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Teacher Communication Practices in Trigonometric Instruction: A Comparative Study Across Experience Levels

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Abstract: Teacher communication is critical in mathematics learning, influencing students' understanding, engagement, and academic success. This study explores the communication practices of novice, intermediate, and senior mathematics teachers when teaching trigonometric comparisons in right triangles. Using a qualitative exploratory design, classroom observations and interviews were conducted with three vocational high school teachers in Keerom Regency, Papua Province, Indonesia, focusing on five communication aspects: clarity, assertiveness, responsiveness, relevance, and presentation style manipulation. The findings reveal significant differences among the teacher groups. Novice teachers exhibited excellent communication by integrating prerequisite knowledge, employing visual aids, and connecting lessons to real-world applications. Intermediate teachers demonstrated structured but conventional communication methods, focusing on content delivery with limited interactivity. Senior teachers, while experienced and accurate, relied heavily on traditional lecture-based approaches and displayed limited responsiveness to student needs. This study highlights the strengths of novice teachers' student-centered strategies, such as group activities and guided discovery, which enhanced student engagement and comprehension. The research underscores the need for professional development programs to promote innovative teaching practices across all experience levels. Future studies should examine how professional growth and contextual factors influence teacher communication, contributing to improved mathematics learning outcomes.

Keywords: teacher communication, vocational school, trigonometry, teaching experience.

▪ INTRODUCTION

Communication skills of teachers and students have been a significant focus of educational research, particularly in the domain of mathematics education. Numerous studies highlight the challenges in students' mathematical communication skills, emphasizing that their ability to articulate mathematical ideas effectively is often inadequate (Baran & Kabael, 2021; Majid et al., 2022). Other investigations have explored the written communication abilities of mathematics students and the factors contributing to their difficulties in problem-solving contexts (Qohar & Sumarmo, 2013; Rahman & Lee, 2014). While these studies provide valuable insights into student performance, limited research has been conducted on teacher communication, which is equally critical in shaping students' mathematical understanding (Khalidzuod & Rawyaalshboul, 2018; McCroskey et al., 2006).

Teacher communication facilitates student learning, especially in mathematics classrooms where abstract concepts require clear and precise explanations. Effective communication enables the teacher to deliver instructions, clarify concepts, and engage students in meaningful discussions (Lee, 2010; Webster, 2010). Furthermore, it influences students' enthusiasm, understanding, and academic success, thereby serving as a cornerstone of effecti teaching and learning (Diloyan, 2017; McCroskey et al., 2006).

Teaching communication encompasses verbal and nonverbal interactions, which create a dynamic learning environment. Verbal communication, including written and

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oral expressions, plays a pivotal role in mathematics education due to its reliance on structured reasoning and specific terminology (Bannon et al., 2020; Young & Travis, 2012). Nonverbal communication, such as gestures and visual aids, complements verbal interactions by enhancing clarity and reinforcing key ideas (Ferguson, 2004; Powell & Powell, 2016). Research emphasizes that the synergy between these communication modes determines the effectiveness of teaching strategies (Retnowati, 2016).

In mathematics classrooms, teacher communication is the primary medium through which complex ideas are conveyed and contextualized. Teachers must effectively introduce mathematical terms, explain relationships, and guide students in constructing logical arguments (Marasabessy & Qohar, 2023; Subanji & Nusantara, 2016). For example, teaching trigonometric concepts in right triangles requires not only the transmission of theoretical knowledge but also the development of practical problem-solving skills. Thus, the quality of teacher communication directly impacts students' comprehension and ability to apply learned concepts (Adeyemi, 2008; Lee, 2015).

Teaching experience is an essential factor influencing communication strategies in the classroom. Novice teachers with less than five years of experience may approach teaching with innovative and adaptive strategies due to their recent training (Kim & Roth, 2011; Salleh & Tan, 2013). Intermediate teachers, with 6–10 years of experience, often rely on conventional methods, balancing innovation and established practices (Barrett et al., 2002; Fantilli & McDougall, 2009). Meanwhile, senior teachers with over a decade of experience may adopt traditional approaches emphasizing discipline and structured learning, which could impact their responsiveness and adaptability (Hartono et al., 2022; Meyer, 2004).

