Intolerant Learners: Correlation between Tolerance of Ambiguity and Mean Performance Level in Mathematics

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ABSTRACT

This study aimed to examine the mean performance level, and the level of ambiguity that can be tolerated in the classroom, with a specific focus on the subject of mathematics. This study employed a quantitative research method, specifically a descriptive correlational research design. The study involved a sample size of 88 students, selected randomly from the pool of 722 grade 10 students at Camarines Norte National High School for the School Year 2022-2023. Data were collected on the students' mean performance level (MPL), level of tolerance (LoT), and underlying causes. Correlational research was employed to determine the presence and extent of any significant relationship between MPL and LoT. The results revealed that the mean MPL in mathematics of grade 10 student was Outstanding ($\bar{x}$=90.04) and the level of tolerance was Very High ($\bar{x}$=63.08). Furthermore, the causes for intolerance, specifically Novelty is High ($\bar{x}$=17.83), and for Complexity ($\bar{x}$=33.14) and Insolubility ($\bar{x}$=12.11) are both Moderate. The null hypothesis of no significant correlation between MPL and LoT was retained ($p = 0.7687$, $\alpha = 0.05$), and the level of tolerance did not significantly predict MPL in the regression model. These findings suggest that, within this sample, students' ambiguity tolerance and mathematics performance are independent of each other. Exposure to problem-based and inquiry-based learning approaches may have contributed to the students' high ambiguity tolerance, though causal interpretations are beyond the scope of this correlational design.

Keywords: Intolerant, Learners, Mathematics, Mean Performance Level, Tolerance of Ambiguity

INTRODUCTION

Change is an inherent part of life, and adaptability is key to navigate the ever-evolving landscape. This holds true in various domains, including education, where students and their academic performance are profoundly influenced by unforeseen shifts and ambiguous circumstances. Academic performance serves as a tangible representation of students' overall progress throughout their educational journey, providing insight into their achievements and areas for improvement. While academic performance is influenced by multiple factors, it is important to note that it does not solely determine a country's overall performance due to various complex factors at play.

In the context of the Philippines, a nation striving to establish itself as a leader in education and provide quality education to all its citizens (NEDA, 2016), recent events such as the pandemic and a decline in the education system have presented significant challenges. These challenges have resulted in a notable decline in grades, particularly in subjects like Science and Mathematics (Masambol, 2022), hindering the country's educational ambitions. The Department of Education, as a learner-centered institution, is committed to continuous improvement in order to better serve Filipino learners and the community (DepEd, 2017). However, such improvements come at a cost, and unanticipated shifts in policies can lead to unclear language and confusion among learners. Students, although displaying a certain level of flexibility and tolerance for changes and ambiguity, often find themselves in a state of uncertainty when faced with changes within the classroom.

Ambiguity, characterized by confusion and multiple possible interpretations, stands as a significant barrier to effective communication (Guilbert, 2002). If learning objectives and instructions are not clearly defined, students and teachers may encounter operational difficulties, ultimately impacting the teaching-learning

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process and students' performance. To foster meaningful and engaging learning experiences, it is crucial for students to have a crystal-clear understanding of the learning path they are undertaking. However, ambiguity in education can create an environment where students are compelled to learn in a seemingly meaningless manner, leading to a lack of vitality and relevance within the academic community (Suzawa, 2013).

Research indicates that ambiguity has an impact on an individual's tolerance (Comadena, 1984; and Guilbert, 2022). Tolerance for ambiguity has been identified as one of the key factors influencing listening comprehension, writing performance, and cloze tests. Furthermore, studies suggest that individuals with a moderate tolerance for ambiguity tend to achieve greater success (Soleimani, 2009). From the educational establishment's perspective, instructors sometimes provide unclear lessons and guidance, changing instructions unexpectedly, which can cause confusion and misunderstanding among students. Therefore, it is essential for instructions and educational goals to be clear and unambiguous, facilitating improved communication between instructors and students.

Given the insights from previous research and the challenges that have arisen, the researcher concludes that all students possess a certain level of tolerance for ambiguity. It has been observed that students display a certain degree of tolerance when faced with unexpected changes and unclear situations. Additionally, classroom rules, the clarity of instructions provided by teachers, and the overall direction of activities have an impact on students' behavior and response.

The purpose of this study is to examine the level of ambiguity that can be tolerated in the classroom, with a specific focus on the subject of mathematics. The research aims to investigate the underlying causes contributing to intolerance and ascertain whether there exists a significant level of tolerance. Additionally, the study seeks to determine the influence of tolerance on students' performance in mathematics. By shedding light on the connection between ambiguity, tolerance, and academic performance, this research strives to enhance the teaching-learning process between instructors and students, ultimately improving the overall educational experience.

