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PEDAGOGICAL CONTENT KNOWLEDGE AND INSTRUCTIONAL EFFECTIVENESS OF PUBLIC JUNIOR HIGH SCHOOL MATHEMATICS TEACHERS IN ECHAGUE, ISABELA

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Abstract

Pedagogical content knowledge is essential in improving teachers' instructional management and students' learning in mathematics. This study determined the level of pedagogical content knowledge and instructional management performance of public junior high school mathematics teachers in Echague, Isabela, and examined the relationship between the two variables. A descriptive-correlational research design was employed involving 45 public junior high school mathematics teachers selected through total enumeration. Data were gathered using an adapted and validated questionnaire and analyzed using frequency, percentage, weighted mean, and Pearson Product-Moment Correlation. The findings revealed that the respondents possessed a very high level of pedagogical content knowledge in terms of pedagogical knowledge, knowledge of learners and learning, curriculum knowledge, content knowledge, and knowledge of contexts. Likewise, the teachers demonstrated an outstanding level of instructional management performance in terms of instructional objectives, content knowledge and pedagogy, learning environment, and diversity of learners. Furthermore, the results showed a very strong and statistically significant positive relationship between pedagogical content knowledge and instructional management performance. The study concludes that strengthening teachers' pedagogical content knowledge contributes to more effective instructional management and supports the delivery of quality mathematics education.

INTRODUCTION

The United Nations Sustainable Development Goals (SDGs), especially SDG 4 or Quality Education which promotes inclusive, equitable, high-quality education and opportunities for lifelong learning for all, highlight the critical role that education plays in national development and is widely acknowledged as a major driver of sustainable development. In this global paradigm, mathematics is acknowledged as one of the fundamental subjects that are crucial to the growth of students' analytical thinking, logical reasoning, and problem-solving skills.

Mangarin and Caballes (2024) emphasized that mathematics is an essential discipline vital for cultivating logical reasoning, problem-solving abilities, and analytical thought. Acquiring mathematical knowledge is essential as it cultivates critical thinking and problem-solving abilities relevant to daily life and various vocations. It improves logical reasoning, allowing individuals to tackle complex circumstances systematically and make educated decisions.

Teachers' proficiency in mathematical subject and successful pedagogical strategies that promote meaningful learning has been continuously associated with the quality of mathematics instruction in all international educational systems. The requirement for qualified teachers who can translate difficult mathematical concepts into understandable and interesting courses for a variety of learners has been underlined more and more in recent years by educational reforms.

Mathematics education remains a significant issue in the Philippines, particularly at the junior high school level, where abstract thought is reinforced and foundational concepts are further developed. Reports from national exams and classroom observations indicate that many students still have difficulty with mathematics despite curriculum changes and ongoing professional development programs. These challenges are frequently ascribed to both teacher-led instructional strategies and student-related issues. As a result, attempts to enhance mathematics learning results have made teacher quality a top priority. According Catador and Mame (2025), one major problem that casts doubt on the efficacy of the educational system was the poor math performance of Filipino students. Both national and international evaluations highlighted the persistently poor performance levels, indicating a more serious systemic issue that required further investigation. Despite the nation's K–12 educational reforms and the introduction of many policies and initiatives to raise student achievement and the quality of education.

Pedagogical content knowledge (PCK) was initially developed by Shulman in the 1980s. It is characterized as the combination of pedagogy and content, encompassing the 'what' and 'how' of instruction. PCK was regarded as the absent paradigm in the examination of pedagogy (Shing et al., 2015). When it comes to teaching mathematics, PCK helps teachers foresee students' challenges, use different representations to convey ideas, and employ techniques that encourage deep conceptual comprehension rather than rote memorization.

On the other hand, instructional effectiveness measures how well teachers support learning through thoughtfully prepared lessons, efficient classroom management, suitable teaching techniques, and significant teacher-student interactions. Clear explanations, logical idea sequencing, responsiveness to learner requirements, and the application of techniques that promote critical thinking and active involvement are all characteristics of effective mathematics training.

Locally, public junior high schools in Echague, Isabela, are still carrying out a number of projects meant to raise the caliber of instruction and enhance students' mathematical performance. Nonetheless, informal observations and anecdotal evidence point to differences in math teachers' effectiveness as teachers. These differences raise significant concerns about how teachers' pedagogical content knowledge influences classroom instruction and learning outcomes. Designing focused professional development initiatives and legislative changes to close certain educational gaps requires an understanding of this relationship.

