satisfactory**, **10 students** received a grade of **Fairly Satisfactory**, and **0 students did not meet the expectations and failed**. This indicates that a majority of the students passed the Math subject. NEUST students were motivated and engaged in their math studies. According to an article by Posamentier, (2013), actively involving students in justifying mathematical curiosities can be an effective technique for motivating them. Additionally, Langoban (2020) stated teaching math in an interesting and engaging manner can make it less daunting and more accessible to students.

Table 10.9: Mathematics Grades of Students

		Mathematics Grades				
		Fairly Satisfactory 75 - 79	Satisfactory 80 - 84	Very Satisfactory 85 - 89	Outstanding 90 - 100	**Total**
Grade Level	Grade 7	3	9	15	8	**35**
	Grade 8	0	10	10	13	**33**
	Grade 9	5	11	3	4	**23**
	Grade 10	2	13	26	19	**60**
Total		**10**	**43**	**54**	**44**	**151**

10.10.1 Association of Sex and Students' Engagement

Sex and Affective Engagement

The Pearson Chi-square value or the test statistic calculated is **29.908[a]** at **29** degrees of freedom. The Asymptotic significance value or the P-value is **0.419** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between sex and affective engagement of students is not rejected. It can be concluded that there is a 95% confidence that sex and affective engagement of students are independent. It also implies that sex is not a determinant of students' affective engagement. In other words, male and female students are comparable in terms of affective engagement.

In contrast, based on the research conducted by Fatou, Nicolas & Kubiszewski (2018), a statistically significant effect of sex on student engagement was found. Another study by Santos, Simões, Cefai, Freitas, & Arriaga (2021) found that there was a significant interaction between age and gender in the affective dimension of student engagement, with males expressing significantly lower emotional engagement with school in both 13 to 15-year-olds and 16 to 18-year-olds age groups.

Sex and Behavioral Engagement of Students

The Pearson Chi-square value or the test statistic calculated is **17.116[a]** at **25** degrees of freedom. The Asymptotic significance value or the P-value is **.878** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between sex and behavioral engagement of students is not rejected. It can be concluded that there is a 95% confidence that sex and behavioral engagement of students are independent.

In contrary, based on the study conducted by Lietaert, S., Roorda, D., Laevers, F., Verschueren, K., & De Fraine, B. (2015) on the gender gap in student engagement, it was found that autonomy support and involvement partially mediated the relationship between gender and behavioral engagement. According to the results, however, it does not matter whether they are male or female in terms of their level of behavioral engagement. It can be concluded that their gender has no effect on their behaviors in Mathematics.

Sex and Cognitive Engagement of Students

The Pearson Chi-square value or the test statistic calculated is **30.882[a]** at **28** degrees of freedom. The Asymptotic significance value or the P-value is **.322** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between sex and cognitive engagement of students is not rejected. It can be concluded that there is a 95% confidence that sex and cognitive engagement of students are independent.

According to a study by Hyde (2016) the sex differences in cognitive functioning, males outperform females on certain spatial tests and females outperform males on certain verbal tests, but overall, males and females perform equally on mathematics assessments. In terms of cognitive engagement, it does not matter whether the individuals are male or female, according to the results. It can be concluded that their sexual orientation has no effect on their mathematics performance cognitively.

Table 10.10.1: Association of Sex and Students' Engagement

Variables	Pearson Chi-Square	Value	Df	Asymptotic Significance (2-sided)
a) Sex and Affective Engagement		29.908[a]	29	.419
b) Sex and Behavioral Engagement		17.116[a]	25	.878
c) Sex and Cognitive Engagement		30.882[a]	28	.322

a. 52 cells (86.7%) have expected count less than 5. The minimum expected count is .38.
b. 47 cells (90.4%) have expected count less than 5. The minimum expected count is .38.
c. 52 cells (89.7%) have expected count less than 5. The minimum expected count is .38.

10.10.2 Correlation of Age and Student Engagement

The table shows the correlation coefficients between age and affective, behavioral, and cognitive engagement. The Pearson correlation coefficient is used to measure the strength and direction of the linear relationship between two variables. The correlation coefficient for age and affective engagement is **-0.277**, which indicates a **moderately negative correlation**. The correlation coefficient for **b -0.180**, which indicates a **weak negative correlation**. Finally,

the correlation coefficient for **b** is **-0.198**, which indicates a **weak negative correlation**. The p-values associated with the correlation coefficients are also provided. For all three relationships, the p-values are less than the significance level of 0.05, indicating that the correlations are **statistically significant**. This suggests that there is evidence of a relationship between age and affective, behavioral, and cognitive engagement.