METHODOLOGY

This study employed a quantitative research method, specifically a descriptive correlational research design—a design that describes characteristics of a population or phenomenon and examines the degree of association between two or more variables without implying causation (Creswell & Creswell, 2018). The aim was to explore the relationship between the level of tolerance of ambiguity and the mean performance level in mathematics among grade 10 students. Data were collected on the students’ mean performance level, level of tolerance, and the causes of ambiguity. Statistical analysis was used to determine if there was a correlation between these variables.

Descriptive research was used to describe the mean performance level, level of tolerance of ambiguity, and underlying causes of ambiguity among grade 10 students at Camarines Norte National High School. Correlational research design was employed to determine the presence and extent of any significant relationship between the mean performance level and tolerance of ambiguity.

The study involved a sample size of 88 students, selected randomly from the 722 grade 10 students at Camarines Norte National High School for the School Year 2022–2023. The sample size was determined using Slovin’s formula at a 95% confidence level and a margin of error of 0.10, yielding a minimum required sample of 88 respondents (Tejada & Punzalan, 2012). The students were selected through a probability sampling method, specifically simple random sampling.

The respondents in this study were grade 10 students from Camarines Norte National High School, with no consideration given to age, gender, or other demographic profiles. The only requirement was that they were enrolled in the grade 10 class for the specified school year.

This study employed questionnaires as mean of data gathering. Seven-point Likert scale (Table 1) was utilized, and a modified tolerance of ambiguity scale developed by Budner (1962) was used to test the level of

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ambiguity of the respondents. It was modified to cater the student's ability to understand the scale. Words were simplified while maintaining the main goal of the test, evaluating their tolerance of ambiguity.

Table 1. Seven-Point Likert Scale

Numerical Scale	Range		Interpretation
7	6.50-7.00	SA	Strongly Agree
6	5.50-6.49	MA	Moderately Agree
5	4.50-5.49	A	Slightly Agree
4	3.50-4.49	N	Neither Agree nor Disagree
3	2.50-3.49	D	Slightly Disagree
2	1.50-2.49	MD	Moderately Disagree
1	1.00-1.49	SD	Strongly Disagree

To assess the level of ambiguity, this study utilized the following five-point scale to determine the extent of tolerance and intolerance (Table 2). And it was used to determine the three major causes of intolerance of ambiguity, Novelty (N), Complexity (C), and/or Insolubility (I); which were described by the following scale (Table 2).

Table 2. Level of Tolerance of Ambiguity

Descriptor	Overall Rating Scale	Novelty	Complexity	Insolubility
Very High	Above 53	Above 19	Above 42	Above 15
High	49-53	17-19	37-42	13-15
Moderate	44-48	15-17	31-36	10-12
Low	39-43	12-14	25-30	7-9
Very Low	Below 39	Below 12	Below 25	Below 7

To determine the mean performance level (MPL), this study adapted the grades for the 1st to 3rd quarter of the school year. It was determined using the scale on table 3. It was adapted from DepEd Order No. 8, s. 2015 to simplify the description of the students' academic performance.

Table 3. Determinant of the Student's MPL*

Descriptor	Performance Scale
Outstanding	90-100
Very Satisfactory	85-89
Satisfactory	80-84
Fairly Satisfactory	75-79
Did Not Meet Expectations	Below 75

*Adapted from DepEd Order No. 8, s. 2015

The data gathering procedure for this study involved selecting 88 respondents randomly from the pool of 722 Grade 10 students at Camarines Norte National High School. The students were assigned numbers, and the researcher drawn from these numbers to randomly select the participants. Prior to answering the questionnaires, an orientation was conducted to explain the study's purpose, assure the respondents of their right to withdraw, and emphasize the confidentiality and anonymity of the collected data. The researcher provided assistance to students who have questions about the questionnaires.

Ethical considerations were taken into account by communicating with the school administration, including the school principal and class advisers, through a letter of communication. Each respondent was given a letter of consent to gather information, and only with their approval and consent that the survey questionnaires be distributed. The data collected were treated as highly confidential and anonymous, following the guidelines of

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the Data Privacy Act of 2012. No personal names were collected, and only the researcher handled the gathered data. Proper disposal of all responses was ensured after data analysis and interpretation to maintain data security.