Existing studies suggest that teaching experience significantly affects classroom dynamics, including teachers' ability to manage students, organize instructional content, and foster interaction (Hogan et al., 2003; Martin et al., 2006). Research has also highlighted the importance of tailoring communication strategies to students' needs, which may vary depending on their prior knowledge and learning styles (Namusoke & Rukundo, 2022; Usman et al., 2022). However, there is limited empirical evidence on how teaching experience shapes these strategies, particularly in mathematics (Engelbrecht & Borba, 2023; Murtafiah et al., 2019).

This study aims to address this research gap by examining the characteristics of teacher communication in mathematics classrooms, specifically in teaching trigonometric comparisons in right triangles. By analyzing five aspects of communication clarity, assertiveness, responsiveness, relevance, and presentation style manipulation this study seeks to identify how teaching experience influences communication practices (Khalidzuod & Rawyaalshboul, 2018; Webster, 2010). Based on the Papua Education Indicators, the percentage of teachers eligible to teach has decreased at the SMK education level compared to SMA, SMP and SD.

This research was conducted at the SMK education level in Keerom Regency. Keerom Regency is one of the districts in Papua Province which borders directly with the State of Papua New Guinea, so it still requires special attention from the Government. It is hoped that the findings of this study will provide insight into the interaction between teaching experience and communication effectiveness, and provide practical recommendations for educators. So that the percentage of teachers eligible to teach increases. Based on the background above, the research question in this study is how the

characteristics of teacher communication in learning mathematics trigonometric comparison material in right triangles in terms of teaching experience.

▪ METHOD

Participants

Based on the research background, this study was conducted at the SMK education level in Keerom Regency, Papua Province, Indonesia. In the district, there are 3 SMKs with a total of six math teachers. Based on the research objectives, the six math teachers were grouped based on teaching experience. There are three groups of teaching experience. Novice teachers with 1-5 years of experience, intermediate teachers with 6-10 years of experience, and senior teachers with more than 10 years of experience.

The beginner group consisted of two teachers, the intermediate group consisted of one teacher, and the senior group consisted of three teachers. Furthermore, they were selected based on the criteria, namely teaching at the same grade level, namely grade X with the same material, namely trigonometric comparison in right triangles. Having the same educational background, namely undergraduate mathematics education. The six teachers met these criteria.

Furthermore, the researchers observed the learning process of the six teachers on the material of trigonometric comparison in right triangles. Based on the results of observations and playback of recordings, one teacher in each group was selected based on teaching experience. For groups consisting of more than one teacher, the subject that could provide the most information about teacher communication in detail was selected. In addition, in order for data collection to run smoothly, subjects who meet additional criteria are needed, namely being able to express their opinions/thoughts orally and in writing well. Then, because novice teachers and intermediate teachers have not been certified, teachers who have not been certified are also selected in the senior teacher group. So that the subjects in this study amounted to three people, where one person from the novice group, one person from the middle group, and one person from the senior group.

Research Design and Procedure

This research is categorized as phenomenological research. This is based on the research objectives, namely to analyze and describe teacher communication in learning mathematics trigonometric comparison material in right triangles. According to Creswell (2014), this research aims to describe individual life experiences. The data collected is in the form of qualitative data which is a description of teacher communication in learning mathematics trigonometric comparison material in right triangles. The data presented is in accordance with the facts and phenomena that occur in the field. Through this qualitative approach, all facts both oral and written from the data sources that have been observed are described as they are. Researchers plan research, design research instruments, carry out observations, collect data, analyze data, make conclusions and make research reports.

Instrument

In research there are two types of instruments, namely the main instrument and supporting instruments. The main instrument in this research is the researcher himself. The researcher is said to be the main instrument because the researcher is a planner,

implementer, and data collector through recording, observation and interviews, analyzing data, interpreting data, and finally as a maker of research reports.

The auxiliary instruments in this research are observation sheets and interview guidelines. The observation sheet is used as a basis in capturing the details of learning, specifically teacher communication in learning mathematics complements the recording results. The following aspects of communication from previous researchers, as a reference for researchers and used as a basis for making instruments.