In summary, the table suggests that age is **negatively correlated** with affective, behavioral, and cognitive engagement, and these correlations are **statistically significant** at the 0.05 level. In contrast, a study on the relationship between students' engagement and academic performance in an eLearning environment, a weak positive correlation was found between student engagement in an online module and their performance in the final learning activity (Rajabalee, Santally, & Rennie, 2019). However, when continuous learning activities were considered, a strong positive correlation was observed. These findings suggest that as students get older, their engagement in school may decrease. However, it is important to note that correlation does not necessarily imply causation. There may be other factors that are contributing to the observed correlations between age and engagement. For example, students who are older may have more responsibilities outside of school that affect their engagement. Additionally, the discussion mentions another study that found a weak positive correlation between student engagement in an online module and their performance in the final learning activity. However, when continuous learning activities were considered, a strong positive correlation was observed. This highlights the importance of considering different aspects of student engagement when examining its relationship with academic performance.

Overall, the information presented in this discussion suggests that there is a relationship between age and student engagement, but further research is needed to understand the factors that contribute to this relationship and how it may impact academic performance.

Table 10.10.2: Correlation of Age and Student Engagement

		Age	Affective	Behavioral	Cognitive
Age	Pearson Correlation	1	-.277**	-.180*	-.198*
	Sig. (2-tailed)		.001	.027	.015
	N	151	151	151	151

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

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

10.10.3 Correlation between Educational Attainment of Parents and Student Engagement

The table shows the correlation coefficients between educational attainment of father and mother and affective, behavioral, and cognitive engagement. The Pearson correlation coefficient is used to measure the strength and direction of the linear relationship between two variables. The correlation coefficient for educational attainment of father and affective engagement is **-0.132**, which indicates a **weak negative correlation**. The correlation coefficient for educational attainment of father and behavioral engagement is **-0.113**, which indicates a **weak negative correlation**. Finally, the correlation coefficient for educational attainment of father and cognitive engagement is **-0.067**, which indicates **no correlation**.

The correlation coefficients for educational attainment of mother and affective, behavioral, and cognitive engagement are also presented in the table. The correlation coefficient for educational attainment of mother and affective engagement is **-0.080**, which indicates **no correlation**. The correlation coefficient for educational attainment of mother and behavioral engagement is **-0.091**, which indicates **no correlation**. Finally, the correlation coefficient for educational attainment of mother and cognitive engagement is **-0.074**, which indicates **no correlation**.

The significance levels (p-values) indicate the probability of obtaining the correlation coefficients by chance, assuming **no correlation** between the variables. None of the correlation coefficients are statistically significant at the 0.05 level (2-tailed), as their corresponding p-values are all greater than 0.05. Therefore, based on the correlation coefficients and significance levels in the table, it can be concluded that there is **no significant relationship** between educational attainment of father and mother and affective, behavioral, and cognitive engagement. The correlation coefficients suggest **weak negative correlations**, but these relationships are **not statistically significant**.

Studies have indicated the importance of parents' involvement in their children's education, as well as the influence of parent educational attainment on children's development. For instance, according to the study on the role of parent educational attainment in parenting and children's development, parent education is a critical factor that impacts children's cognitive and socioemotional development (Davis-Kean et al., 2020). In contrast, the study of the influence of age and gender on students' achievement in Mathematics has shown that academic performance tends to decline as students get older, which highlights the need for interventions that target this age group (Dr. M Khata Jabor et al., 2011). According to the results, none of the dimensions of students' engagement are correlated with their parent's educational attainment. It indicates that their parent's occupation has no bearing on their affective, behavioral, and cognitive engagement in mathematics. The parents play important roles in their teenagers' performance in mathematics, and the result "no correlation" does not imply that the students' parents do not encourage or motivate them to perform well in mathematics; rather, the result is primarily related to their parents' educational attainment.

