High School Student's Emotional Intelligence and Self-Reliance in Learning Mathematics: A Simple-Regression Analysis

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Abstract: The prediction potential of the model "emotional intelligence and self-reliance" to students' mathematical performance was investigated in this study. This research was conducted in the third and fourth quarters of the academic year 2021-2022. The quantitative research design, specifically comparative and regression analysis, was used in this study. The comparative design was utilized to assess the differences in emotional intelligence and self-reliance between male and female students, and the regression analysis was performed to see if the model "emotional intelligence and self-reliance" can predict students' mathematical performance. In terms of emotional intelligence and self-reliance, the findings show no significant difference between male and female students. Furthermore, the student's emotional intelligence and self-reliance were strong predictors of mathematics performance. It implies that emotional intelligence and self-reliance are essential factors in better math learning. The study suggested that teachers may improve their students' emotional intelligence and self-reliance by integrating social and emotional learning programs into their classes.

Keywords: *Emotional intelligence, learning mathematics, self-reliance.*

Introduction

It is difficult to learn during a pandemic. Face-to-face learning is being replaced by online, modular, blended, and other learning modalities, with modular learning being the most popular in the Philippines, with 87 percent of enrollees choosing printed modular learning (De Guzman, 2021). Self-learning modules helps students to rely on their ability to acquire knowledge independently (Vallespin, 2021). Furthermore, because there are no teachers to explain the topics assigned to them, students must exert greater effort to study them. In addition, some students may be tutored by their parents or guardians, while other wealthier parents may hire tutors for their children. However, most NEUST-Gabaldon campus students cannot afford tutorials. As a result, the vast majority of students rely only on their abilities. Furthermore, learning mathematics through modules is challenging for both parents and students, as students complained that the modules included too many tasks/activities (Dargo & Dimas, 2021).

Self-reliance is defined by Webster Dictionary (2022) as reliance on one's efforts and talents. Students must rely on themselves and their abilities in situations such as this modular learning. Furthermore, the high level of self-directed learning necessitates students to take responsibility for their learning (Alghamdi, 2021). According to Aisyah and Syamsuddin (2020), students' self-reliance pushes them to do better in mathematics. Similarly, classroom self-reliance can predict students' adolescent mathematical achievement (Gardner-Neblett et al., 2014). Meanwhile, Tariq et al. (2013) show that male students are more self-sufficient than female students and that there is a positive relationship between mathematical performance and self-confidence. Furthermore, according to the self-reliance classification, students with high comprehension of concepts were placed in the high category, students with moderate comprehension of concepts were placed in the medium-high category, and students with low comprehension of concepts were placed in the medium-low category (Eriana et al., 2019). Additionally, the visual, auditory, tactile, group

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and individual learning styles of students have a direct association with their self-reliance, but the kinesthetic learning style has no impact on the students' self-reliance (Puri, 2017). Alternatively, according to Farlina and Rohaeti (2018) mathematical understanding competence and self-reliance have no direct association, but a strong relationship between mathematical communication and self-reliance was observed.

Emotional intelligence, on the other hand, influences mathematics achievement; the higher the level of the student's emotional intelligence, the better the performance (Prafitriyani et al., 2019). Emotional intelligence, according to Mental Health America (2022), is the ability to control your own emotions as well as comprehend the feelings of those around you, and it consists of five main components: self-awareness, self-regulation, motivation, empathy, and social skills. Furthermore, the Emotional Skills and Competence Questionnaire and the Vocabulary of Emotions Test can predict students' academic success (Costa & Faria, 2015). Meanwhile, Ambarwati (2018) demonstrates that emotional intelligence has a slightly significant impact on students' learning outcomes. Furthermore, emotional intelligence is the third most important predictor of academic performance, following intellect and conscientiousness (MacCann et al., 2020). Gender differences in emotional intelligence, on the other hand, are completely mediated by age for the branches of facilitation and understanding, for the strategic area and overall score, and partially by age for the dimension of emotional managing (Fernández-Berrocal et al., 2012). According to Mahdaly and Usman (2019), as emotional intelligence and other factors such as learning style, motivation, and creativity increase, students' independence learning (self-reliance) increases. Furthermore, self-esteem and achievement drive might predict a student's emotional intelligence (Murad, 2021).

