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Predictive Role of Classroom Learning Environment on the Academic Performance of Students in Mathematics in the Modern World in Isabela State University-Echague

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ABSTRACT

A supportive and positive Classroom Learning Environment (CLE) creates the conditions for students to feel secure, motivated, and capable of achieving academic success. When a positive CLE is cultivated, mathematics learning thrives effectively. This study explored the predictive role of CLE on the mathematics performance of the freshman students in Isabela State University – Main Campus. The perception of the respondents on CLE was described using the instrument devised by Fraser et al. (1996). Using Pearson's r correlation, the findings indicated that students perceived the classroom environment as positive, which correlated with improved mathematics performance, specifically in terms of student cohesion, investigation, task orientation, and cooperation. Regardless of sex, the respondents perceived a positive CLE to be evident inside the classroom. Finally, stepwise regression analysis revealed that instructor's support and student involvement are the best predictors of performance in mathematics. It is recommended that the teachers provide mathematics learning tasks through group activities to allow students to learn from their peers and eventually promote a positive learning environment.

Keywords: *Mathematics, Classroom Learning Environment, Mathematics in the Modern World, instructor's support, student involvement*

Introduction

A Classroom Learning Environment (CLE) is a broad concept that may be attributed to the physical, psychological, and emotional environment. Nonetheless, CLE is a space where students feel safe, motivated, and confident to learn. One of the most widely utilized instruments to assess a positive CLE is devised by Fraser et al. (1996) which extends the learning environment into seven (7) aspects, such as student cohesion, equity, task orientation, instructor's support, investigation, involvement, and cooperation. They believed that by regularly assessing these dimensions of CLE, educators could gather data to reflect on and improve their teaching practices.

According to Prieur (2022), a supportive CLE exists when the students feel safe in their learning environment; eventually, they are more willing to learn without fear of being judged when failing. Conversely, a discouraging CLE is where students have a high level of frustration, which may possibly lead to frequent disciplinary rates. Prieur (2022) also suggested that an engaging CLE may be attained when the following are practiced: build a positive connection with the learners and their parents; present classroom rules for desirable behavior; use positive reinforcement; use culturally responsive teaching strategies; and keep a positive mindset, among others.

On the other hand, mathematics is one of the core components of the Philippine curriculum, such that mathematics is taught from basic education to higher education. While the course is given due importance, most students still struggle with mathematics. In fact, the country ranked at the bottom in the Programme for International Student Assessment (PISA), both in 2018 and 2022 (Bautista, 2023).

The connection between a positive CLE and mathematics performance has been researched in the past few years. Say, for instance, Yueping (2023) highlighted the significant impact of the mathematics learning environment on mathematics achievement. When CLE is cohesive with the presence of a positive teacher-learner relationship and with the full involvement of the students, their mathematics performance improves. Additionally, Zysberg and Schwabsky (2021) affirmed that a positive school climate is directly associated with academic achievement. In a similar vein, Sabanal et al. (2024) concluded that the learning environment is one of the predictors of higher achievement in mathematics.

The above-cited findings underscore the important role that CLE has in the overall mathematics achievement of the learners. If positive CLE is cultivated, mathematics learning would effectively thrive inside the classroom despite the complexities and the abstractness that this subject has.

While past studies established CLE's influence on academic achievement, few have examined which specific CLE dimensions best predict math performance in Philippine higher education; hence, this study.

Objectives of the Study

This study aimed to examine the extent to which the Classroom Learning Environment (CLE) predicts student performance in Mathematics in the Modern World.

Specifically, it sought to:

1. Describe the perception of the students on the Classroom Learning Environment (CLE).
2. Find out the difference in the respondents' perception of CLE when grouped according to their sex.
3. Determine the mathematics performance of the respondents.

4. Assess the correlation between students' perceptions of CLE and their academic performance in Mathematics in the Modern World.
5. Determine the best predictor of the students' mathematics performance in terms of the seven dimensions of CLE.