Table 10.10.3: Correlation between Educational Attainment of Parents and Student Engagement

		Affective	Behavioral	Cognitive
Father	Pearson Correlation	-.132	-.113	-.067
	Sig. (2-tailed)	.106	.166	.416
	N	151	151	151
Mother	Pearson Correlation	-.080	-.091	-.074
	Sig. (2-tailed)	.331	.265	.369
	N	151	151	151

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

10.10.4 Association between Occupation of Parents and Students' Engagement

Occupation of Father and Affective Engagement

The Pearson Chi-square value or the test statistic calculated is **215.894[a]** at **203** degrees of freedom. The Asymptotic significance value or the P-value is **.255** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between occupation of father and affective engagement of students is not rejected. It can be concluded that there is a 95% confidence that occupation of father and affective engagement of students are independent.

This indicates that the father's occupation has no consequence on a student's affective engagement, which measures their emotional connection to mathematics. However, it is essential to observe that parents can still play significant roles in their adolescents' mathematics performance. The absence of a correlation between parental occupation and affective engagement does not necessarily imply that parents do not encourage or inspire their children to excel in mathematics. Rather, the dearth of correlation is primarily attributable to the parents' occupations.

Occupation of Father and Behavioral Engagement

The Pearson Chi-square value or the test statistic calculated is **188.691[a]** at **175** degrees of freedom. The Asymptotic significance value or the P-value is **.227** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between occupation of father and behavioral engagement of students is not rejected. It can be concluded that there is a 95% confidence that occupation of father and behavioral engagement of students are independent.

The results of the test showed that there is no significant relationship between the occupation of a student's father and their behavioral engagement in school. This means that regardless of their father's occupation, students are equally likely to be engaged or disengaged in their academic activities.

For example, a student whose father is a blue-collar worker may be just as engaged in school as a student whose father is a white-collar professional. On the other hand, a student whose father is a white-collar professional may be disengaged in school, while a student whose father is a blue-collar worker may be highly engaged.

It is essential to note that this study does not suggest that a student's father's occupation has no influence on their academic performance. Other factors such as family income, educational background, and parental involvement can also play a crucial role in determining a student's level of engagement and academic success.

Occupation of Father and Cognitive Engagement

The Pearson Chi-square value or the test statistic calculated is **194.814[a]** at **196** degrees of freedom. The Asymptotic significance value or the P-value is **.510** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between occupation of father and cognitive engagement of students is not rejected. It can be concluded that there is a 95% confidence that occupation of father and cognitive engagement of students are independent.

Occupation of Mother and Affective Engagement

The Pearson Chi-square value or the test statistic calculated is **217.735[a]** at **174** degrees of freedom. The Asymptotic significance value or the P-value is **.014** which is less than the significance level 0.05. The null hypothesis that states there is **no association** between occupation of mother and affective engagement of students is **rejected**. It can be concluded that there is a 95% confidence that occupation of mother and affective engagement of students are dependent.

The students who agreed to be affectively engaged in mathematics at the highest frequency were those with unemployed mothers, followed by those whose mothers were government-employed. This suggests that a student's mother's occupation may influence their emotional and psychological engagement in school. For instance, students whose mothers are unemployed may be more emotionally engaged in school, while students whose mothers are professionals or highly educated may have slightly less affective engagement than those with unemployed mothers. This could be because unemployed mothers may have more time for their children than those who are government-employed. However, it is important to note that correlation does not necessarily imply causation, and other factors may also play a role in determining a student's level of affective engagement.

Occupation of Mother and Behavioral Engagement

The Pearson Chi-square value or the test statistic calculated is **166.823[a]** at **150** degrees of freedom. The Asymptotic significance value or the P-value is **.165** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between occupation of mother and behavioral engagement of students is not rejected. It can be concluded that there is a 95% confidence that occupation of mother and behavioral engagement of students are independent.

These findings indicate that occupation of a student's mother has no bearing on their behavioral engagement in mathematics. Behavioral engagement refers to a student's participation and involvement in learning activities, including things like attendance, participation in class, and completion of assignments. The lack of correlation between mother's occupation and behavioral engagement suggests that factors other than parental occupation may be more important in predicting behavioral engagement in mathematics.

It's important to note that there may be other factors that influence behavioral engagement in mathematics that were not considered in this study. For example, the study did not examine the influence of a student's own attitudes or motivation on their behavioral engagement. The findings from this study suggest that occupation of mother may not be a significant factor in predicting behavioral engagement in mathematics.

