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Teachers' Instructional Supervision: Its Influence on Students' Conceptual Understanding In The Language of Mathematics

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Abstract

This study aims to examine the influence of teachers' instructional supervision on students' conceptual understanding in the language of mathematics. Specifically, it seeks to determine the relationship between instructional supervision components—organizational skills, goal setting, environment structuring, and help-seeking—and the conceptual understanding of 433 second-year Bachelor of Elementary Education (BEED) students at a community college in Bukidnon, Philippines. A descriptive-correlational research design was employed. Data were collected using two validated survey instruments: a 65-item adapted conceptual understanding test, and a 23-item instructional supervision questionnaire modified, both of which demonstrated acceptable reliability. Data were analyzed using descriptive statistics, Pearson correlation, and regression analysis. Despite generally positive perceptions of instructional supervision, students showed low levels of conceptual understanding. Statistically significant relationships were found between conceptual understanding and two supervision components: environment structuring ($p = 0.001$) and help-seeking ($p = 0.002$). Further, regression analysis identified environment structuring as a significant predictor of conceptual understanding ($F = 3.876$, $p = 0.004$). The findings suggest that instructional supervision, particularly in structuring learning environments and promoting help-seeking behavior, plays a crucial role in enhancing students' grasp of mathematical concepts. The study recommends that teachers and school administrators develop strategies that strengthen these areas to improve mathematics learning outcomes.

Keywords: Environment Structuring, Goal Setting, Help-Seeking, Instructional Supervision, Language of Mathematics, Organizational Skills

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INTRODUCTION

Teaching and learning mathematics has always posed a significant challenge for both educators and students. Mathematics requires not only the mastery of procedures but also a deep understanding of concepts and the language in which these concepts are expressed. However, the onset of the COVID-19 pandemic in 2020 exacerbated existing challenges, forcing schools to transition rapidly to online or modular learning modalities (Nagal et al., 2024) (Berico & Travero, 2023). This shift has had lasting effects on how students engage with mathematical content, with many struggling to adapt to new learning environments that demand greater autonomy, digital literacy, and self-regulation.

These disruptions have altered students' study habits and performance in mathematics, particularly among those in higher education (Travero et al., 2025). Compounding this issue is the Philippines' consistently low performance in international assessments. The Program for International Student Assessment (PISA) 2018 revealed that Filipino students ranked among the lowest in mathematics, scoring only 353 compared to the OECD average of 489 ((OECD)., 2019) (Berico & Travero, 2023). This placed the country in the bottom tier globally, with similar results observed for science and reading (Padilla et al., 2024).

At the local level, the problem is equally evident. In a community college in Bukidnon, student performance data from the course Mathematics in the Modern World during the 2020–2021 school year revealed that 31% of students performed below average. Specifically, 6.37% performed fair, 4.85% poorly, 2.42% were barely passing, and 17.75% fell below the passing mark. These figures underscore the urgent need to address students' conceptual understanding in mathematics—a foundational skill not only for academic success but also for future teaching competence, particularly among Bachelor of Elementary Education (BEED) students.

One central factor contributing to these low performances is the lack of conceptual understanding in the language of mathematics. Many students continue to rely on procedural knowledge without fully grasping the meaning of key terms and concepts (Surif et al., 2012). Feedback from students has revealed that some believe teachers are introducing unfamiliar examples, when in fact these had already been taught. This points to a deeper issue: students' overreliance on steps rather than concepts, and a limited vocabulary in mathematical language, which hinders problem-solving and critical thinking (Bresser, 2019) (Andamon & Tan, 2018).

Instructional supervision may offer a viable pathway to address these gaps. When teachers actively supervise learning through clear guidance, feedback, and supportive strategies, students are more likely to stay engaged and develop self-directed learning behaviors. Kearsley and Shneiderman's Engagement Theory, as cited by (Zheng, 2021), posits that meaningful learning occurs when students engage in worthwhile tasks through connections with others. Developed in the context of technology-based learning environments, the theory asserts that students learn more effectively when meaningfully engaged in activities involving interaction, collaboration, and authentic tasks (Kearsley & Shneiderman, 1998). It proposes three core principles—Relate, Create, and Donate—which highlight the importance of interpersonal relationships, project-based learning, and contributions to real-world contexts. In mathematics education, this implies that engagement can be enhanced through structured learning environments, purposeful goal-setting, opportunities to seek help from knowledgeable others, and organized learning strategies—all of which fall under instructional supervision. When teachers scaffold these processes, they promote not only engagement but also deeper conceptual understanding. Instructional supervision, particularly in online and modular settings, supports such engagement through four key strategies: organizational skills, goal setting, environment structuring, and help-seeking (Yen et al., 2016) (Flynn, 2016).