Table 1. Teacher communication

Researcher	Teacher Communication Aspect
McCroskey et al. (2006)	1. Interaction engagement: nonverbal proximity, clarity 2. Dimensions of socio-communicative style: assertiveness, responsiveness
Webster (2010)	1. Rhetorical: being clear, the relevance of communication using humor. 2. Relational: showing closeness, manipulation of presentation style, listening
Zlatić et al. (2014)	1. Interaction engagement: attention, sensitivity, responsiveness 2. Social skills: emotional expression, emotional sensitivity, emotional control, social expressiveness, social sensitivity, social control 3. Conflict management styles: integration, dominance, avoidance, obliging

Based on the aspects of communication that have been formulated above, this study will look at teacher communication in terms of clarity, assertiveness, responsiveness, communication relevance, and manipulation of presentation style. This is adjusted to the research objectives which only look at the teacher's verbal communication in the classroom, namely the teacher's written and oral communication. The following is the lattice of the observation sheet.

Table 2. Observation sheet

Aspect	Indicator	Statement to
Clarity	a. Content	
	1) Introduce new material gradually	1. 70
	2) Using a variety of examples	3-9
	3) Explain to students about the essential elements of a related skill or task	10-18
	4) Checking students' understanding	19-25
	5) The accuracy of teacher statement	26-29
	6) Maintain continuity in explaining the material	30-32
	b. Delivery	
	1) Short and clear	30-32
	2) Writing	33-46
Assertiveness	a. Teacher approach students as a leader	
	1) Be fair, allow all students to ask questions or convey ideas	47-48
	2) Be wise in making decisions	49-50 51-53

	b. Maintaining proper control in class, such as through good classroom management	
Responsiveness	a. Respond if students do not understand the material or make mistakes	54-56
	b. Willingness to listen to student questions or ideas and feedback	57-59
Communication Relevance	The strategy used by the teacher in:	
	a. Connecting the usefulness of content in everyday life	60-61
	b. Selecting examples	62-63
	c. Adopting student experiences	64-66
Presentation Style Manipulation	a. Presentation style	67-68
	b. Presentation strategy	2. 69

In the observation sheet there are instructions, so it is clear in its use. Teacher communication cannot be fully seen/revealed through observation alone, so it needs another auxiliary instrument, namely interview guidelines. With interview guidelines, we can double-check if there is a discrepancy in data about teacher communication in mathematics learning. Thus, it can be maximally explored. The interview guidelines used are unstructured interview guidelines. So that the questions given are based on findings in the field.

Researchers consulted with supervisors about observation sheets, interview guidelines, and validation sheets for observation sheets, as well as validation sheets for interview guidelines. Furthermore, after being approved by the supervisor, the observation sheet, interview guidelines, and observation sheet validation sheet, as well as the interview guideline validation sheet were validated. Validation was carried out by one Mathematics Education Lecturer and one Mathematics Lecturer.

The purpose of validation is to find out whether the instrument can really see how teacher communication in mathematics learning. If the observation sheet instrument is able to see teacher communication in learning mathematics, then the instrument is said to be valid. So, the criteria for validating the observation sheet instrument and interview guidelines is that the instrument is really able to see teacher communication in learning mathematics.

Validation criteria were identified from three components, namely (1) clarity of instructions, (2) suitability of content, (3) suitability of language used. The general assessment for the observation sheet format was (1) suitable for use without revision, (2) suitable for use with revision, and (3) not suitable for use. Improvement and development of instruments based on suggestions/improvements from validators. After obtaining a valid and ready-to-use instrument, then the instrument can be used to explore and collect data on teacher communication in mathematics learning.

If the data obtained is in accordance with the reality in the field, data credibility is obtained. Creswell (2012), explains about the validity strategy, namely by triangulating different data sources by checking these sources. This research uses time triangulation and technical triangulation. Time triangulation is done by observing the learning process on several mathematics materials that continue to run and with changing times. Triangulation of techniques is done by collecting data with different techniques, namely recording, observation and interviews. This is intended by researchers to look for the same characteristics of teacher actions in several different mathematics materials. One of the

techniques for checking the degree of trust (credibility) according to Creswell (2014) is observation persistence. Observational persistence means looking consistently for interpretations in various ways related to the analysis process. Observation persistence aims to find characteristics and elements that are very relevant to the problem then focus on these in detail.

Data Analysis

The data analysis process in qualitative research can be carried out since the researcher is in the field. Meanwhile, intensive data analysis is carried out after researchers return from the field or when all research data is collected. According to Creswell (2014), there are six steps of research data analysis carried out after the research data is collected, namely as follows.