Self-reliance and emotional intelligence are two concepts that may help students be more motivated to learn mathematics. Based on this literature, the researcher investigates students' self-reliance and emotional intelligence in predicting their mathematics performance. As a result, the researcher developed the following research questions: 1) How may the mathematics performance of the high school students be described? ; 2) How may the students' self-reliance and emotional intelligence be described? ; 3) Is there a significant difference in self-reliance and emotional intelligence between male and female students?; and 4) Can students' self-reliance and emotional intelligence predict students' math performance?

Methodology

Research Design

The study employed a comparative research design and regression analysis. A comparative research design concludes by comparing two groups (Richardson, 2018). While regression analysis is a quantitative research tool used to examine the prediction potential of two or more independent variables to a dependent variable (Business Research Methodology [BRM], 2022).

The comparative design was utilized to determine the differences in self-reliance and emotional intelligence between male and female students. The regression analysis was used to investigate the prediction potential of self-reliance and emotional intelligence on mathematics achievement.

Sampling Technique

Using the Raosoft sample size calculator, 207 respondents were computed from a total population of 445 high school students at the Nueva Ecija University of Science and Technology Gabaldon campus. These high school students are enrolled in the third and fourth quarters of the 2021-2022 academic year. All of these students use self-paced learning modules.

Stratified sampling was used by the researcher to choose respondents. Stratified random sampling is a form of sampling that separates a population into smaller sub-groups known as strata (Hayes, 2021). The strata in this study are grade levels, and for each stratum, respondents were chosen using the fishbowl method. The sample size is 32.28 percent (51) males and 67.72 percent (107) females.

Questionnaires Validity

The emotional intelligence questionnaire was adapted from Leading across London (2022), "Emotional Intelligence Questionnaire." It was utilized to describe the emotional intelligence of the students. While the researcher devised the self-reliance questionnaire. The questionnaires employed a four-point Likert scale, with 1 indicating strongly disagree, 2 indicating agree, 3 indicating disagree, and 4 indicating strongly agree.

The questionnaires were validated using the Lawshe method. Lawshe (1975) established the Lawshe method, which determines the validity of an item based on the level of agreement among a group of panellists or experts on how an item is essential. The formula for Content Validity Ratio is*: (CVR) = [ne – (N/2)] / (N/2),* where *ne* is the total number of raters who rate the item essential and *N* is the total number of panellists or experts. The Content Validity Index was determined using the formula: *CVI = CVR's/ No*, where *No* is the total number of items. According to Davis (1992), a CVI

value greater than 0.80 is preferred. The researcher seeks the professional knowledge of 15 faculty members from the colleges of education and hotel management to serve as raters.

Self-reliance and Emotional Intelligence have Content Validity Indexes of 0.811 and 0.813, respectively. The CVI value demonstrates the validity of the questionnaires. Fifteen faculty members evaluated the questionnaire's validity for self-reliance and emotional intelligence. The content validity indexes for self-reliance and emotional intelligence are .811 and .813 respectively, both of which exceed the critical value of .80. This value indicates statistically significant findings. This means that the questionnaires were valid for assessing student self-reliance and emotional intelligence.

Table 1. Validity of the Questionnaires

Questionnaires	Number of Items	Number of Raters	Content Validity Index (CVI)	Preferred Threshold Value of CVI	Interpretation
Self-reliance	12	15	.811	.80	Valid Questionnaire
Emotional Intelligence	15	15	.813	.80	Valid Questionnaire

Questionnaires Reliability

The surveys were pre-tested on 50 high school students who were not involved in the study. Cronbach Alpha was used to assess the data, and the reliability coefficients for self-reliance and emotional intelligence are .89 and .88, respectively. The reliability coefficient suggests that the questionnaires were reliable.

Eliminating Method Bias

The researcher also provides motivational words before administering the questionnaire for the students to provide accurate answers to each questionnaire. The questionnaires were written in both English and Tagalog. It was written in simple, specific, and concise words to ensure that the students understood it correctly. The researcher also ensures that the questionnaire items contain no double-direct questions or compound questions. According to Podsakoff et al. (2012), improving scale items can reduce ambiguity because ambiguous items are difficult to interpret and require people to create their idiosyncratic meanings for them.

Data Collection

The researcher requests permission from the campus director of the Nueva Ecija University of Science and Technology Gabaldon campus to perform the study. The surveys were sent to students with the assistance of student advisers. Questionnaires were attached to the student's self-learning module in mathematics. The researcher ensured the respondent's data was kept private. The survey questionnaire was accompanied by a letter requesting their time to answer the questionnaire and give some important information. Answering the questionnaires is entirely voluntary.