Occupation of Mother and Cognitive Engagement

The Pearson Chi-square value or the test statistic calculated is **172.787[a]** at **168** degrees of freedom. The Asymptotic significance value or the P-value is **.384** which is greater than the significance level 0.05. The null hypothesis that states there is **no association** between occupation of mother and cognitive engagement of students is not rejected. It can be concluded that there is a 95% confidence that occupation of mother and cognitive engagement of students are independent.

According to research conducted by Aspiras, Quia & Manalo, Erika & Lapada, Maverick & Castro, Calvin & Alido, Charles (2020), contrary to the belief that a parent's occupation may directly affect their child's engagement in education, research has not found any conclusive evidence to support this claim. However, in a study on the impact of age and gender on students' academic achievement in Mathematics, empirical evidence has shown that older students tend to perform worse academically, and the decline in their performance continues as they age.

This means that a mother's profession does not appear to have a direct impact on her child's cognitive engagement. This finding is consistent with recent research that suggests that parental occupation may not be a strong predictor of a child's academic success. However, other factors such as socioeconomic status, parental involvement, and access to educational resources may play a more significant role in a child's cognitive engagement and academic achievement.

It is essential to note that the lack of association found in this study does not necessarily mean that a mother's occupation is entirely irrelevant to her child's cognitive engagement. There may be other variables that were not accounted for in this analysis that could potentially influence the relationship between occupation and cognitive engagement.

Table 10.10.4: Association between Occupation of Parents and Students' Engagement

Variables	Pearson Chi-Square	Value	df	Asymptotic Significance (2-sided)
a)	Occupation of Father and Affective Engagement	215.894[a]	203	.255
b)	Occupation of Father and Behavioral Engagement	188.691[a]	175	.227
c)	Occupation of Father and Cognitive Engagement	194.814[a]	196	.510
d)	Occupation of Mother and Affective Engagement	217.735[a]	174	.014
e)	Occupation of Mother and Behavioral Engagement	166.823[a]	150	.165
f)	Occupation of Mother and Cognitive Engagement	172.787[a]	168	.384

a. 240 cells (100.0%) have expected count less than 5. The minimum expected count is .05.
b. 208 cells (100.0%) have expected count less than 5. The minimum expected count is .05.
c. 231 cells (99.6%) have expected count less than 5. The minimum expected count is .05.
d. 210 cells (100.0%) have expected count less than 5. The minimum expected count is .02.
e. 182 cells (100.0%) have expected count less than 5. The minimum expected count is .02.
f. 200 cells (98.5%) have expected count less than 5. The minimum expected count is .02.

10.10.5 Correlation of Grade Level and Students' Engagement

The table shows the Pearson correlation coefficients and associated p-values between grade level and affective, behavioral, and cognitive engagement. The correlation coefficient measures the strength and direction of the linear relationship between two variables. The correlation coefficient between grade level and affective engagement is **-0.306**, which indicates a **moderate negative correlation**. The correlation coefficient between grade level and behavioral engagement is **-0.208**, indicating a **weak negative correlation**. Finally, the correlation coefficient between grade level and cognitive engagement is **-0.238**, indicating a **weak negative correlation**.

The p-values associated with the correlation coefficients are also provided. For all three relationships, the p-values is less than the significance level of 0.05, indicating that the correlations are **statistically significant**. This suggests that there is evidence of a relationship between grade level and affective, behavioral, and cognitive engagement.

In summary, the table suggests that grade level is **negatively correlated** with affective, behavioral, and cognitive engagement, and these correlations are **statistically significant** at the 0.05 level.

Based on a report by Loveless (2015), it was found that there is a negative correlation between engagement and achievement as students' progress from fourth to eighth grade. Specifically, the correlation coefficients for the association of enjoyment and achievement were -0.67 and -0.75 respectively for fourth and eighth grade students. This implies that as students get older, their engagement with academic material decreases, resulting in a decline in their academic achievement.

As the student progress through grade levels, their engagement decreased based on the statistical result. These findings have substantial implications for educators and policymakers. It highlights the importance of identifying strategies to promote and maintain student engagement in academic content, particularly as students' progress through the grade levels.