1. Organizing and preparing data for analysis, namely by transcribing all recordings of the learning process or interviews.
2. Reading through the data, using the observation sheet as a basis for capturing the details of teacher communication in mathematics learning or general ideas about teacher communication when playing back video recordings of learning.
3. Analyzing the data by giving codes, i.e. taking pictures or writing data that have been collected during the data collection process, novice teachers are coded GP, intermediate teachers GM, senior teachers GS, and codes on each aspect of communication, between codes are given a dot as in Table 3 below.
4. Describing the data. This step was carried out after identifying categories during the data coding process. The researcher linked the categories in a series of stories/narratives about teacher communication.
5. Presentation of data in narrative. This step applies a narrative approach, including discussion of the relationship between categories.
6. Interpreting or interpreting the data. In this step, the researcher expressed the essence of the researcher's ideas. The researcher emphasizes how the teacher communicates. The researcher's efforts to interpret the data were carried out by reviewing the collected data and comparing with previous research (Creswell, 2014).

Table 3. Coding

Indicator	Code	Observation Aspect	Code
Clarity	Kj	c. Content	Kj.a
		7) Introduce new material gradually	Kj.a.1
		8) Using a variety of examples	Kj.a.2
		9) Explain to students about the essential elements of a related skill or task	Kj.a.3
		10) Checking students' understanding	Kj.a.4
		11) The accuracy of teacher statement	Kj.a.5
		12) Maintain continuity in explaining the material	Kj.a.6
		d. Delivery	Kj.b
		3) Short and clear	Kj.b.1
		4) Writing	Kj.b.2
Assertiveness	Kt	c. Teacher approach students as a leader	Kt.a
		3) Be fair, allow all students to ask questions or convey ideas	Kt.a.1

		4) Be wise in making decisions d. Maintaining proper control in class, such as through good classroom management	Kt.a.2 Kt.b
Responsiveness	Dt	c. Respond if students do not understand the material or make mistakes d. Willingness to listen to student questions or ideas and feedback	Dt.a Dt.b
Communication Relevance	Rk	The strategy used by the teacher in: d. Connecting the usefulness of content in everyday life e. Selecting examples f. Adopting student experiences	 Rk.a Rk.b Rk.c
Presentation Style Manipulation	Mg	a. Presentation style b. Presentation strategy	Mg.a Mg.b

▪ RESULT AND DISSCUSSION

This section presents the detailed findings on the communication styles of novice, intermediate, and senior teachers teaching trigonometric comparisons in right triangles. The five key communication aspects clarity, assertiveness, responsiveness, relevance, and presentation style manipulation are elaborated with examples and insights from observations and interviews.

Clarity

Novice teachers excelled in delivering material with clarity by emphasizing prerequisite knowledge and employing systematic strategies to ensure understanding. This is in accordance with the results of research by Khalidzuod and Rawyaalshboul (2018) and McCroskey et al. (2006), that teacher communication affects student understanding. One novice teacher stated:

"I always begin with the basics triangles, ratios, and the Pythagorean theorem before diving into trigonometry. This way, students feel prepared for the new concepts."

The use of color-coded diagrams in worksheets further enhanced clarity. For instance, the hypotenuse was marked in red, the adjacent side in blue, and the opposite side in green. During an observation, a student remarked:

"It's easy to see which side we're talking about because the colors make it clear."

Intermediate teachers maintained a logical explanation sequence but relied heavily on verbal instruction. One teacher explained:

"I follow a structured plan, starting with the Pythagorean theorem to find unknown sides. However, I use verbal descriptions rather than tools like colored diagrams."

While effective for some students, this approach was less engaging for those who benefited from visual aids. Senior teachers delivered accurate but less structured explanations. They often introduced prerequisite material reactively during problem-solving. A senior teacher shared:

"I explain the Pythagorean theorem when the problem requires it. I prefer focusing on solving problems rather than revisiting earlier topics."

This approach sometimes caused students to struggle with connecting foundational concepts to the new material.

Novice teachers demonstrated exceptional clarity in delivering material by introducing concepts gradually. They began lessons by revisiting prerequisite knowledge, such as the properties of triangles, basic ratios, and the Pythagorean theorem, which laid a strong foundation for understanding trigonometric comparisons. Teaching aids, including diagrams and color-coded worksheets, were employed to visually distinguish the hypotenuse, opposite, and adjacent sides. This approach not only facilitated comprehension but also enabled students to engage actively with the material. In contrast, intermediate teachers followed a structured yet conventional approach. While they introduced material in logical sequences, their reliance on lectures and pre-written examples limited opportunities for interactive engagement. Prerequisite knowledge was briefly reviewed at the beginning of the lesson, with less emphasis on connecting these concepts to new material. Senior teachers, although accurate in their explanations, lacked structure in their delivery. Prerequisite concepts were mentioned only during problem-solving sessions, leaving some students struggling to connect earlier knowledge to the current topic. The lack of visual aids and step-by-step guidance further diminished the clarity of their explanations.