In the Philippine context, research on the influence of instructional supervision on students' conceptual understanding—particularly in mathematics—remains scarce. While existing studies have examined related factors such as self-regulated learning and online academic performance (McKenna et al., 2018) (Snyder et al., 2002), limited attention has been given to how specific aspects of teacher supervision, such as environment structuring and help-seeking, affect students' comprehension of mathematical concepts.

This study, therefore, investigates the relationship between teachers' instructional supervision and the conceptual understanding of second-year Bachelor of Elementary Education (BEED) students in the language of mathematics. It focuses on four key components of supervision: organizational skills, goal setting, environment structuring, and help-seeking. As these students are future educators, gaining insights into the factors that shape their understanding of mathematical language is essential to improving both their academic success and their preparedness to teach mathematics effectively.

To guide the investigation, the study seeks to determine the level of students' conceptual understanding in the language of mathematics and assess their perceptions of teachers' instructional supervision across the four components. It further examines whether a significant relationship exists between instructional supervision and conceptual understanding, and identifies which supervision components serve as significant predictors of students' conceptual grasp of mathematical concepts.

METHOD

The present study used descriptive-correlational research design. This design determines the level of the student's conceptual understanding and instructional supervision; discovers the relationships among variables; and allows predictions of students' conceptual understanding.

The study was conducted in a local college in Bukidnon, Philippines. The respondents were the conveniently selected 433 second year Bachelor of Elementary Education (BEED) students enrolled in the course Mathematics in the Modern World for school year 2021-2022. The researchers believed that future elementary educators have to develop conceptual understanding in mathematical topics for them to easily explain the concepts to their students. This made BEED students viable respondents to the study.

Adapted survey questionnaires were used to gather data. The conceptual understanding test in the language of mathematics with sixty-five (65) questions with Cronbach's alpha of 0.80 adapted from the study of (Andamon & Tan, 2018). The instructional supervision questionnaire is based on the questionnaire of (Yen et al., 2016) which was modified to fit this study. The indicators, while some were heavily based from (Yen et al., 2016) were improved to measure the variables this study opted to measure. The modified questionnaire was a 23-item scale with a 5-point Likert response format having values ranging from strongly agree (5) to strongly disagree (1). The questionnaire is divided into the following indicators: organizational skills, goal setting, environment structuring and help-seeking. The said questionnaire was pilot tested in the same school but to different students that were not part of the target respondents, and it obtained a Cronbach's alpha of 0.89. Table 1 shows the scoring procedure for the instructional supervision.

Table 1. Teachers' Instructional Supervision Scoring Procedure

Rating	Scale	Qualitative Description	Interpretation
5	4.50-5.00	Strongly agree	Highly positive
4	3.50-4.49	Agree	Positive
3	2.50-3.49	Uncertain	Neutral
2	1.50-2.49	Disagree	Negative
1	1.00-1.49	Strongly disagree	Highly negative

The data were grouped and categorized based on the objectives of the study. Mean was used to describe the conceptual understanding of students and the teachers' instructional supervision. Correlational analysis and regression analysis were also used to determine the relationship of the variables and to test whether or not instructional supervision influences and predicts conceptual understanding.

RESULTS AND DISCUSSION

Conceptual Understanding in the Language of Mathematics

Table 2. Frequency Distribution of Students' Scores in Conceptual Understanding in the Language of Mathematics

Range Scale (%)	Qualitative Interpretation	Frequency	Percentage
98-100 %	Excellent	0	0
94-97%	Very Good	0	0
87-91%	Good	0	0
82-84%	Average	0	0
80-81%	Fair	0	0
76-79%	Poor	0	0
75%	Passing	0	0
>75%	Failed	433	100
Mean Score: 42.68		Standard Dev.: 11.98	

As shown in Table 2, the student's level of conceptual understanding in the language of mathematics has a mean percentage score of 42.68, which falls below the passing score of 75%. This indicates that 2nd-year BEED students have difficulty understanding mathematics concepts. They cannot also define ideas and concepts relating to mathematics, which are crucial in solving word problems. This showed that students have insufficient mathematical vocabulary, which prevents them from grasping concepts with written language. They probably do not know the meaning of prime numbers and factors and other terms such as imaginary numbers, common multiple, at least, and many more, as presented in the table reflected with a very low mean percentage. Failure to define these words will hinder students' ability to solve the problem. For this reason, it is essential to set both content and language in teaching mathematics, especially in problem solving, because its difficulty increases in the later years as it becomes more linguistically and conceptually complex, and it uses specialized technical vocabulary (Bresser, 2019). However, it should also be considered that the survey was given online; hence, other factors can cause the inferior result.