Given these considerations, this study seeks to examine the pedagogical content knowledge and instructional effectiveness of public junior high school mathematics teachers in Echague, Isabela. The study intends to provide empirical information that could serve as a basis for instructional improvement and professional development initiatives in mathematics education.

Literature Review

I. Conceptual Foundations and Components of Pedagogical Content Knowledge in Mathematics

A key attribute of mathematics educators is their expertise, which allows them to facilitate learning situations that enhance students' comprehension, a concept termed pedagogical content knowledge by Shulman in 1986.A total of 83 distinct topic-specific learning difficulties were identified in PCK assessments, encompassing both procedural and conceptual challenges or their mixtures. Teaching tactics were documented seldom, with certain methods, such as manipulatives and visualizations, referenced across several mathematical disciplines (Grigaliūnienė et al., 2025)

Van Driel and Berry (2012) underscored that the development of pedagogical content knowledge (PCK), which encompasses teachers' comprehension of student learning processes regarding specific subject matter, is a crucial objective for professional development programs. The study literature unequivocally demonstrates the intricate nature of pedagogical content knowledge (PCK) as a type of professional knowledge for educators that is distinctly particular to topics, individuals, and contexts. This indicates that professional development programs focused on enhancing teachers' pedagogical content knowledge (PCK) must extend beyond merely providing input, such as instances of exemplary subject matter instruction. Such programs should be tightly associated with teachers' professional practice and, in addition to offering specific guidance, should incorporate chances for the enactment of particular teaching practices and for individual and group reflection on their experiences.

The findings of Galimova et al. (2023) were examined about the competencies of preservice and in-service science and mathematics educators in pedagogical subject knowledge, the evaluation of the advancement of prospective teachers' pedagogical content knowledge, and the elements of pedagogical content knowledge. The findings offer implications for ascertaining and enhancing the pedagogical content knowledge of both prospective and in-service science and mathematics educators.

Similarly, according to Sakaria, D. A., et al., (2023), mathematics teachers are crucial in mirroring students' capabilities and interests, facilitating conceptual comprehension through elevated pedagogical content knowledge (PCK). Nonetheless, there is a deficiency of research that thoroughly examines the existing literature concerning elements that may influence mathematics instructors' pedagogical content knowledge (PCK). There is a pressing need to enhance the capabilities of our current mathematics teachers to bridge this gap and elevate their pedagogical content knowledge (PCK) level. The findings indicated that mathematics instructors' pedagogical content knowledge is affected by three categories of factors: individual, professional, and organizational. Professional development and teaching experience are the two most prevalent and dominant elements. The findings of this research

may serve as a guide for researchers in mathematics education initiating PCK projects. This paper additionally proposes ideas for further investigation into mathematics instructors' pedagogical content knowledge (PCK).

A teacher plays a vital part in cultivating students' knowledge and competencies in mathematics. This article examines the enhancement of mathematics teachers' Pedagogical Content Knowledge (PCK) on the instruction of polyhedra, namely cubes and cuboids, for Year 8 pupils. PCK is a specialized knowledge for educators that amalgamates content knowledge, pedagogical knowledge, and understanding of pupils. Content knowledge refers to the understanding of facts, concepts, relationships among concepts, and procedures pertaining to mathematics, specifically the concept of polyhedra. Pedagogical knowledge pertains to a teacher's expertise in structuring the teaching and learning process of polyhedra, whereas knowledge of students is characterized as a teacher's understanding of students' challenges and errors regarding polyhedra. The findings indicated that the instructor frequently integrated conceptual and operational explanations to rectify errors and mitigate students' challenges with polyhedra by offering scaffolding and utilizing peer tutoring (Ma'rufi et al., 2018).

According to Kurniawan et al., (2018), the knowledge and experience of prospective mathematics teachers in field practice include communication in factual, conceptual, procedural, and metacognitive domains, including facts, concepts, principles, procedures, and reasoning. Teacher communication influences mathematics learning, particularly the capacity to concurrently and accurately use formulae, rules, and methodologies for precise computations. Prospective teachers can offer guidance to students during mathematics lessons and while utilizing the blackboard, facilitating discussions and addressing frequently asked questions, employing language suitable for the students' comprehension to ensure that the symbols, procedures, and strategies presented are clearly understood.

II. Pedagogical Content Knowledge and Instructional Effectiveness in Mathematics Teaching

A growing body of research establishes a strong link between teachers' pedagogical content knowledge and instructional effectiveness. According to Fukaya et al. (2024), pedagogical content knowledge (PCK) has garnered considerable interest as a category of educators' professional expertise.