Table 10.10.5: Correlation of Grade Level and Students' Engagement

		Affective	Behavioral	Cognitive
Grade Level	Pearson Correlation	-.306**	-.208*	-.238**
	Sig. (2-tailed)	.000	.010	.003
	N	151	151	151

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

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

10.11.1 Association of Sex and Mathematics Achievement of Students

The Pearson Chi-square value or the test statistic calculated is **30.353[a]** at **21** degrees of freedom. The Asymptotic significance value or the P-value is **.085** which is greater than the significance level 0.05. The null hypothesis that states there is no association between **sex** and **mathematics achievement** of students is not rejected. It can be concluded that there is a 95% confidence that **sex** and **mathematics achievement** of students are independent.

It is supported by Cao's (2022) study, which investigated the relationship between high school students' academic self-efficacy and achievement in mathematics in the United States, there was no correlation between gender and success in mathematics. The lack of association between sex and mathematics achievement of students is an interesting finding. While there are still societal stereotypes about gender and mathematics, it is important to base our conclusions on empirical evidence. The fact that the null hypothesis was not rejected in this study suggests that the sex of the student does not significantly affect their performance in mathematics. In conclusion, the lack of significant association between sex and mathematics achievement of students is supported by both statistical analysis and previous research. It is important to continue monitoring and addressing gender disparities in education to ensure equal opportunities for all students.

Table 10.11.1: Association of Sex and Mathematics Achievement of Students

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	30.353[a]	21	.085
Likelihood Ratio	34.660	21	.031
Linear-by-Linear Association	4.193	1	.041
N of Valid Cases	151		

a. 33 cells (75.0%) have expected count less than 5. The minimum expected count is .38.

10.11.2 Correlation of Age and Mathematics Achievement of Students

The table shows the Pearson correlation coefficient and associated p-value between age and average grades in math. The correlation coefficient measures the strength and direction of the linear relationship between the two variables. The correlation coefficient between age and average grades in math is **0.144**, which indicates a **weak positive correlation**. The p-value associated with the correlation coefficient is 0.078. This is greater than the significance level of 0.05, suggesting that the correlation is **not statistically significant**. Therefore, it cannot be concluded that there is a significant relationship between age and average grades in math.

In summary, the table suggests that there is a **weak positive correlation** between age and average grades in math, but this correlation is **not statistically significant** at the 0.05 level. According to a report by UNESCO (2022), the gender gap in mathematics achievement is gradually disappearing, with girls now performing equally well as boys. However, there is still no clear consensus on the correlation between age and mathematics achievement. Some studies have shown that older students tend to perform worse and are more likely to drop out of school (Jabor, M., Machtmes, K., & Nordin, M. S., 2011). This means that as a person gets older, their average math grades tend to increase slightly. However, the connection between age and math grades is not significant. For example, when analyzing the grades of a group of students and their ages, it may be noticed that older students have marginally better math grades than younger students. Nevertheless, this link is not strong enough to accurately predict a student's math grades solely based on their age.

Table 10.11.2: Correlation of Age and Mathematics Achievement of Students

		Mathematics Achievement

Age	Pearson Correlation	.144
	Sig. (2-tailed)	.078
	N	151

10.11.3 Correlation of Educational Attainment of Parents and Mathematics Achievement of Students

The table shows the Pearson correlation coefficients and associated p-values between Mathematics Achievement and the educational attainment of the father and mother. The correlation coefficient measures the strength and direction of the linear relationship between two variables. The correlation coefficient between Mathematics Achievement and the educational attainment of the father is **-0.070**, which indicates a **weak negative correlation**. The correlation coefficient between Mathematics Achievement and the educational attainment of the mother is **-0.006**, indicating a **very weak negative correlation**. The p-values associated with the correlation coefficients are also provided. For both relationships, the p-values are greater than the significance level of 0.05, indicating that the correlations are **not statistically significant**. This suggests that there is no evidence of a relationship between Mathematics Achievement and the educational attainment of the father and mother.

In summary, the table suggests that there is **no significant correlation** between Mathematics Achievement and the educational attainment of the father and mother. In contrast, a research conducted by Gabriele Kaiser and Yan Zhu (2022), the academic performance of students in mathematics is influenced by their socioeconomic status, including their parents' educational attainment, occupation, prestige, economic status, and cultural resources. This means that a parent's education level may not be a reliable indicator of their child's success in mathematics. However, there may be other factors, such as cultural resources and economic status, that could have a greater impact on determining a student's level of mathematics achievement. Therefore, further investigation is needed to explore the influence of these variables on mathematics achievement.