Assertiveness

Classroom management and interaction varied significantly across teacher experience levels. Novice teachers created an inclusive environment by encouraging group discussions and peer collaboration. This is in accordance with the results of Khalidzuod and Rawyaalshboul (2018) research, teacher communication affects the level of student enthusiasm in the classroom. One teacher explained:

"Group activities allow students to explore concepts together. Presenting their findings builds confidence and ensures active participation."

Observations revealed a lively classroom atmosphere where students confidently shared ideas and asked questions during group presentations. Intermediate teachers encouraged questions but maintained a more teacher-centered approach. A teacher noted:

"After explaining the material, I ask if there are any questions. Students can clarify their doubts, but I don't frequently use group work because it's time-intensive."

While this method is effective for individual understanding, it also limits opportunities for peer interaction. Senior teachers emphasized discipline and order but offered fewer opportunities for active student participation. As one teacher explained:

"My focus is on ensuring students listen carefully and take notes. I answer questions one-on-one after class."

This strategy maintained control but restricted classroom collaborative learning and dynamic exchanges. Classroom management varied significantly among the three groups. Novice teachers maintained a highly interactive and conducive learning environment by promoting group discussions and actively engaging students in problem-solving. Group

discussions were guided using well-designed worksheets, and each group was tasked with presenting their findings. This approach promoted equal participation and gave students the confidence to ask questions and express ideas. The novice teachers maintained excellent classroom management, ensuring a conducive atmosphere for learning. Intermediate teachers demonstrated moderate assertiveness by allowing students to ask questions and offer feedback. However, their teacher-centered approach limited interaction among students. Although the classroom remained orderly, peer-to-peer learning was not maximized. While maintaining authority in the classroom, senior teachers adopted a more traditional approach. Students were encouraged to listen and take notes but had fewer opportunities to interact with peers or the teacher. The classroom atmosphere, while disciplined, lacked the dynamic exchange of ideas that characterized novice teachers' classrooms.

Responsiveness

Novice teachers responded highly to students' needs, tailoring explanations and strategies to address individual challenges. For instance, one teacher used mnemonics like "sine = demi," "cosine = sami," and "tangent = desa" to simplify the memorization of formulas. This is in accordance with the results of research by Rahman and Lee (2014) and Lee (2015), stating that teachers play an important role in helping children develop and refine mathematical communication skills. The teacher elaborated:

"These mnemonics are simple and stick with students, especially during exams. They also find them fun to use in class."

Visual aids, such as arrows highlighting triangle sides, further clarified relationships between sides and angles. A student commented during a discussion:

"The arrows show exactly what's being measured, so I don't get confused about the hypotenuse or adjacent side."

Intermediate teachers relied on repetition to address misunderstandings. One teacher stated:

"If a student struggles, I re-explain using simpler language. However, I don't usually use visual aids or alternative strategies."

While this approach worked for some, it left others without the varied techniques needed for deeper comprehension. Senior teachers expected students to resolve difficulties independently, offering minimal additional support. A teacher remarked:

"I guide them only when absolutely necessary. Students need to figure things out on their own to build resilience."

This method benefitted more advanced learners but often left less confident students struggling. Novice teachers responded highly to student needs, addressing questions with detailed explanations and practical tips. For instance, they used mnemonics such as "sine = demi," "cosine = sami," and "tangent = desa" to help students remember trigonometric formulas. These techniques, combined with visual aids like arrows and colors to identify triangle sides, made the material more accessible. Novice teachers supported struggling students by offering step-by-step demonstrations and one-on-one assistance during group

activities. Intermediate teachers showed some responsiveness but tended to address student difficulties using repetitive explanations rather than adapting their methods. For instance, while they reinforced the Pythagorean theorem as a foundational tool, they did not employ creative techniques to help students identify triangle sides or understand the relationships between angles and sides. Senior teachers exhibited the least responsiveness. Their explanations were often limited to restating previously delivered content, and they relied heavily on students' ability to deduce solutions independently. While this approach may benefit advanced learners, it poses challenges for students requiring additional guidance.