Demonstrated that teachers' pedagogical content knowledge (PCK) had a positive correlation with their content knowledge (CK) and teaching efficacy, but not with their gender. The quality of instruction and students' academic performance varied by model, however multilevel analyses found positive associations.

Similarly, the study of Aderinoye-Rabiu et al. (2025) reported that no correlation between primary mathematics teachers' content knowledge (CK) and instructional effectiveness. Having a thorough comprehension of arithmetic ideas may not be enough to improve student learning outcomes. The study shows a strong correlation between teachers' pedagogical content knowledge (PCK) and instructional effectiveness. Teachers' ability to communicate mathematical concepts is vital for engaging pupils and facilitating learning. Effective mathematics teaching requires both subject and pedagogical content understanding.

Teachers have a crucial role in education, especially in math, where complicated concepts can be difficult to grasp. Effectiveness in the classroom depends on combining content understanding with strong pedagogical abilities. Effective integration is crucial for engaging pupils and promoting deeper understanding of mathematical concepts. Teachers can improve their teaching methods and create a more meaningful learning experience for pupils. Investing in CK and PCK development can enhance mathematics teaching quality.

Pangan and Magno (2025) examined the complex correlation between mathematics educators' Pedagogical Content Knowledge (PCK) and their instructional management strategies, employing the Classroom Observation Tool (COT) within the Results-Based Performance Management System (RPMS). It offered an exhaustive account of the pedagogical content knowledge (PCK) of junior high school mathematics educators in Cluster III, Division of Pampanga, emphasizing aspects such as pedagogical knowledge, curriculum knowledge, and topic knowledge. The results indicated a robust consensus among participants for PCK indicators, especially in Content and Curriculum Knowledge, although Pedagogical Knowledge and Knowledge of Context garnered marginally lower evaluations. Educators received superb ratings in all critical facets of instructional management, signifying remarkable performance. Nonetheless, notable discrepancies arose between educators' self-evaluations and assessments conducted by their superiors in several aspects of pedagogical content knowledge (PCK). Despite the absence of a substantial overall link between PCK and instructional management performance, a small but statistically significant correlation was seen between Content Knowledge and instructional management. A customized Teachers' Developmental Plan was developed to improve pedagogical content knowledge and instructional management skills, based on data from 91 teachers and targeting specific issues highlighted during RPMS observations. This approach is to enable t

III. Influence of Pedagogical Content Knowledge on Student Learning, Engagement, and Achievement

The findings of Kumi, E. M., & Wonu,N. (2021) suggested that students had a favorable opinion of teachers' pedagogical content competence in Mathematics instruction. The mean ratings of students for IRS, IOC, and KSU were all inferior to those of SMK, indicating that the teachers possessed greater content understanding than instructional delivery, which has a more significant impact on student progress in Mathematics. It was stated, among other recommendations, that Mathematics teachers should focus on their Subject Matter Knowledge (SMK), as students' perceptions of teachers' SMK may influence their understanding of the subject.

The findings Alhassan et al. (2024) indicated that although JHS mathematics educators possess substantial understanding of problem-solving, they employed problem-solving instructional strategies sparingly, while utilizing task-based instruction and cooperative learning strategies extensively. Consequently, the researcher advocates for a novel paradigm in training educators on problem-solving methodologies for mathematics instruction in public junior high schools. Headteachers must ensure that mathematics instructors are supervised and incentivized to employ problem-solving techniques to improve students' academic achievement in mathematics.

The research of Anyeta and Suglo (2024) determined that teachers' pedagogical topic knowledge and self-efficacy do not significantly affect the mathematics competency of senior high school students. This indicates that factors such as student background variables, school resources, or instructional procedures may exert a more significant influence on kids' mathematical achievement. The study advised that subsequent research employ more comprehensive assessments of teacher commitment and other variables that may influence student performance to investigate the relationship between teacher characteristics and student achievement in mathematics instruction.

IV. Professional Development, Instructional Challenges, and Contextual Factors Affecting Pedagogical Content Knowledge

Maudia et al. (2024) investigate how collaborative professional development programs might augment the Pedagogical Content Knowledge (PCK) of mathematics educators, specifically in the integration of pedagogy and content, enhancement of teaching strategies, and resolution of classroom difficulties. The research indicated that collaborative professional development markedly enhanced instructors' capacity to amalgamate pedagogy with content, execute novel teaching methodologies, and formulate more organized lesson plans. Furthermore, 75% of educators indicated heightened student involvement, although 60% encountered difficulties associated with time and resource constraints.

