INDUSTRIAL TECHNOLOGY STUDENTS' PERSISTENCE IN LEARNING MATHEMATICS: PREDICTIVE ROLES OF TEACHING QUALITY AND LEARNING REGULATION

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***ABSTRACT**: This study determined the predictive roles of teaching quality and learning regulation in Industrial Technology students' persistence in learning Mathematics in a selected university in Region IX. It employed a quantitative predictive research design. The respondents were Industrial Technology students who were enrolled in Mathematics-related courses. A survey questionnaire was used to gather data on teaching quality, learning regulation, and persistence in learning Mathematics. The data were analyzed using descriptive and inferential statistical tools. Findings revealed that the students perceived the teaching quality of their Mathematics teachers as very high. The students also demonstrated high levels of learning regulation and persistence in learning Mathematics. Further analysis showed that teaching quality and learning regulation significantly predicted students' persistence in learning Mathematics. Among the two predictors, learning regulation emerged as the stronger predictor. The study concluded that students' persistence in learning Mathematics may be strengthened through quality Mathematics instruction and the development of self-regulated learning skills among Industrial Technology students.*

Keywords: Industrial Technology students, mathematics persistence, teaching quality, learning regulation, predictive research design

INTRODUCTION

Mathematics is an important component of Industrial Technology education because it supports measurement, computation, estimation, technical drawing, equipment operation, design interpretation, and problem-solving. For Industrial Technology students, mathematics is not only a general education subject. It also serves as a foundation for technical tasks that require accuracy, logical thinking, and practical application. However, many students experience mathematics as difficult and demanding. When students lack confidence or become frustrated with mathematical tasks, their persistence in learning may be affected.

Persistence in learning mathematics refers to students' willingness to continue studying, solving problems, completing tasks, reviewing lessons, and exerting effort despite difficulty. This is important for Industrial Technology students because mathematics supports their academic preparation and future technical practice. Students who persist in mathematics are more likely to complete learning tasks, ask questions, review previous lessons, and continue working even when they encounter challenging topics. Adamuti-Trache explained that persistence in mathematics is connected with students' intention to continue engaging in mathematics learning and with their beliefs about the usefulness of the subject [1].

One factor that may influence students' persistence is teaching quality. Teaching quality refers to the clarity, organization, support, engagement, feedback, and relevance of instruction. In mathematics classes, quality teaching helps students understand concepts, follow procedures, correct errors, and connect lessons to practical situations. Engida noted that teaching quality remains an important factor in student achievement, although it should be examined using clear and reliable indicators [2]. Ekmekci and Serrano also found that teacher quality was associated with students' motivation, achievement, and persistence in science and mathematics [3].

Another important factor is learning regulation. Learning regulation refers to students' ability to set goals, plan study activities, monitor understanding, manage time, use learning strategies, and evaluate progress. In mathematics, learning regulation is essential because students often need repeated practice, error correction, independent study, and sustained effort. Göller et al. emphasized the importance of self-regulated learning in university mathematics because students are expected to manage a large part of their learning independently [4]. Dai et al. also found that self-regulated learning was connected with mathematics learning engagement [5].

This study was conducted among Industrial Technology students in one selected university in Region IX. It examined whether teaching quality and learning regulation predicted students' persistence in learning mathematics. The findings may provide useful bases for improving mathematics instruction, strengthening student support, and developing learning strategies that help Industrial Technology students persist in mathematics.

Research Questions

This study determined the predictive roles of teaching quality and learning regulation in Industrial Technology students' persistence in learning mathematics.

Specifically, it answered the following questions:

1. What is the level of teaching quality of the teachers in mathematics as perceived by Industrial Technology students in a university?
2. What is the level of learning regulation among Industrial Technology students in mathematics?
3. What is the level of students' persistence in learning mathematics?
4. Do teaching quality and learning regulation significantly predict Industrial Technology students' persistence in learning mathematics?