Nevertheless, the study of (Andamon & Tan, 2018) already revealed that students' conceptual understanding was low before the pandemic. This means that this difficulty in conceptual understanding is not only because of the pandemic, which shifted the classes to online learning, but is already an existing problem before the pandemic.

Also, the study of (Surif et al., 2012) stated that a lack in conceptual understanding resulted in the lack of conceptual usage in solving problems, and this shows that language plays a vital role in learning mathematics. It further reported that students' conceptual knowledge was weak. The result is also supported by the study of (Amanda et al., 2021), explaining that the average scores of students' concept mastery were poor. (Bresser, 2019) even said that students can increase their comprehension of mathematics by using language to express mathematical ideas and provide opportunities for the teachers to identify students who do understand and do not understand. But this poses a problem, because online learning limits students' interaction and may not be enough to recognize students' difficulty and math concepts. The academic language specific to mathematics will be more challenging to teach. The study result could also mean that teachers are ineffective in developing mathematical concepts for the students. Teachers may evaluate their teaching methodology and reflect on the students' impoverished conceptual understanding in different areas.

Instructional Supervision

Table 3. Mean Scores on Organizational Skills

	Indicators	Mean	Qualitative Description	Interpretation
1.	Advising me to summarize my learning in online/modular courses to examine my understanding of what I have learned	3.94	Agree	Positive
2.	Encouraging me to schedule the same time every day or every week to study for my online/modular class and to observe the schedule	3.91	Agree	Positive
3.	Reminding me that although I don't have to attend daily classes, I still must try to distribute my studying time evenly across days	3.89	Agree	Positive
4.	Encouraging me to allocate extra studying time for my online/modular class because I know it is time demanding	3.85	Agree	Positive
5.	Encouraging me to ask myself a lot of questions about the course material when studying for an online/modular course	3.84	Agree	Positive
6.	Encouraging me to try to take more thorough notes for my online class because notes are even more important for learning online than in a regular classroom.	3.76	Agree	Positive
	Over-all Mean	**3.86**	**Agree**	**Positive**

The teachers' instructional supervision has been divided into organizational skills, goal setting, environment structuring, and help-seeking. Tables 3, 4, 5, and 6 present the mean scores of these indicators, respectively.

Table 3 shows a positive result for each indicator, totaling an overall mean of 3.86, which can be interpreted as positive. This means that the teacher provides good supervision to the students in developing their' organizational skills. This further means that students can summarize their lesson to examine how far they have learned. It is also evident that students develop the skill of time management because of teachers' active supervision of their learning. Moreover, it helps the students build confidence in asking questions relevant to the course material.

The result indicates that teachers did not fail to supervise the students' organizational skills. This is in response to the study of (McKenna et al., 2018), which revealed that students need preparation for the self-discipline and self-direction that online classes require, as they lack the cognitive organizational skills to navigate an electronic classroom or to work independently. (Sorensen & Baylen, 2009) also found that today's colleges need to teach students the managerial skills required to remain focused on their academics.

Table 4. Mean Scores on Goal Setting

	Indicators	Mean	Qualitative Description	Interpretation
1.	Setting goals to help me manage my study time for my online or modular class	4.01	Agree	Positive
2.	Setting standards for my assignment.	3.94	Agree	Positive
3.	Setting short-term (daily or weekly) and long-term goals (monthly or for the semester)	3.86	Agree	Positive
4.	Setting a high standard for my learning digital or modular	3.58	Agree	Positive
5.	Not compromising the quality of my work because it is online/modular	3.57	Agree	Positive
6.	Providing extra problems in addition to the assigned ones to master the course content	3.49	Uncertain	Neutral
	Over-all Mean	**3.74**	**Agree**	**Positive**

It can be seen in Table 4 that, among others, the indicator "setting goals to help me manage my study time for my online or modular class" obtained the highest mean score of 4.01. This indicates that students can choose an appropriate or best time to do their classwork if teachers do their part in supervising their students when it comes to goal setting. Having goals makes the

students aware of their own progress in learning, their efforts, and their management skills, especially in time. It gives them a responsibility to continue to study regardless of the problems that may arise. This will encourage the students to develop critical thinking skills and new problem-solving techniques (2018).