Statistical analyses were conducted on the collected data using various tools. Percentage technique, weighted mean, and standard deviation were used to describe and determine the independent variables, such as the mean performance level (MPL), level of tolerance (LoT), and causes of ambiguity. Linear Regression Analysis was employed to assess the cause-and-effect relationship between MPL and LoT among grade 10 students. Additionally, Pearson Moment Correlation was used to evaluate the relationship between MPL and LoT. While Pearson Moment Correlation examined the relationship between variables without assuming causation, Linear Regression Analysis helped in determining whether the level of tolerance of ambiguity influences the mean performance level (MPL) of grade 10 students in Mathematics.

RESULTS

During the conduct of the survey, it was noted that grade 10 students have varied performance level (MPL). And that they showed higher tolerance to unfavorable situations. However, this study also revealed that the scope and the variables should be taken into account as it was affected by the behavior of the students answering.

Mean Performance Level in Mathematics and Level of Tolerance of Ambiguity of Grade 10 Students

Table 4. Mean Performance Level and Level of Tolerance

	Mean	**SD**	**n**	**Interpretation**
MPL	90.04	4.1162	88	Outstanding
Level of Tolerance	63.08	7.1894		Very High

The results revealed that the Mean Performance Level in Mathematics of Grade 10 student in Camarines Norte National High School was on average Outstanding (90.04). This indicates that, on average, the students showed outstanding performance in the subject (See table 4). Furthermore, this has a standard deviation of 4.12, meaning that the data are closer together and are showing homogeneity in terms of their performance. Furthermore, the results also showed that the level of tolerance of ambiguity of the students were very high (63.08) than the average score. However, it also showed that their scores were greatly spread out (SD=7.19), meaning that the level of tolerance of the students can be concluded as heterogeneous.

Causes for Intolerance Identified from Three Dimensions: Novelty, Complexity, and Insolubility

A wide range of reactions are possible consequences of an individual's ambiguity tolerance, such as career avoidance, delayed decision making, inaccurate choices, errors made in attributing causality, and other reactions ranging from the general to the situation-specific (McLain, Kefallonitis, & Armani, 2015). The three subscales were also computed to reveal the major source of intolerance of ambiguity.

Table 5. Subscales to Determine the Causes for Intolerance

Causes for Intolerance	**Mean**	**SD**	**n**	**Interpretation**
Novelty (N)	17.83	3.39	88	High
Complexity (C)	33.14	5.73		Moderate
Insolubility (I)	12.11	3.43		Moderate

The results shows (Table 5) that the subscale scores determining the causes for intolerance of ambiguity among the 88 Grade 10 respondents. Results showed that Novelty (N) obtained the highest mean of 17.83 (SD = 3.39), interpreted as High, indicating that unfamiliar situations are the most prominent source of discomfort among students. Complexity (C) yielded a mean of 33.14 (SD = 5.73), while Insolubility (I) recorded a mean of 12.11 (SD = 3.43), both interpreted as Moderate. These findings suggest that while students exhibit some

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difficulty with complex and unsolvable problems, novel or unfamiliar situations pose the greatest challenge to their tolerance of ambiguity.

Finding the Significant Relationship Between MPL and Level of Tolerance

It was hypothesized that the mean performance level in mathematics is not significantly correlated with the level of tolerance for ambiguity of grade 10 students. Table 6 shows the correlation between MPL and the level of tolerance. Figure 1 shows the scatterplot view of each student in relation to their MPL and level of tolerance.

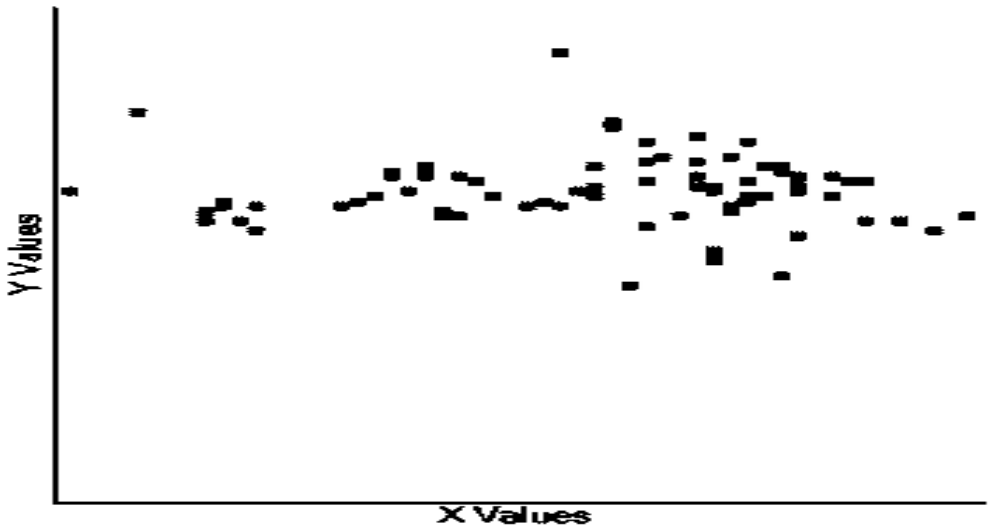

Figure 1. Correlation between MPL (*x-values*) and Level of Tolerance (*y-values*)