Methods

Descriptive-correlational research design was used in this study. A revised instrument with seven (7) constructs devised by Fraser et al. (1996) was utilized to describe the perception of the respondents on CLE. Each construct consisted of 10 items. The internal consistency of the revised instrument was tested, and an overall Cronbach's Alpha of 0.86 was obtained.

Thre 342 freshman students from Isabela State University Main Campus who completed the General Education Mathematics course were selected as participants of the study. The number of respondents was calculated using Cochran's formula, while the selection of these respondents was done using stratified random sampling.

The assumption of the normality of the variables was tested using the Shapiro-Wilk Test. Results showed that mathematics performance ($W=0.98$, $p=0.13$) and perception of CLE ($W=0.78$, $p=0.23$) were normally distributed.

To further describe the data, frequency count, percentage, and mean were used. Likewise, an independent samples t-test was utilized to test the differences in the perception of the respondents on CLE when grouped according to their sex. Pearson's r correlation was used to test the relationship between the mathematics performance of the respondents and their perception of CLE. Finally, multiple linear regression was utilized to find the predictors of mathematics performance in terms of the seven (7) dimensions of CLE.

Ethical Considerations

Prior to conducting the study, approval from the Office of the Executive Officer of Isabela State University-Main Campus was sought. The same approval was also sought from the Dean of the different colleges where the study was conducted. Informed Consent was obtained from the respondents. They were provided with a clear explanation of the study's purpose and procedure. Participation was purely voluntary, and respondents were informed of their right to withdraw from the study without any consequences. To ensure confidentiality, no personally identifiable information was collected, while all data collected was securely stored and used solely for the study.

Results and Discussion

Profile of the Respondents

As gleaned from Table 1, the majority of the respondents are female which comprises 67 percent of the total sample, while 33 percent are male. This data is important to consider in analyzing students' perception of CLE, as shown in Table 2.

Table 1. Profile of the Respondents

Demographics	Frequency n=342	Percentage
Sex		
Female	113	33.00
Male	229	67.00

Perception of the Respondents on Classroom Learning Environment

Table 2 presents the perception of the respondents of a positive classroom learning environment. Generally speaking, it can be noted that a conducive CLE is evident in Isabela State University based on the perception of the respondents. Likewise, it can be noted that each of the seven categories of a positive classroom learning environment was perceived to be evident inside the classroom. Specifically, cooperation scored the highest mean (M=3.92), which implies that students perceived a strong sense of teamwork, mutual help, and collaborative interaction within the classroom. This result is also a good step in testing the different predictors of mathematics performance in terms of CLE, since Sithole (2017) mentioned that the existence of a caring environment in the school setup can lead to improved students' academic outcomes.

Table 2. Perception of Respondents on Classroom Learning Environment

Indicators	Mean	Descriptive Equivalent
Student Cohesion	3.83	Evident
Instructor's Support	3.54	Evident
Investigation	3.67	Evident
Involvement	3.80	Evident
Task Orientation	3.87	Evident
Cooperation	3.92	Evident
Equity	3.82	Evident
Grand Mean	**3.78**	**Evident**

Scale used: 1.00-1.79=Not Evident; 1.80-2.59=Rarely Evident; 2.60-3.39=Sometimes Evident; 3.40-4.19=Evident; 4.20-5.00=Very Evident

Differences in the Respondents' Perceived Classroom Learning Environment in Terms of Sex

Table 3 revealed that when the students were grouped based on sex, no significant difference was observed in their perception of a positive classroom learning environment. Considering the arithmetic mean of each group, the result of the study implies that the respondents, regardless of sex, perceived a positive classroom learning environment to be evident in their Mathematics in the Modern World class. This lack of statistically significant difference may also imply that the classroom dynamics and instructional approaches employed in the Mathematics in the Modern World class were inclusive and supportive of all students, regardless of sex. A study by Koul et al (2021)

highlighted that female students had more negative views of a classroom climate. However, there are research studies suggesting gender to have an influential role in the classroom learning environment (Kinzie et al., 2015).