Table 10.11.3: Correlation of Educational Attainment of Parents and Mathematics Achievement of Students

		Father	Mother
Mathematics Achievement	Pearson Correlation	-.070	-.006
	Sig. (2-tailed)	.396	.946
	N	151	151

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

10.11.4 Association between Occupation of Parents and Mathematics Achievement of Students

Occupation of Father and Mathematics Achievement of Students

The Pearson Chi-square value or the test statistic calculated is **146.888[a]** at **147** degrees of freedom. The Asymptotic significance value or the P-value is **.487** which is greater than the significance level 0.05. The null hypothesis that states there is no association between **occupation of father** and **mathematics achievement** of students is not rejected. It can be concluded that there is a 95% confidence that **occupation of father** and **mathematics achievement** of students are independent.

According to study by Yusof, Rashid, & Mohamed (2019) shows that a student's level of mathematics achievement is not significantly influenced by their father's occupation. For example, a student whose father is a farmer has an equal chance of performing well in mathematics as a student whose father is a doctor or a lawyer. Thus, it can be concluded that a father's occupation does not have a notable impact on a student's level of mathematics achievement.

Occupation of Mother and Mathematics Achievement of Students

The Pearson Chi-square value or the test statistic calculated is **130.313a [a]** at **126** degrees of freedom. The Asymptotic significance value or the P-value is **.378** which is greater than the significance level 0.05. The null hypothesis that states there is no association between **occupation of mother** and **mathematics achievement** of students is not rejected. It can be concluded that there is a 95% confidence that **occupation of mother** and **mathematics achievement** of students are independent. According to a study conducted in Ghana, there is a significant correlation between parental occupation and the mathematics achievement of their children, as indicated by the positive association between household possessions and children's math performance (Chowa, Masa, Wretman, & Ansong, 2013).

Based on the statistical analysis result, it can be concluded that there is no significant association between the occupation of mother and the mathematics achievement of students. This finding suggests that other factors aside from parental occupation, such as access to educational resources and quality of instruction, may play a more critical role in determining students' performance in mathematics. For instance, a student may come from a family with a mother who works as a farmer and has limited formal education, but if the student has access to quality educational resources, they may still perform well in mathematics. Thus, this result emphasizes the importance of addressing disparities in educational resources and opportunities to ensure that all students have an equal chance to excel in mathematics regardless of their parents' occupation or educational attainment.

Table 10.11.4: Association between Occupation of Parents and Mathematics Achievement

Variables	Pearson Chi-Square	Value	df	Asymptotic Significance (2-sided)
a)	Occupation of Father and Mathematics Achievement	146.888[a]	147	.487
b)	Occupation of Mother and Mathematics Achievement	130.313[a]	126	.378

a. 176 cells (100.0%) have expected count less than 5. The minimum expected count is .05.

b. 154 cells (100.0%) have expected count less than 5. The minimum expected count is .02.

Table 10.11.5 Correlation of Grade Level and Mathematics Achievement

The table shows the Pearson correlation coefficient and associated p-value between grade level and Mathematics Achievement. The correlation coefficient measures the strength and direction of the linear relationship between two variables. In this case, the correlation coefficient between grade level and Mathematics Achievement is **0.095**, indicating a **weak positive correlation**. The p-value associated with the correlation coefficient is **0.244**, which is greater than the significance level of 0.05. Therefore, the correlation **is not statistically significant** at the 0.05 level, and it cannot be concluded that there is a significant relationship between grade level and Mathematics Achievement.

In summary, the table suggests that there is a **weak positive correlation** between grade level and Mathematics Achievement, but this correlation is **not statistically significant** at the 0.05 level. On contrary, one study conducted by Kaiser and Zhu (2022) found that grade level significantly impacts students' mathematics achievement in the PISA test. This implies that other factors, such as teaching methods, socioeconomic status, or learning ability, might have a stronger impact on students' mathematics achievement than their grade level. However, it is important to note that other studies have found significant correlations between grade level and mathematics achievement than their grade level. However, it is important to note that other studies have found significant correlations between grade level and mathematics achievement, indicating that the relationship may vary depending on the context and the research design. Therefore, it is essential to consider the context and specific factors that may impact the relationship between grade level and Mathematics Achievement when interpreting the results of studies in this area.