Data Analysis

IBM-SPSS was used to compute and analyze the data. Mean and standard deviation was used to describe students' mathematics performance. Mean was also used to describe the student's self-reliance and emotional intelligence. The t-test for independent samples was used to examine the differences in self-reliance and emotional intelligence between men and women. While regression analysis was performed to examine the association between the two constructs (self-reliance and emotional intelligence) and students' mathematical performance. It was utilized to determine the predictive capability of self-reliance and emotional intelligence on students' mathematical performance.

Students' self-reliance and emotional intelligence were described using the following verbal interpretations: 1.00 – 1.74 for strong disagreement; 1.75 – 2.49 for disagreement; 2.50 – 3.24 for agreement; and 3.25 – 4.00 for a strong agreement. The following verbal interpretations were used to describe mathematics performance: 90–100 is outstanding; 85–89 is very satisfactory; 80–84 is satisfactory; 75–79 is fairly satisfactory, and 74 and below do not meet expectations.

Table 2 shows that the data for Mathematics performance, (w = .97, p>.05), emotional intelligence, (w = .99, p>.05), and self-reliance, (w = .97, p>.05), are normally distributed. The assumptions of non-collinearity are also shown in Table 2. The VIF is 1.97, and the tolerance is .506, indicating that there is no multicollinearity between predictors. The value of Durbin-Watson of 1.6 is closer to 2, meeting the assumption that the residual values are independent. Table 2 also shows that the minimum (-199) and maximum (2.07) values of standard residuals are between -3 and 3, indicating that the residual distribution is normal. Cook's Distance has a minimum (.00) and maximum (.18) value of less than one, indicating that no influential cases are biasing the model.

Table 2. Assumptions of Regression Analysis

Normality			
	Shapiro-Wilk		
	Statistic	df	Sig.
Math Performance	0.97	158	0.15
Emotional Intelligence	0.99	158	0.47
Self-reliance	0.97	158	0.15
Collinearity Statistics			
Tolerance		VIF	
0.506		1.97	
Residuals			
Durbin-Watson		1.60	
Std. Residual			
	Minimum	Maximum	
Std. Residual	-1.99	2.07	
Cook's Distance			
Cook's Distance	.00	0.18	

The probability plot demonstrates that the relationship between the residuals and the predicted dependent variables is linear. Thus, the relationship between the dependent and independent variables is linear.
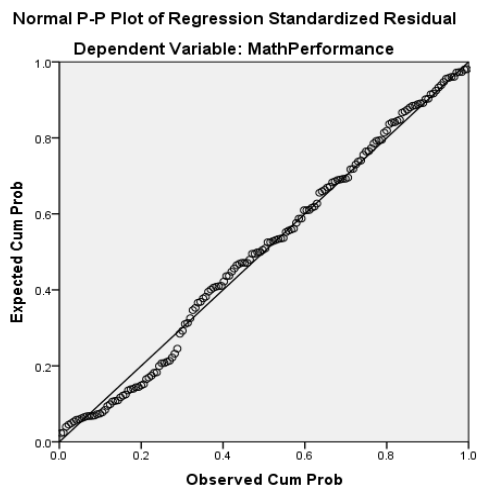

Figure 1. Linear Relationship Between the Dependent and Independent Variables
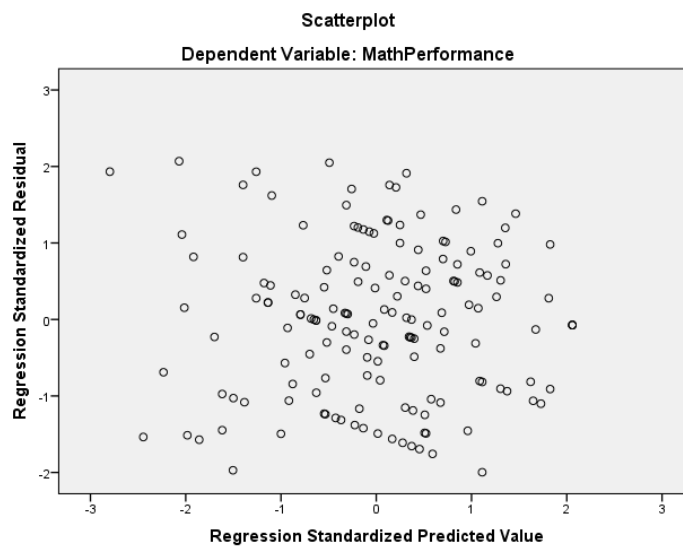

Figure 2 Homoscedasticity

Figure 2. shows how the data appears to be distributed at random. This shows that the assumption that the variation in the residuals is similar at each point of the model.