Methodology

Research Design

This study employed a quantitative predictive research design. This design was appropriate because the study aimed to determine whether teaching quality and learning regulation predicted Industrial Technology students' persistence in learning mathematics. The study was non-experimental because no treatment or intervention was introduced. Instead, it examined existing perceptions, learning behaviors, and persistence levels among the respondents.

Research Locale

The study was conducted in one selected university in Region IX. The university offered Industrial Technology programs and mathematics-related courses, making it an appropriate setting for examining students' persistence in learning mathematics.

Respondents of the Study

The respondents of the study were 750 Industrial Technology students enrolled in one selected university in Region IX. They were chosen because they were taking or had taken mathematics-related courses as part of their program requirements.

Research Instrument

The study used a survey questionnaire composed of three major sections. The first section measured teaching quality in mathematics. The second section measured students' learning regulation. The third section measured students' persistence in learning mathematics. The questionnaire used a Likert-type scale, and the responses were interpreted based on the study's descriptive interpretation scale.

Data Gathering Procedure

Permission was secured from the appropriate university authorities before the conduct of the study. The respondents were informed about the purpose of the study, the confidentiality of their responses, and the voluntary nature of their participation. After the questionnaires were administered and collected, the responses were checked, encoded, and prepared for statistical analysis.

Statistical Treatment of Data

Mean and standard deviation were used to determine the levels of teaching quality, learning regulation, and students' persistence in learning mathematics. Multiple linear regression analysis was used to determine whether teaching quality and learning regulation significantly predicted students' persistence in learning mathematics. The level of significance was set at .05.

RESULTS

Level of Teaching Quality

Table 1 presents the level of teaching quality of mathematics teachers as perceived by Industrial Technology students.

Table 1: Level of Teaching Quality of Mathematics Teachers as Perceived by Industrial Technology Students

Statement	M	SD	Interpretation
The instructor clearly explains mathematical concepts.	4.33	0.668	Very High
The instructor organizes the course content in a logical manner.	4.33	0.634	Very High
The instructor provides constructive feedback on assignments.	4.30	0.652	Very High
The instructor stimulates interest and enthusiasm for learning mathematics.	4.27	0.636	Very High
The instructor encourages students to ask questions and participate in discussions.	4.43	0.628	Very High
Overall	**4.33**	**0.545**	**Very High**

The results showed that the level of teaching quality of mathematics teachers was very high, with an overall mean of 4.33 and a standard deviation of 0.545. This indicated that students had a very favorable perception of their mathematics teachers' instructional practices. The highest mean was obtained by the statement on encouraging students to ask questions and participate in discussions (M = 4.43, SD = 0.628). This suggested that students perceived their teachers as supportive of participation and classroom interaction. The lowest mean was obtained by the statement on stimulating interest and enthusiasm for learning mathematics (M = 4.27, SD = 0.636), although it was still interpreted as very high.

Level of Learning Regulation

Table 2 presents the level of learning regulation among Industrial Technology students in mathematics.

Table 2: Level of Learning Regulation Among Industrial Technology Students in Mathematics

Statement	M	SD	Interpretation
I set specific goals before starting to study mathematics.	4.15	0.683	High
I monitor my understanding of mathematical concepts while studying.	4.17	0.644	High
I make a plan to study and follow it to prepare for math exams.	4.17	0.684	High
I keep studying even when the material is difficult.	4.17	0.690	High
I organize my study time to ensure I complete assignments on schedule.	4.22	0.671	Very High
Overall	**4.18**	**0.563**	**High**

The results showed that Industrial Technology students had a high level of learning regulation, with an overall mean of 4.18 and standard deviation of 0.563. This indicated that students generally practiced self-directed learning behaviors such as goal setting, monitoring, planning, time management, and effort regulation. The highest mean was obtained by the statement on organizing study time to complete assignments on schedule (M = 4.22, SD = 0.671), interpreted as very high. The lowest mean was obtained by the statement on setting specific goals before studying mathematics (M = 4.15, SD = 0.683), interpreted as high.