This was followed by the indicator "setting standards for my assignment," with a mean score of 3.94. This means that students are encouraged to produce high-quality output. Notably, only one (1) of the indicators, the indicator "provide extra problems in addition to the assigned ones to master the course content," neither agreed nor disagreed. It could mean that extra problems given, if there are any, may or may not be seen by the students as a contributor to the mastery of the course content. Moreover, the table shows that the overall mean score of teachers' supervisions on students' goal setting is 3.74. This further means that students were being supervised by the teachers in setting goals and standards for their learning, which supports the idea that helping students learn to develop strong goals can help them focus on objectives and overall success (2016). The inclusion of goal setting is supported by the study of (Kim & Ra, 2015), which found that it is one of the factors students deemed critical to college class success.

Table 5. Mean Scores on Environment Structuring

	Indicators	Mean	Qualitative Description	Interpretation
1.	Allowing me to find a comfortable place to study	4.11	Agree	Positive
2.	Encouraging me to find a place where I can study most efficiently	4.06	Agree	Positive
3.	Allowing me to choose location where I study to avoid too much distraction	3.98	Agree	Positive
4.	Encouraging me to choose a time with few distractions for my study	3.87	Agree	Positive
	Over-all Mean	**4.00**	**Agree**	**Positive**

As seen in Table 5, all four (4) indicators on environment structuring show positive interpretation, and all of these contributed to the overall mean of 4.00, described as agreed and interpreted as positive. This means that the teacher encouraged the students to structure their environment to their most comfortable place and time, and supervised them in structuring their study area to make efficient learning. It further agrees that teachers reminded the students to structure their study area free of unwanted distractions, which could affect their concentration in learning. It is just as crucial to create a learning environment for students as it is to teach them content. A pleasant learning environment improves students' sense of belonging. Self-Brown et al. (2003; as cited by (Selfridge, 2014) explained that the classroom climate has also been directly linked with student success. Hence, a favorable classroom climate is essential for students to learn.

Table 6. Mean Scores on Help-Seeking

Indicators	Mean	Qualitative Description	Interpretation
1. Advising me to find someone who is knowledgeable in course content so that I can consult with him/her when I need help	4.06	Agree	Positive
2. Advising me that if needed, you can try to meet my classmate face to face while observing the physical distancing	3.96	Agree	Positive
3. Encouraging me to communicate with my classmates to find out how I am doing in my online/modular classes.	3.93	Agree	Positive
4. Encouraging me to communicate with my classmates to find out if I have learned something that is different from what they are learning.	3.93	Agree	Positive
5. Encouraging me to share my problems with my classmates online, so we know what we are struggling with and how to solve our problems	3.91	Agree	Positive
6. Encouraging me to be persistent in getting help from him/her through mobile call, fb messenger or via email	3.91	Agree	Positive
7. Encouraging me to prepare my questions before joining in discussion forum	3.88	Agree	Positive
Over-all Mean	**3.94**	**Agree**	**Positive**

Table 6 shows that the overall mean on students' help-seeking is 3.94. This indicates that students were encouraged by the teachers to look for more knowledgeable others whom they can consult online or face-to-face, whichever is favorable. It also means that students develop good communication with their classmates. This is shown by students' positive attitudes toward sharing their problems online so that others can determine the areas of problem-solving they find challenging. The result also indicates that students are also encouraged by the teacher to prepare questions before joining the class discussion, which is crucial in online learning to prevent delay in discussion, where every time counts.

The data in the table also shows that the students agree with all indicators. With the indicator "advises me to find someone knowledgeable in course content so that I can consult with him/her when I need help" has the highest mean score of 4.06 and all other indicators have negligible mean score differences with a mean score of at least 3.9 except for the indicator "encourages me to prepare my questions before joining in discussion forum" which has the lowest mean score of 3.88. This shows that teachers actively support the students, to the extent that it encourages the students to be persistent in getting help from him/her through mobile call, fb messenger or via email.