Findings / Results

Students Mathematics Performance

According to Table 3. *65 (41.1 %)* received very satisfactory grades, *46 (29.1 %)* received an outstanding grade, *37 (23.4 %)* received a satisfactory grade, and *10 (6.3 %)* received a fairly satisfactory grade in mathematics.

Table 3. Students Mathematics Performance

Scale	Verbal Interpretation	Frequency	Percent
75-79	Fairly Satisfactory	10	6.3
80-84	Satisfactory	37	23.4
85-89	Very Satisfactory	65	41.1
90-100	Outstanding	46	29.1
Total		158	100

Students' Emotional Intelligence and Self-reliance

Table 4 shows that majority of students *(m = 3.10, SD = .79)* agree on the emotional intelligence items. In addition, the majority of students agree *(m = 3.23, SD = .72)* with the items supplied for self-reliance.

Table 4. Emotional Intelligence and Self-reliance

	Total Weighted Mean	Verbal Interpretation	Standard Deviation
Emotional Intelligence	3.1	Agree	.79
Self-reliance	3.23	Agree	.72

Comparison between males and females in terms of their emotional intelligence and self-reliance

Table 5 shows that there are no significant differences between males and females in terms of their emotional intelligence, *(t = .38, p>.05),* and self-reliance, *(t = 1.20, p<.05).*

Table 5. t-test for Emotional Intelligence and Self-Reliance.

Sex		N	Mean	t	df	Sig. (2-tailed)
Emotional Intelligence	male	51	3.09	.38	156	.70
	female	107	3.06			
Self-reliance	male	51	3.25		156	.23
	female	107	3.15	1.20		

Regression Model

Table 6 shows the overall regression model. It shows that the adjusted R squared (*AR^2 = 0.167* is highly significant, *(F (2,155) = 16.71, p<.001).*

Table 6. Regression Model

Model	R	R Square	Adjusted R Square	Change Statistics			
				F Change	df1	df2	Sig. F Change
1	.42[a]	.17	.16	16.71	2	155	.00

Predictors Model

Table 7 shows that each predictor is significant: emotional intelligence, *(t = 2.03, B = 2.28, p<.05)*; and self-reliance, *(t = 2.42, B = 2.35, p<.05).*

Table 7. Predictor's Model

Model	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
1 (Constant)	71.76	2.56	27.96	.00
Emotional Intelligence	2.28	1.12	2.03	.04
Self-reliance	2.35	.97	2.42	.01

Discussion

According to the data, the majority of students obtain very satisfactory marks followed by outstanding performance. It suggests that even in a modular distance learning program, students continue to strive for a high level of performance. Students demonstrate that even in the face of adversity, learning must continue and its quality must not be compromised. The data also shows that certain factors may influence student performance, which may be intrinsic or extrinsic variables. It also demonstrates that NEUST Gabaldon's modular learning is successful during the lockdown. Likewise, Valencia (2020) claims that the modular learning approach significantly improved students' performance. Sintema (2020), on the other hand, reveals that this pandemic had a detrimental impact on STEM subject learner performance in the national test.

The data demonstrate that the average of students is self-aware, can control emotions, and motivate themselves, as well as exhibit social skills and empathy for others. This suggests that even amid a pandemic, some students manage their feelings and emotions. Similarly, Mirahmadizadeh et al. (2020) concluded that, despite the imposed situation during the pandemic, students displayed a satisfactory level of emotions and enthusiasm for learning and schools. In contrast, the standard deviation demonstrates that one cannot rule out the possibility that some students experienced unbalanced emotions during the pandemic. According to Camacho-Zuiga et al. (2021), students express negative emotions and have low energy levels as a result of lockdowns. Furthermore, Moroń and Biolik-Moroń (2021) claim that the trait of emotional intelligence has a protective effect during the pandemic, as it is associated with experiencing unpleasant emotions less intensely but not less frequently. On the other hand, most students demonstrate mediocre self-reliance in their learning. It indicates that during the lockdown, students can complete their activities and tasks in mathematics in a modular learning environment. Similarly, Bacomo et al. (2022) show in their study that the majority of their student respondents who are learning through modules are enthusiastic about learning and require little supervision. Students have not lost their confidence in learning mathematics.