Level of Students' Persistence in Learning Mathematics

Table 3 presents the level of students' persistence in learning mathematics.

Table 3: Level of Students' Persistence in Learning Mathematics

Statement	M	SD	Interpretation
I continue working on math problems even when they are challenging.	4.21	0.719	Very High

Statement	M	SD	Interpretation
I consistently complete all mathematics assignments on time.	4.12	0.715	High
I make an extra effort to understand difficult math topics.	4.20	0.699	High
I persist in learning mathematics even if I feel frustrated.	4.17	0.688	High
I review past lessons regularly to keep up with the course.	4.17	0.690	High
Overall	**4.17**	**0.583**	**High**

The results showed that students had a high level of persistence in learning mathematics, with an overall mean of 4.17 and a standard deviation of 0.583. This indicated that students generally continued learning mathematics despite difficulty, frustration, and challenging tasks. The highest mean was obtained by the statement on continuing to work on math problems even when they are challenging (M = 4.21, SD = 0.719), interpreted as very high. The lowest mean was obtained by the statement on consistently completing mathematics assignments on time (M = 4.12, SD = 0.715), interpreted as high.

Predictive Roles of Teaching Quality and Learning Regulation

Table 4 presents the multiple regression analysis on the predictive roles of teaching quality and learning regulation on students' persistence in learning mathematics.

Table 4: Multiple Regression Analysis Predicting Students' Persistence in Learning Mathematics

Predictor	B	SE	β	t	p	Interpretation
Constant	0.264	0.093	—	2.846	.005	Significant
Teaching Quality	0.150	0.028	0.140	5.371	< .001	Significant predictor
Learning Regulation	0.781	0.027	0.754	28.859	< .001	Significant predictor

Model Fit Summary

R	R^2	Adjusted R^2	SE Estimate	F	df	p
0.857	0.734	0.734	0.301	1032.565	2, 747	< .001

Note. Dependent variable: students' persistence in learning mathematics. Predictors: teaching quality and learning regulation.

The regression model was statistically significant, $F(2, 747) = 1032.565$, $p < .001$. The R value of 0.857 indicated a strong relationship between the combined predictors and students' persistence in learning mathematics. The R^2 value of 0.734 showed that teaching quality and learning regulation explained 73.4% of the variance in students' persistence. This means that a large portion of students' persistence in mathematics could be explained by their perceived teaching quality and learning regulation.

The coefficients showed that teaching quality significantly predicted students' persistence in learning mathematics, B = 0.150, SE = 0.028, β = 0.140, t = 5.371, $p < .001$. This means that higher perceived teaching quality was associated with higher persistence in learning mathematics. Learning regulation also significantly predicted students' persistence, B = 0.781, SE = 0.027, β = 0.754, t = 28.859, $p < .001$. The standardized beta coefficient showed that learning regulation was the strongest predictor.

The regression equation was: **Persistence in Learning Mathematics = 0.264 + 0.150(Teaching Quality) + 0.781(Learning Regulation)**

DISCUSSION

The findings showed that Industrial Technology students perceived the teaching quality of their mathematics teachers as very high. This suggested that the teachers were viewed as clear, organized, supportive, engaging, and responsive to students' learning needs. The highest rating was given to encouraging students to ask questions and participate in discussions. This finding implies that the teachers created a classroom environment where students felt encouraged to engage in mathematics learning. This is important because student engagement supports active participation and sustained learning. Bergdahl et al. emphasized that engagement is a complex but important part of learning in higher education [6].

The findings also showed that students had a high level of learning regulation. This means that they generally planned, monitored, and managed their learning in mathematics. The strongest indicator was organizing study time to complete assignments on schedule. However, setting specific goals before studying resulted in the lowest mean. This suggests that although students managed their time well, they may still need guidance in setting clear learning targets. This finding supports the view of Göller et al., who noted that self-regulated learning is important in university mathematics because students need to manage their own learning processes [4]. Lourenço and Paiva also found that self-regulated learning influences time-management planning and academic performance [7].