According to De Freitas and Spangenberg (2019), a significant number of teachers of mathematics encounter difficulties in properly incorporating information and communication technology (ICT) into their instruction and require ongoing professional development programs to enhance their technological pedagogical content knowledge (TPACK). Despite global trends favoring the effective integration of ICTs in education, South African mathematics educators frequently encounter difficulties in utilizing ICTs as a transformative instrument to enhance students' comprehension of mathematics. The issue may stem from CPD programs designed to train teachers in ICT usage not sufficiently addressing the specific needs of mathematics educators about their TPACK levels and obstacles to ICT integration. This paper sought to ascertain mathematics teachers' TPACK levels and the obstacles to ICT integration to guide the development of CPD programs. The findings indicated that in-service mathematics instructors exhibit sufficient content knowledge (CK),

Tuya et al. (2025) emphasized that every student deserves quality, differentiated education, which equalizes. Kenya's Competency-Based Education (CBE) develops problem-solving and other skills in holistic learners. CBE relies on instructors' Pedagogical Content Knowledge (PCK) to adapt education to varied learners while learning subject matter. PCK improves competency-based learning, but systemic impediments restrict its impact, the study found. Continuous teacher retooling to match PCK with CBE is recommended. Collaborative learning and technology integration to improve problem-solving weaknesses. These findings help the Ministry of Education make policy, teacher trainers assess curriculum, and schools improve instruction.

According to the study of Mante and Sayao (2025), teachers who are unit-earners in education, or licensed educators without formal education degrees, are assuming a progressively significant role in the Philippine public school system, prompting critical inquiries regarding their proficiency in pedagogical content knowledge (PCK) to guarantee quality

instruction. The study advocates for the augmentation of the curriculum and praxis in certification programs for Education unit-earners, the fortification of licensure regulations to encompass pedagogical training and mentoring, and the institutionalization of focused professional development inside schools. The study advocates for the enhancement of certification programs for education unit-earners by augmenting pedagogical training, practicum, and mentoring.

METHODS

Research Design

The study employed a descriptive-correlational research design. The descriptive research analyzed the pedagogical content knowledge and instructional management performance of public junior high school mathematics teachers. The correlational part of the study analyzed the relationship between pedagogical content knowledge and instructional effectiveness of public junior high school mathematics teachers. This design is deemed appropriate as it allows for the examination of existing conditions and relationships among variables without manipulation.

Respondents and Locale of the Study

The respondents of the study consisted of all public junior high school mathematics teachers in the Municipality of Echague, Isabela, during the School Year 2025–2026. A total enumeration sampling technique was employed, wherein all mathematics teachers from the identified public junior high schools were included as participants in the study.

Research Instrument

The instrument consists of three major parts. Part I contained the respondents' personal information. Part II assessed the level of pedagogical content knowledge of the respondents. Such instrument was adapted from the study of Pangan and Magno (2025). Meanwhile, the instructional management performance of public junior high school mathematics teachers was measured based on the Philippine Professional Standards for Teachers (PPST) and the corresponding Results-Based Performance Management System (RPMS) objectives of the Department of Education.

Data Gathering Procedure and Analysis

Prior to the conduct of the study, the researcher formally sought permission from the Schools Division Superintendent through the respective school heads to ensure proper authorization and compliance with institutional protocols. Upon approval, the finalized research instrument was prepared and distributed to the identified respondents. Ethical considerations were strictly observed by informing the participants of the purpose of the study and assuring them of confidentiality, anonymity, and voluntary participation. The questionnaires were administered and retrieved on scheduled dates agreed upon with the respondents to ensure completeness and accuracy of the data collected.

The gathered data were systematically organized, analyzed, and interpreted using appropriate statistical tools. Frequency and percentage were employed to describe the profile of the respondents, including their level of pedagogical content knowledge and instructional management performance. Pearson Product-Moment Correlation Coefficient (r) was applied

to test the relationship between the level of pedagogical content knowledge and instructional management performance of the respondents.