As seen on Figure 1, the scatterplot displays a widely dispersed pattern of data points with no discernible linear trend, further confirming the absence of a meaningful relationship between MPL and the level of tolerance of ambiguity. The data points are scattered randomly across the plot without clustering along any upward or downward trajectory, which is consistent with the near-zero correlation coefficient obtained. This visual representation reinforces the statistical finding that the mean performance level in mathematics and the level of tolerance of ambiguity among Grade 10 students are not associated with one another.

Table 6. Correlation between MPL and Level of Tolerance

Compared Groups	**Mean**	**SD**	**n**	**df**	**Correlation *r***	***p*-value**	**Decision**
MPL (x values)	90.04	4.1162	88	86	-0.0318	0.7687	Accept H_o
Level of Tolerance (y values)	63.08	7.1894					

It is shown that the computed p-value of 0.7687 is greater than the alpha value of 0.05, the null hypothesis of no significant correlation is retained between the mean performance level in mathematics and the level of tolerance. Also, even though the correlation r is -0.0318, that means negative weak relationship, it can be neglected as there was no association between the two variables (Table 6).

Determining whether MPL is affected by Level of Tolerance

It was also hypothesized that the mean performance level in mathematics is not affected by the level of tolerance of ambiguity. Table 7 shows the linear regression between MPL and level of tolerance, meanwhile figure 2 shows the scatterplot for MPL and level of tolerance.

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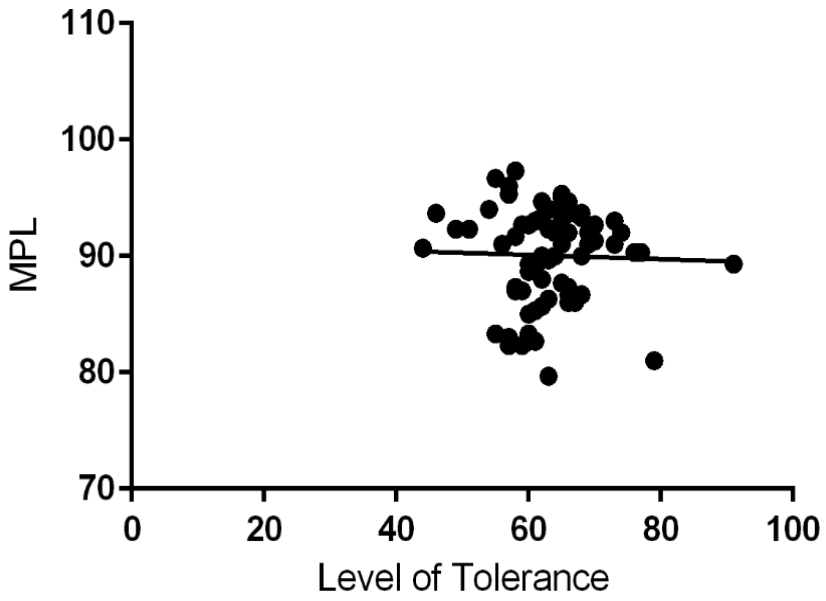

Figure 2. Scatterplot for MPL and Level of Tolerance

As shown in figure 2, the scatterplot shows that the best of fit line has negative slope (-0.01819), and is almost perfectly horizontal, meaning no association can be predicted with the two variables.

Table 7. Linear Regression between MPL and Level of Tolerance

Compared Groups	**Observations**	**R**	**R^2**	**Slope**	**Significance Level**	***p*-value**	**Decision**
MPL		0.0317	0.001	-0.01819	0.05	0.7687	Accept H_o
Level of Tolerance	88						

It is shown that the correlation coefficient R of 0.0317 for linear relationship indicates that it is closer to zero. This goes to show that the relationship is almost non-existent and negligible. Furthermore, the value of R-squared of 0.001 which is closer to zero, it means that the predictor (level of tolerance) indicates that the response variable (MPL) cannot be explained by the predictor variable. This means that the level of tolerance does not affect the mean performance level in mathematics of grade 10 students. Also, the p-value of 0.7687 is significantly higher than the significance level of 0.05, therefore, it can be said that we fail to reject the null hypothesis and that the mean performance level in mathematics is not affected by the tolerance of ambiguity.