Relevance

Novice teachers excelled in connecting trigonometric concepts to real-world applications. One teacher highlighted practical examples during class:

"When designing roofs or measuring wave heights, trigonometry is essential. Showing these applications motivates students to see the value in their learning."

Such examples captured students' attention, with one student enthusiastically asking:

"Could this method calculate how high a tree is without climbing it?"

Intermediate teachers rarely incorporated practical applications into their lessons. When asked, one teacher admitted:

"I usually stick to textbook examples. Sometimes, I forget to link the material to real-world problems."

This omission made the content less relatable for students. Senior teachers occasionally mentioned general mathematical applications but avoided specific examples related to trigonometry. A senior teacher explained:

"I tell students that math is important in many areas, but I don't explain how trigonometry is applied in daily life."

This broad explanation failed to illustrate the immediate relevance of the subject. The ability to connect mathematical concepts to real-world applications differed markedly among the three teacher groups. Novice teachers stood out for their ability to make the material relatable. For example, they illustrated the use of trigonometry in calculating the height of buildings, determining slopes for construction projects, and estimating wave heights in geophysics. These examples captured students' interest and underscored the practical utility of the subject. Intermediate teachers rarely linked the material to practical applications, focusing on theoretical explanations and textbook exercises. When prompted during interviews, some intermediate teachers acknowledged forgetting to incorporate real-world examples into their lessons. While occasionally mentioning general applications of mathematics, senior teachers did not explicitly connect trigonometric comparisons to everyday problems. This oversight limited students' ability to appreciate the broader relevance of the material.

Presentation Style Manipulation

Novice teachers adopted innovative and engaging strategies to facilitate learning. For example, one teacher used group worksheets that required students to identify triangle sides and calculate trigonometric ratios. The teacher explained:

"I believe students learn better when they discover concepts on their own. The worksheets guide them step-by-step, and using colors makes it easier to follow."

This approach promoted active participation and a deeper understanding of concepts. Intermediate teachers relied predominantly on lecture-based instruction with occasional question-and-answer sessions. One teacher noted:

"Teachings help me cover the material efficiently. I include practice problems but don't use visual aids or group work regularly."

This strategy ensured content delivery but lacked the interactive elements in novice teachers' classrooms. Senior teachers adhered to traditional methods focused on repetitive drilling. A teacher remarked:

"Practice is essential. I provide as many exercises as possible to reinforce the material."

While effective for procedural fluency, this approach did not foster creativity or deeper conceptual engagement. The presentation styles employed by the teachers varied significantly across experience levels. Novice teachers adopted creative and student-centered strategies, such as using color-coded diagrams, group worksheets, and guided discovery activities. These methods encouraged active learning and allowed students to explore concepts independently before receiving teacher input. For example, students were asked to identify triangle sides using diagrams with distinct colors for the hypotenuse, opposite, and adjacent sides. This approach not only facilitated understanding but also made the learning process engaging. Intermediate teachers relied on lecture-based instruction and question-and-answer sessions. Although they provided sufficient practice problems, their lack of visual aids and interactive methods limited the diversity of their presentation. Senior teachers adhered to a classical teaching style, characterized by repetitive drilling and problem-solving exercises. While this approach ensured adequate practice, it did not foster deeper conceptual understanding or creativity in learning.

Discussion

This study comprehensively analyzes how teaching experience influences communication strategies in mathematics classrooms, specifically in trigonometric comparisons in right triangles. The findings reveal significant differences among novice, intermediate, and senior teachers across five communication aspects: clarity, assertiveness, responsiveness, relevance, and presentation style manipulation.

Clarity aspects, novice teachers' emphasis on systematically introducing prerequisite concepts demonstrates their ability to scaffold learning effectively. This approach aligns with existing research suggesting that structured instruction enhances student comprehension and reduces cognitive load (Subanji & Nusantara, 2016; Webster, 2010). Their use of visual aids, such as color-coded diagrams, further supports students'

understanding by providing concrete representations of abstract concepts. In contrast, intermediate and senior teachers relied more on verbal explanations, with limited or no use of supplementary tools. While verbal instruction can be effective, its lack of visual support may hinder students who struggle with abstract reasoning (McCroskey et al., 2006). These findings highlight the importance of integrating diverse instructional tools, especially in teaching complex mathematical concepts.