Table 3. Difference Between the Perceived Classroom Learning Environment and Sex of the Respondents

Indicators	Means				t-value	p-value
	Male	Desc.	Female	Desc.		
Student Cohesion	3.93	E	3.78	E	1.39^{ns}	0.17
Instructor's Support	3.51	E	3.56	E	0.38^{ns}	0.71
Investigation	3.70	E	3.65	E	0.54^{ns}	0.59
Involvement	3.71	E	3.84	E	1.24^{ns}	0.22
Task Orientation	3.85	E	3.87	E	0.39^{ns}	0.70
Cooperation	3.85	E	3.97	E	1.09^{ns}	0.28
Equity	3.80	E	3.83	E	0.29^{ns}	0.78

Legend: SE=Strongly Evident, E=Evident, SoE=Sometimes Evident, RE=Rarely Evident, NE=Not Evident

Respondents' Performance in Mathematics in the Modern World

ISU adopts a grading system in which 1.0 is the highest while 3.0 is the lowest passing mark. The table below suggests that the majority of the respondents obtained a final grade of 2.50, indicating a fair level of performance. Meanwhile, only 1.75% of the respondents achieved the highest rating of 1.25, reflecting a very satisfactory performance. The overall mean of 2.32 suggests average proficiency among respondents. This baseline can be used in evaluating predictors of higher performance.

Table 4. Performance of the Respondents in Mathematics in the Modern World

Final Grade	Description	Frequency	Percent
1.25	Very	6	1.75
1.50	Satisfactory	21	6.14
1.75	Satisfactory	37	10.82
2.00	Fairly	59	17.25
2.25	Satisfactory	57	16.67
2.50	Good	61	17.84
2.75	Fairly Good	52	15.20
3.00	Fair	49	14.33
	Below Fair		
	Passed		
Overall Mean = 2.32			

Relationship Between Classroom Learning Environment and Academic Performance

The mathematics performance of the students appeared to be significantly related to some of the indicators of a positive classroom learning environment, as shown in Table 5.

In terms of student cohesion, the p-value 0.01 with a positive r-value suggests a direct relationship between the performance of the students in Mathematics in the Modern World and their social relationship with each other. This means that students who are excelling in the class usually get along with their classmates. In other words, it can be said that when students establish a relationship with their classmates, their mathematics performance is improved. This certainly means that the evidence of student unity inside the class is related to the mathematics performance of the students. This result is similar to the study of Ramos et al. (2017), in which they found that there is a moderate positive association between cohesion and academic performance of students in a private Junior High School in the United States.

Table 5. Relationship Between the Respondents' Perception of Classroom Learning Environment and their Mathematics Performance

Indicators	r-Value	p-Value
Student Cohesion	0.14*	0.01
Instructor's Support	0.01^{ns}	0.86
Investigation	0.17*	0.00
Involvement	0.06^{ns}	0.24
Task Orientation	0.12*	0.03
Cooperation	0.12*	0.02
Equity	-0.02^{ns}	0.70

The investigation was highly significant, as gleaned from the same table. The r-value of 0.17 and the p-value of 0.00 suggest a significant and direct relationship between the academic performance of the students and the provision of various learning activities to support the lesson. This implies that learning activities that involve inquiry may improve the performance of the students. This result negates the findings of Riaz and Asad (2018), in which they concluded that the subscale investigation of the Classroom Learning Environment is negatively correlated with students' achievement in Mathematics.

Task orientation is also positively correlated with academic performance. This suggests that when students are aware of what they are going to do during the class, their academic performance will improve.

Cooperation, meanwhile, shows a positive relationship with academic performance. This implies that when cooperative learning is evident inside the class, the performance of the students can be improved. This is similar to the studies of Blad (2017), who emphasized the importance of cooperative learning in the improvement of the academic performance of the students.

On the othher side, Lei (2018) stated that while the present study revealed that the instructor's support is not statistically related to the mathematics performance of

the students, this result negates the findings of Sharma (2016) and who found that the teacher's support positively affects the performance of the learners.

The table also revealed that student involvement does not correlate with the academic performance of the students. This result contradicts the study of Fung at al., (2018), in which they concluded that student engagement can significantly improve academic performance.