Table 10.11.5: Correlation of Grade Level and Mathematics Achievement

		Mathematics Achievement
Grade Level	Pearson Correlation	.095
	Sig. (2-tailed)	.244
	N	151

10.12 Regression Analysis of Mathematics Achievement and Students' Engagement

Table 6.12 shows the model summary for a regression analysis with Mathematics Achievement as the dependent variable and Cognitive, Affective, and Behavioral as the predictors. The table includes the correlation coefficient (R), R-Square, Adjusted R-Square, Standard Error of the Estimate, R-Square Change, and F-Change.

The R-Square value of **0.026** indicates that the predictors together explain only **2.6%** of the variance in Mathematics Achievement. However, when adjusted for the number of predictors in the model, the Adjusted R-Square value of **0.006** suggests that the predictors are not very effective in explaining the variance in Mathematics Achievement.

The F-Change value of **1.313** is associated with a p-value of **0.273**, which indicates that the overall model is not statistically significant at the 0.05 level. Therefore, it can be concluded that the model is not a good fit for predicting Mathematics Achievement based on Cognitive, Affective, and Behavioral predictors.

Table 10.12: Model Summary[b] for Regression Analysis of Mathematics Achievement and Students' Engagement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					R Square Change	F Change
1	.162[a]	.026	.006	4.56228	.026	1.313

a. Predictors: (Constant), Cognitive, Affective, Behavioral

b. Dependent Variable: Mathematics Achievement

The ANOVA table summarizes the results of the hypothesis test for the significance of the regression model. The table shows the breakdown of the variation in the Mathematics Achievement into two components, namely the variation explained by the model (Regression) and the variation not explained by the model (Residual).

The table indicates that the regression model with Cognitive, Affective, and Behavioral as predictors explains a statistically insignificant amount of the variation in Mathematics Achievement, as evidenced by the F-statistic of **1.313** and its associated p-value of .**273**, which is greater than the significance level of 0.05. The null hypothesis, which states that the model has no effect on Mathematics Achievement, cannot be rejected based on these results.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	81.958	3	27.319	1.313	.273[b]
	Residual	3059.711	147	20.814		
	Total	3141.669	150			

a. Dependent Variable: Mathematics Achievement

b. Predictors: (Constant), Cognitive, Affective, Behavioral

The table shows that the Cognitive, Affective, and Behavioral predictors do not significantly affect Mathematics Achievement. This could be because other variables not included in the model have a stronger influence. Factors like family support, socio-economic status, and cultural background may impact math performance. Although the ANOVA table does not support a significant effect of the regression model, it helps identify factors influencing math achievement.

In conclusion, empirical studies indicate that there are three dimensions of student engagement, including affective, behavioral, and cognitive engagement. In contrary to the research results, Khine, Afari, and Mutawah (2015) found that affective engagement has a positive correlation with overall student engagement, while Flores et al. (2021) showed that there is a moderately positive relationship between behavioral engagement and academic performance in mathematics. Additionally, Francis, Yong, and Chen (2018) argued that cognitive engagement is the most important dimension of student engagement, as it has the strongest positive association with academic performance. Thus, it is crucial for educators to promote all three dimensions of student engagement in order to enhance academic success in students.

SUMMARY OF FINDINGS

1. **How may profile of the respondent be described in terms of:**

1.1) Sex

- The majority of the respondents are females.

1.2) Age

- The largest proportion of respondents in the student sample was age 15-year-old.

1.3) Educational attainment of parents

- In terms of father, the highest frequency of educational attainment is College Graduate.
- In terms of mother, the most common educational attainment among mothers is college graduate.

1.4) Occupation of Parents

- In terms of father, the most common occupation is farming.
- In terms of mother, the most common occupation is government employee.

1.5) Year Level

- The most represented grade level is Grade 10.

2. **How may the student engagement be described in terms of:**

2.1) Affective

- The data indicates that students generally have a positive attitude towards learning math. They strongly agree that they are interested in **learning new things in math**, while they remain neutral about the statement that **time passes quickly when studying math**. The overall average score for all statements is in the "Agree" category.

2.2) Behavioral

- Students tend to **follow their teacher's directions in math class**, according to the data, with a "Strongly Agree" average score. However, they agree that **they can get distracted in math class**. The overall average score for all statements is in the "Agree" category.

2.3) Cognitive

- The data suggests that students agree with the statement that **memorizing important facts helps them understand math better.** Additionally, they agree that **changing their strategy and thinking about what they learned in math class at home** can also be helpful. The overall average score for all statements is in the "Agree" category.