Assertiveness aspects, the interactive and collaborative classroom environment fostered by novice teachers underscores their commitment to student-centered learning. Group activities and peer discussions, as observed in their classrooms, are well-documented strategies for enhancing critical thinking and communication skills among students (Almulla, 2023). While maintaining a teacher-centered approach, Intermediate teachers provided students with opportunities to ask questions, albeit in a less collaborative setting. Senior teachers' reliance on traditional lecture methods, while effective for maintaining classroom discipline, limited student engagement and collaborative learning opportunities. These variations suggest that novice teachers align with contemporary pedagogical practices emphasizing active learning, whereas intermediate and senior teachers rely on more conventional methods.

Responsiveness aspects, the responsiveness of novice teachers, particularly their use of mnemonics and visual aids, reflects a high degree of adaptability to student needs. These strategies are consistent with research emphasizing the importance of responsive teaching in addressing diverse learning styles (Hartono et al., 2022). Intermediate teachers' tendency to rely on repetitive explanations indicates a more rigid approach that may not accommodate all students. Senior teachers' limited responsiveness, characterized by an expectation of student independence, risks alienating less confident learners. As novice teachers demonstrate, effective responsiveness requires a balance between guiding students and encouraging autonomy.

Relevance aspects, the ability of novice teachers to connect mathematical concepts to real-world applications significantly enhances student motivation and engagement. By illustrating the practical utility of trigonometry in fields such as architecture and geophysics, they contextualized abstract concepts, making them more relatable (Diloyan, 2017; Khalidzuod & Rawyaalshboul, 2018). Intermediate and senior teachers, who either neglected to provide real-world examples or offered only generalized applications, missed opportunities to reinforce the relevance of the material. Research indicates that contextualized teaching motivates students and improves their ability to retain and apply knowledge (Usman et al., 2022). These findings emphasize the need for all teachers to integrate practical examples into their lessons, regardless of their teaching experience.

Presentation Style Manipulation aspects, novice teachers' creative use of teaching aids and group worksheets highlights their alignment with student-centered pedagogical models. These approaches are consistent with research advocating for interactive and discovery-based learning to deepen conceptual understanding (Namusoke & Rukundo, 2022). Conversely, intermediate and senior teachers' reliance on traditional methods, such as lectures and repetitive drills, limits opportunities for interactive learning. While such methods can reinforce procedural fluency, they may fail to foster higher-order thinking skills (Saepuzaman et al., 2021). This finding underscores the need for continuous professional development to encourage teachers at all experience levels to adopt more innovative instructional strategies.

For implications for practice, the findings suggest several implications for improving mathematics education. First, integrating structured and visual-based instruction, as novice teachers demonstrate, can significantly enhance student comprehension and engagement. Professional development programs should emphasize the importance of diverse instructional tools and active learning strategies. Second, promoting responsive teaching practices across all experience levels can help address the diverse needs of students. Third, encouraging real-world applications in mathematics teaching can bridge the gap between abstract concepts and practical relevance, fostering greater student motivation and understanding.

▪ CONCLUSION

This study examined novice, intermediate, and senior teachers' communication practices in trigonometric comparisons in right triangles. The analysis focused on five key aspects of communication: clarity, assertiveness, responsiveness, relevance, and presentation style manipulation. The findings revealed notable differences based on teaching experience, with novice teachers demonstrating exceptional communication practices characterized by structured delivery, interactive methods, and practical relevance. Intermediate teachers exhibited moderately effective communication, often relying on conventional methods. While accurate and experienced, senior teachers displayed limited adaptability and engagement strategies. Novice teachers' scaffolding techniques, visual aids, and real-world examples significantly enhanced student understanding and motivation. In contrast, the less interactive approaches of intermediate and senior teachers highlighted the need for professional development programs to encourage adopting more student-centered practices across all levels of teaching experience.

This study underscores the critical role of effective teacher communication in mathematics education, particularly in bridging the gap between abstract concepts and practical applications. Future research should explore the long-term impact of varied communication strategies on student learning outcomes and investigate methods to support teachers in refining their communication practices. By addressing these areas, educators can enhance teaching effectiveness, improve student engagement, and foster a deeper understanding of mathematical concepts.

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