DISCUSSION

This study sought to determine the mean performance level in mathematics of grade 10 students by gathering their grade for the first until third quarter of the school year. Furthermore, they took test on tolerance of ambiguity scale to determine their level of tolerance.

The result was contrary to the results of PISA in Math that showed that the Philippines fall below the average OECD (Luz, 2022). This could be due to teachers being more lenient and considerate on grading students. Furthermore, this showed that the students may indicate higher MPL but does not necessarily reflect on the overall learning of the students. Furthermore, the results also showed that the level of tolerance of ambiguity of the students were very high (63.08) than the average score. However, it also showed that their scores were greatly spread out (SD=7.19), meaning that the level of tolerance of the students can be concluded as heterogeneous.

This study revealed that the students have high tolerance of ambiguity due to them being exposed to problem-based learning and inquiry-based approaches positively that influenced the students' tolerance of ambiguity

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(Yu, Wang, & Xia, 2022). These active learning methods promoted students' ability to handle uncertainty and engage in complex problem-solving tasks.

On the other hand, it was revealed that the students have high novelty tolerance, and moderate tolerance on complexity and insolubility. This means that the students are generally tolerant and that the causes for intolerance are not prominent among them. It was also in conjunction with the results of high level of tolerance that was previously reported. Therefore, within the scope of this sample, the data suggest that the students demonstrated relatively high tolerance of ambiguity, with no dominant sources of intolerance identified across the three subscales.

Regarding the relationship between MPL and the level of tolerance of ambiguity, the Pearson Moment Correlation analysis yielded a correlation coefficient of $r = -0.0318$ and a p-value of 0.7687, which is substantially greater than the significance level of 0.05. This confirms that there is no significant correlation between the two variables, and the null hypothesis is accepted. The near-zero negative correlation suggests only a negligible inverse relationship, which is practically meaningless and can be disregarded. This finding is consistent with the view that academic grades, particularly those shaped by teacher-assigned marks, may not be sufficiently sensitive to detect psychological dispositions such as tolerance of ambiguity (Soleimani, 2009). The independence of these two variables implies that a student's capacity to tolerate unclear or novel situations does not necessarily translate into higher or lower mathematics grades, at least when performance is measured through quarterly grades.

The linear regression analysis further supports this conclusion. The regression model produced an R-value of 0.0317, an R-squared value of 0.001, a slope of -0.01819, and a p-value of 0.7687 — all of which confirm that the level of tolerance of ambiguity is not a significant predictor of the mean performance level in mathematics. The coefficient of determination ($R^2 = 0.001$) indicates that less than one percent of the variance in MPL can be attributed to the level of tolerance, rendering the model practically ineffective as a predictor. The near-horizontal best-fit line visible in the scatterplot (Figure 2) visually reinforces this statistical outcome. These results are in contrast with prior studies suggesting that ambiguity tolerance influences academic outcomes (Comadena, 1984; McLain et al., 2015), which may be attributed to the context-specific nature of the present study, particularly the use of quarterly grades as a performance measure rather than standardized assessments. Taken together, the correlation and regression findings affirm that MPL and the level of tolerance of ambiguity operate as independent dimensions among Grade 10 students in this context.

CONCLUSION

Based on the findings of the study, it was concluded that the mean performance level in mathematics of grade 10 students was outstanding, but it does not necessarily reflect their actual performance as there are other factors that affects it. The level of tolerance of ambiguity of the students was generally very high, and that the causes for intolerance were not prominent as the subscales were high in novelty, and moderate in complexity and insolubility. Finally, it was concluded that MPL and the level of tolerance of ambiguity were not significantly correlated and the level of tolerance did not significantly predict MPL within this sample.

Based on the abovementioned findings and conclusions, the following recommendations were given: as the MPL of the students were high but may not fully reflect objective academic achievement, future studies should consider supplementing MPL with standardized or criterion-referenced measures to reduce the influence of teacher subjectivity on the performance variable (Soleimani, 2009). Students demonstrated high ambiguity tolerance; as such, teachers may consider designing instructional activities that challenge students with novel and complex problem situations to further develop this capacity, given that MPL and level of tolerance were not associated with one another. For future researchers, it would be advisable to increase the number of respondents and employ a wider scope to improve generalizability. Policymakers, education department, schools, and teachers must take into account the importance of high tolerance among students to give them appropriate strategies and content that would be beneficial to them. Furthermore, they must look into other measuring tools to determine student performance, as this study highlighted the potential subjectivity inherent in teacher-assigned quarterly grades as the sole performance indicator.

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