(Snyder et al., 2002) found that help-seeking strongly correlates with online student success. Although achieving success in online learning rests to a significant degree on the student, teacher and peer support also play a significant role (Flynn, 2016).

Correlation and Regression Analyses of the Variables Involved

Table 7. Correlation Of Students' Conceptual Understanding with Their Perceived Level of Teachers' Instructional Supervision

Indicators	Coefficient of Correlation (r)	Interpretation	Probability
Organizational skills	0.069	Weak positive correlation	0.076
Goal Setting	0.014	Weak positive correlation	0.389
Environment Structuring	0.144	Weak positive correlation	0.001 *
Help-seeking	0.136	Weak positive correlation	0.002 *

**significant at 0.05 level of significance*

Table 7 shows the relationship between the students' perceived level of teachers' instructional supervision and their conceptual understanding. As shown, all five components of

instructional supervision have a weak positive correlation with the students' conceptual understanding. However, environment structuring and help-seeking are found to have a significant relationship with conceptual understanding.

(Khatib, 2010) also supports the importance of environmental structuring. When adult learners are more adept and comfortable with an online learning system, they may access the course room and materials more often, persist to overcome challenges, and take control over their learning. (Snyder et al., 2002) also found a strong correlation between online student success and their ability to seek help. Moreover, for students to meet the unique demands of the online environment, they must be encouraged to stay focused and manage their time efficiently (McKenna et al., 2018). Even though the students' conceptual understanding is low, as shown in this study, environment structuring and help-seeking are very important for students.

It is worth emphasizing that what is being measured here is the ability of the teachers to give instructional supervision to the students and whether the students follow the advises and encouragement or not is beyond the scope of the survey

Table 8. Regression Analysis Showing the Extent of Influence of Predictor Variables on Students' Conceptual Understanding

	Unstandardized Coefficients		Standardized Coefficients		
Indicators	B	Std. Error	Beta	**t**	**Sig.**
(Constant)	20.980	3.332		6.297	.000
Organizational skills	.071	.154	.030	.464	.643
Goal Setting	-.381	.180	-.140	-2.121	.035
Environment structuring	.450	.215	.134	2.098	.037*
Help-seeking	.234	.135	.114	1.733	.084
R = .187	R^2 = .035		F = 3.876*	Sig .004	

From Table 8, the linear regression equation in predicting students' conceptual understanding is y=19.985+0.484x, where *y* is the conceptual understanding and *x* is environment structuring.

The model proves to be significant (*F=3.876, p=0.004*) at the 0.05 level of significance. This only shows that environment structuring has a significant bearing on the students' conceptual understanding. Learners become comfortable with online learning as it allows them to access course rooms and materials, giving them control over learning (Khatib, 2010).

The model shows that increasing environment structuring would significantly increase students' conceptual understanding. (Murphy, 2016) study supports the model, which claims that the environment has a significant impact on student performance. (Gazmuri et al., 2016) study also supports the model, which states that the overall school environment is a better predictor of students' academic performance. They further suggest that the most effective course of action would be to improve the overall school environment.

CONCLUSION

This study explored the relationship between teachers' instructional supervision and the conceptual understanding of second-year BEED students in the language of mathematics. Findings revealed that while instructional supervision was generally perceived positively across the domains of organizational skills, goal setting, environment structuring, and help-seeking, students demonstrated a low level of conceptual understanding. Correlational analysis showed a significant relationship between conceptual understanding and two components of instructional supervision: environment structuring and help-seeking. Moreover, regression analysis identified environment structuring as a significant predictor of students' conceptual understanding.

These findings underscore the importance of providing students with a well-structured and supportive learning environment. In online or modular settings where direct supervision is limited,

encouraging students to study in distraction-free environments and at consistent times can significantly enhance their ability to grasp mathematical concepts. Likewise, fostering help-seeking behaviors can improve students' engagement and comprehension, particularly in the context of abstract or technical subjects like mathematics.

Based on these insights, it is recommended that teachers intensify their efforts in guiding students to create conducive study environments—both physically and mentally—by offering structured routines, reminders, and environmental planning strategies. Teachers may also provide explicit guidance on where and how students can seek help when struggling with mathematical language. Additionally, schools may conduct professional development programs focused on building teachers' capacity for remote instructional supervision, particularly in areas shown to influence learning outcomes. Lastly, curriculum planners should consider embedding strategies that support environment structuring and help-seeking into mathematics instruction to help improve students' conceptual understanding and future teaching effectiveness.

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