According to the findings, there is no significant difference in emotional intelligence between male and female groups. It implies that both male and female students are capable of understanding and managing their emotions in the same ways. Similarly, Wen et al. (2020) demonstrate that there is no significant difference in emotional intelligence between male and female students. Anari (2012), on the other hand, finds that females have higher emotional intelligence than males. In addition, according to Fernández-Berrocal et al. (2012), age completely mediates gender differences in EI for the branches of facilitation and understanding, strategic area, and total score, and somewhat for the dimension of emotional managing. Findings also show that male and female students have comparable self-reliance. According to the data, male and female students have equal ability to complete a specific task in mathematics modules provided by their teachers. It also means that female students are as likely to be confident in their ability to understand mathematics. On contrary, Tariq et al. (2013) found that males were more confident in their mathematical abilities.

Data shows that the value of the adjusted R square is statistically significantly greater than zero. It also implies that the predictors (independent variables) can account for a significant amount of variance in the grades of the students. The adjusted R squares show that 16.7 percent of the dependent variable (grade) is explained by the independent variables. In other words, the 16.7 percent variability in the dependent variable (grade) can be explained by the 16.7 percent variability in the independent variables. The data suggests that by combining the independent variables (emotional intelligence and self-reliance), the particular value of the dependent variable (grade) can be predicted. This means that the predictors are highly significant in predicting students' specific mathematical achievements. Data also implies that emotional intelligence and self-reliance are essential in learning mathematics. It helps students conquer their fears about mathematics and alleviate the negative impact of the pandemic. Moroń and Biolik-Moroń (2021) found that emotional intelligence only slightly but significantly predicted a decrease in the frequency and intensity of fear, anxiety, and sadness during the first week of the pandemic.

The emotional intelligence Beta coefficient that is equal to 2.280 implies that for every 1 unit increase in emotional intelligence there is a 2.28 unit increase in the performance of the students in mathematics. It shows that emotional intelligence is a good predictor of mathematics performance in high school students. Students' emotional intelligence assists them in overcoming challenges that arise during distance learning in mathematics. Students can use positive emotion management to help them overcome the challenges of learning mathematics through modules. Ugwuanyi et al. (2020) show that emotional intelligence is one of the predictors of students' performance in mathematics. Furthermore, higher levels of emotional intelligence and self-efficacy are linked to higher exam scores (Tariq et al., 2013). Self-reliance Beta coefficient of 2.356 implies that for every 1 unit increase in self-reliance there is a 2.356 unit increase in mathematics performance of the students. It implies that self-reliance is also a good predictor of the mathematics performance of the students. Self-reliance during modular learning is one of the ingredients required for optimal mathematics performance. Even if there is no teacher to teach them, students will find a way to learn different mathematical concepts. Furthermore, students who are self-reliant are motivated to complete a task assigned to them by their teacher. Thus, self-reliance is required for distance learning mathematics. According to Nur Aisyah et al. (2020), self-reliance learning has a positive and significant influence on mathematical learning performance; self-reliance in learning mathematics is necessary to increase the spirit of students in achieving maximum learning performance.

Conclusions

Despite the pandemic, the majority of students achieve very satisfactory grades in mathematics. It implies that students are still striving to learn. The research also suggests that the majority of students are self-aware and emotionally intelligent. Sex, on the other hand, does not affect students' self-awareness and emotional intelligence. It demonstrates that male and female students exhibit comparable self-reliance and emotional intelligence. The regression model was significantly greater than zero, indicating that the independent factors can predict mathematical achievement (emotional intelligence and self-reliance). The adjusted R square of 0.167 indicates that 16.7 percent of the variability in the dependent variable (grade) can be explained by 16.7 percent variability in the independent variables. Emotional intelligence and self-reliance can be used to predict a student's mathematical success.

Recommendations

The institution may continue and improve its modular learning practice. Through the use of various strategies and methodologies in the classroom, teachers may focus not only on improving students' mathematical performance but also on some students' factors such as emotional intelligence and self-reliance. Teachers may survey their students' emotional intelligence and self-reliance to see if there is a need for intervention, as the study shows that emotional intelligence and self-reliance are critical in learning mathematics. Social and emotional learning programs can be integrated into classroom lessons by teachers. Curriculum developers may include emotional intelligence and self-reliance as a foundation in developing high school curricula. Further research on this topic may be conducted, and other variables such as self-efficacy and self-esteem may be included.

Limitation

The primary purpose of this research is to examine several elements that may influence students' mathematical performance. The findings of this study were only intended for the laboratory High school of Nueva Ecija University of Science and Technology - Gabaldon campus. It was carried out to improve the teaching and learning process at this particular institution.

Acknowledgements

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