Finally, equity does not significantly relate to the mathematics performance of the students, as revealed in its p-value greater than 0.05. This suggests that the provision of equal opportunities to learn does not necessarily affect the mathematics performance of the students. However, this result negates the studies of Blad (2017), who concluded that when students feel the presence of equal learning opportunities, their academic performance can improve.

Predictors of Academic Performance in Terms of Classroom Learning Environment

In Table 6, it can be gleaned that CLE is statistically significant in predicting the mathematics performance of the respondents. Additionally, Table 7 provides the model summary in which the multiple correlation coefficient of 0.47 indicates a moderate level of prediction. This suggests that the perception of CLE can moderately predict mathematics performance.

Table 6. Statistical Significance of the Model

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.47	56	0.29	1.46	0.03
	Residual	56.98	283	0.20		
	Total	73.44	339			

The R2 value of 0.22 shows the proportion of variation in the mathematics performance that can be explained by the respondents' perception of CLE. This further means that the respondents' perception explains only 22 percent of the variability of the mathematics performance. While the model is statistically significant in predicting mathematics performance, the low R2 value of 0.22 indicates a weak predictive power.

Table 7. Model Summary

Model	R	R^2	Adjusted R^2	Standard Error of the estimate
1	0.47	0.22	0.07	0.45

Meanwhile, Table 8 shows how much mathematics performance varies with the perceived CLE when all other independent variables are held constant. The table further revealed that among the seven indicators of a positive classroom learning environment, instructors' support and student involvement appeared to be predictors of academic performance in Mathematics in the Modern World. This result emphasized the important role of teachers, as well as students' active participation in the classroom, in

developing academic performance in Mathematics in the Modern World. Based on the analysis, instructors' support increases mathematics performance by 0.13 units, while students' involvement improves mathematics performance by 0.13 units.

While the instructor's support was not significantly correlated with mathematics performance, this finding does not imply that the instructor's support has no role in predicting student success. Pearson's r measures the linear relationship between the instructor's support and mathematics performance, and the non-significant result suggests that, in isolation, there is no strong or consistent linear link between these two variables. Meanwhile, the instructor's support being a significant predictor of mathematics performance may imply that it is moderated by other variables included in the regression model.

Table 8. Estimated Model Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
Constant	0.20	0.03		13.16	0.01
Instructor's Support	0.13	0.04	-0.30	-3.34	0.01
Involvement	0.10	0.04	0.19	2.37	0.02

Conclusion and Future Works

The University cultivates a positive CLE based on the perception of the students. This reflects an institutional climate that supports learning and may be a contributing factor to academic performance, especially in mathematics. The perception of a positive CLE is consistent across sex, which indicates an inclusive classroom experience. The majority of the respondents obtained a final rating of 2.50, while the highest rating given to the respondents is 1.25; however, this rating was attained by only 1.75 percent of the respondents. There is a significant relationship between the mathematics performance of the respondents and the perceived CLE in terms of student cohesion, investigation, task orientation, and cooperation. This implies that improving classroom dynamics, such as encouraging teamwork, providing learning tasks that are thought-provoking, may improve mathematics achievement.

Furthermore, instructor's support and student involvement are the best predictors of performance in mathematics. Theoretically, this aligns with constructivist learning models that emphasize active engagement and teacher facilitation. These findings suggest that institutional efforts to enhance instructor-student interaction and promote meaningful student engagement could lead to improved mathematics outcomes. Future research may explore interventions aimed at strengthening the identified CLE dimensions, particularly instructors' support and student involvement.

Additionally, it is also recommended that during mathematics class, students may be encouraged to share their ideas to stimulate active participation. Cooperative learning may be provided, such as group work, to allow students to learn from their peers. Likewise, the instructors should maintain a positive classroom learning environment by providing support so that the students will be encouraged to participate during mathematics class. Nevertheless, the study is limited by its reliance on self-reported data. Experimental studies may also help clarify the causal mechanisms behind CLE dimensions and student performance.

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Conflict of Interest

The author declares that there are no conflicts of interest regarding the publication of this paper.

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