3. **How may the student's mathematics achievement be described?**

- In Grade 7, all 35 students passed Math: 3 Fairly Satisfactory, 9 Satisfactory, 15 Very Satisfactory, and 8 Outstanding.
- In Grade 8, all 33 students passed Math: 0 Fairly Satisfactory, 10 Satisfactory, 10 Very Satisfactory, and 13 Outstanding.
- In Grade 9, all 23 students passed Math: 5 Fairly Satisfactory, 11 Satisfactory, 3 Very Satisfactory, and 4 Outstanding.
- In Grade 10, all 60 students passed Math: 2 Fairly Satisfactory, 13 Satisfactory, 26 Very Satisfactory, and 19 Outstanding.

Overall, out of 151 students, none failed: 44 Outstanding, 54 Very Satisfactory, 43 Satisfactory, and 10 Fairly Satisfactory.

4. Is there a significant relationship between the profile of respondents and their:

4.1) engagement

- There is no association between sex and affective engagement, behavioral engagement, and cognitive engagement of students.
- Age is negatively correlated with affective, behavioral, and cognitive engagement, and these correlations are statistically significant.
- There is no significant relationship between the educational attainment of the father and mother and affective, behavioral, and cognitive engagement. The correlations suggest weak negative relationships but are not statistically significant.
- There is no association between the occupation of the father and affective engagement, behavioral engagement, and cognitive engagement of students.
- The null hypothesis that states there is no association between the occupation of the mother and behavioral engagement of students is not rejected.
- The null hypothesis that states there is no association between the occupation of the mother and cognitive engagement of students is not rejected.
- Grade level is negatively correlated with affective, behavioral, and cognitive engagement, and these correlations are statistically significant.

4.2) Mathematics achievement

- There is no association between sex and mathematics achievement of students.
- There is a weak positive correlation between age and average grades in math, but this correlation is not statistically significant.
- There is no significant correlation between mathematics achievement and the educational attainment of the father and mother.
- The null hypothesis that states there is no association between the occupation of the father and mathematics achievement of students is not rejected.
- The null hypothesis that states there is no association between the occupation of the mother and mathematics achievement of students is not rejected.
- There is a weak positive correlation between grade level and mathematics achievement, but this correlation is not statistically significant.

5. Does the students' engagement such as affective, behavioral, and cognitive predictors significantly explain the variance in mathematics achievement?

- The R-Square value of **0.026** indicates that the predictors together explain only **2.6%** of the variance in Mathematics Achievement. However, when adjusted for the number of predictors in the model, the Adjusted R-Square value of **0.006** suggests that the predictors are not very effective in explaining the variance in Mathematics Achievement. The F-Change value of **1.313** is associated with a p-value of **0.273**, which indicates that the overall model is not statistically significant at the 0.05 level.

The null hypothesis, which states that the model has no effect on Mathematics Achievement, cannot be rejected based on these results.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The following conclusions were drawn from the presented findings:

1. Female students made up the majority of the responses, and the majority of those students were the ages of 15. In addition, most of the parents are college graduate with a job of farmers and college workers. Lastly, students are mostly grade 10.
2. The students showed positive engagement in math across all three domains, with behavioral, cognitive, and affective domains.
3. The majority of the students received grades of Very Satisfactory or higher.

4. The older and higher-grade students tend to have lower engagement levels.
5. The occupation of the mother was found to be significantly associated with affective engagement.
6. The students' engagement does not predict mathematics achievement.

Recommendation

1. Teachers may incorporate more hands-on activities, using technology in the classroom, or providing more challenging material for advanced students.
2. Teachers may strive to balance their workload expectations to ensure students are not overwhelmed and can maintain focus and engagement in class.
3. Teachers may need to provide additional support to help struggling students improve their math skills. This could involve one-on-one tutoring, additional practice materials, or targeted interventions to address specific areas of difficulty.
4. Parents may play an important role in supporting their children's education by dedicating time for family activities that promote learning, such as setting aside dedicated time for homework, monitoring their progress, and providing resources such as books and educational apps.
5. Future researchers may explore a variety of factors that may impact mathematics achievement, including teaching strategies, student motivation, socio-economic status, and others.
6. Future research could explore the relationship between engagement and achievement in other subject areas, as well as the factors that contribute to engagement among students. This could include examining the impact of teacher characteristics, classroom environment, and student attitudes and beliefs on engagement and achievement.

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