The findings further revealed that students had a high level of persistence in learning mathematics. The students were most persistent in continuing to work on challenging math problems. This suggests that they were willing to continue solving mathematics tasks even when these were difficult. However, the lowest mean was found in completing all mathematics assignments on time. This implies that some students still needed support in assignment planning, study scheduling, and deadline management. Adamuti-Trache explained that persistence in mathematics is connected with students' intention to continue engaging in mathematics learning and with their beliefs about the value of the subject [1].

The regression results showed that teaching quality and learning regulation significantly predicted students' persistence in learning mathematics. The model explained 73.4% of the variance in persistence, indicating a strong predictive model. Teaching quality was a significant predictor, which means that clear explanations, organized lessons, constructive feedback, and classroom encouragement contributed to students' persistence. This finding is supported by Ekmekci and Serrano, who found that teacher quality was related to students' motivation, achievement, and persistence in science and mathematics [3].

Learning regulation emerged as the stronger predictor of students' persistence. This means that students' own ability to set goals, monitor understanding, plan study time, sustain effort, and manage learning tasks played a greater role in their persistence than teaching quality alone. This finding is theoretically connected to self-regulated learning theory, which explains that students become more persistent when they can control and evaluate their own learning. Dai et al. found that self-regulated learning was related to mathematics learning engagement [5], while Lumoto et al. found that self-regulated learning was related to mathematics performance among first-year college students in Southern Philippines [8].

The findings have practical implications for mathematics instruction in Industrial Technology programs. Since teaching quality significantly predicted persistence, mathematics teachers should continue improving clarity of instruction, logical organization of lessons, constructive feedback, and classroom participation. Since learning regulation was the stronger predictor, teachers and program administrators should also develop activities that strengthen students' self-regulated learning. These may include goal-setting tasks, study plans, reflection sheets, progress monitoring, guided reviews, and time-management exercises. Mathematics lessons may also be contextualized using Industrial Technology examples such as measurement, fabrication, technical drawing, machine operation, estimation, and workplace problem-solving.

Although the findings were strong, the study should be interpreted within its limits. The design was predictive and non-experimental; therefore, the results showed prediction but not direct cause-and-effect. The study also used self-report data, which may have been influenced by students' personal perceptions and response tendencies. Future studies may include classroom observation, interviews, academic performance records, or longitudinal data to provide deeper support for the findings.

CONCLUSION

The study concluded that Industrial Technology students perceived the teaching quality of their mathematics teachers as very high. The students also demonstrated high levels of learning regulation and persistence in learning mathematics. The regression results showed that teaching quality and learning regulation significantly predicted students' persistence in mathematics. The model explained 73.4% of the variance in students' persistence, which indicated strong predictive power.

Among the two predictors, learning regulation was the stronger predictor of students' persistence. This means that students' ability to manage, monitor, and sustain their own learning played a greater role in their persistence than teaching quality alone. However, teaching quality remained significant, showing that effective mathematics instruction still contributed to students' willingness to continue learning.

Overall, the findings suggest that persistence in mathematics among Industrial Technology students may be strengthened by combining quality teaching with intentional development of students' self-regulated learning skills.

Recommendations

Based on the findings, mathematics teachers may continue to improve the clarity, organization, relevance, and supportiveness of their instruction. They may also use contextualized examples related to Industrial Technology to make mathematics more meaningful and applicable to students' program of study.

Teachers may also integrate learning regulation activities into mathematics instruction. These may include goal setting, study planning, progress monitoring, reflection activities, guided review, and time-management exercises.

Program heads and university administrators may provide academic support programs that help Industrial Technology students strengthen mathematics study habits, assignment completion, and persistence.

Future researchers may conduct similar studies in other universities, include other technology-related programs, and examine additional predictors such as mathematics anxiety, self-efficacy, motivation, academic performance, and learning environment.

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