RESULTS AND DISCUSSIONS

Table 1. Profile of the Respondents

Profile	Frequency (n=45)	Percent
Age		
25-30	17	37.8
31-35	12	26.7
36-40	4	8.9
41-45	6	13.3
46-50	4	8.9
51 and above	2	4.4
Sex		
Male	12	26.7
Female	33	73.3
Civil Status		
Single	18	40.0
Married	27	60.0
Position		
Teacher 1	18	40.0
Teacher 2	2	4.4
Teacher 3	24	53.3
Teacher 4	1	2.2
Highest Educational Attainment		
Bachelor's Degree	23	51.1
Master's Degree	1	2.2
Doctoral Degree	21	46.7

Table 1 presents the demographic profile of the public junior high school mathematics teachers. In terms of age, the largest proportion of respondents belongs to the 25–30 years age group (37.8%), followed by those aged 31–35 years (26.7%). Smaller proportions are distributed across the 41–45 years (13.3%), 36–40 years (8.9%), and 46–50 years (8.9%) age groups, while only 4.4% are aged 51 years and above. These findings indicate that the teaching workforce is predominantly composed of young professionals who are in the early stages of their teaching careers.

With respect to sex, the majority of the respondents are female (73.3%), whereas only 26.7% are male.

In terms of civil status, most respondents are married (60.0%), while 40.0% are single. This finding indicates that a considerable proportion of mathematics teachers manage both professional responsibilities and family commitments.

Regarding plantilla position, more than half of the respondents hold the rank of Teacher III (53.3%), followed by Teacher I (40.0%), Teacher II (4.4%), and Teacher IV (2.2%). This distribution suggests that most respondents have progressed beyond the entry-level teaching position. Meanwhile, the relatively small proportion of Teacher IV positions indicates that only a few teachers have attained higher professional ranks within the teaching service.

With respect to highest educational attainment, slightly more than half of the respondents possess a bachelor's degree (51.1%), while 46.7% have already completed a doctorate degree. Only 2.2% reported a master's degree as their highest educational attainment. Such qualifications may enhance teachers' pedagogical competence, subject matter expertise, instructional leadership, and capacity to implement evidence-based teaching practices, thereby contributing to improved educational outcomes.

Table 2. Level of Pedagogical Content Knowledge of Public Junior High School Mathematics Teachers in terms of Content Knowledge and Pedagogy

	Items	Mean	Qualitative Description
1.	I am confident in my ability to implement a variety of teaching strategies to facilitate mathematics learning.	4.73	Strongly Agree
2.	I use questioning techniques effectively to deepen students' mathematical understanding.	4.67	Strongly Agree
3.	I utilize classroom discussions effectively to explore mathematical concepts.	4.78	Strongly Agree
4.	I adapt my teaching methods based on the diverse needs of students in my mathematics class.	4.62	Strongly Agree
5.	I employ assessment strategies that accurately measure students' understanding of mathematics.	4.69	Strongly Agree
6.	I introduce and implement technology in my teaching to enhance learning of mathematical concepts.	4.58	Strongly Agree
7.	I create a learning environment that encourages students to explore mathematical ideas and think critically.	4.78	Strongly Agree
8.	I implement strategies to manage classroom disruptions effectively when teaching mathematics.	4.56	Strongly Agree
9.	I use feedback effectively to improve student learning in mathematics.	4.78	Strongly Agree
10.	I reflect on my teaching practices regularly to improve my instructional methods in mathematics.	4.78	Strongly Agree
	Grand Mean	**4.70**	**Strongly Agree**

Table 2 presents the level of pedagogical content knowledge of public junior high school mathematics teachers in terms of content knowledge and pedagogy. The respondents obtained an overall weighted mean of 4.70, which is verbally interpreted as "Strongly Agree." This result indicates that the teachers possess a very high level of pedagogical content knowledge, reflecting their strong mastery of mathematical concepts and their ability to employ appropriate pedagogical strategies that facilitate meaningful learning. The findings suggest that the respondents are highly capable of integrating content knowledge with effective instructional approaches, thereby promoting learners' conceptual understanding, critical thinking, and academic achievement in mathematics.

Among the indicators, the statements "I utilize classroom discussions effectively to explore mathematical concepts," "I create a learning environment that encourages students to explore mathematical ideas and think critically," "I use feedback effectively to improve student learning in mathematics," and "I reflect on my teaching practices regularly to improve my instructional methods in mathematics" obtained the highest weighted mean of 4.78, all verbally interpreted as "Strongly Agree." These findings demonstrate that the respondents place strong emphasis on learner-centered instructional practices, collaborative discourse, reflective teaching, and the provision of constructive feedback. The high ratings further indicate that the teachers recognize reflection and feedback as essential mechanisms for continuously improving instructional effectiveness and enhancing student learning.

On the other hand, the indicator "I implement strategies to manage classroom disruptions effectively when teaching mathematics" obtained the lowest weighted mean of 4.56, although it likewise received a verbal interpretation of "Strongly Agree." While this aspect received the lowest rating among the indicators, the result nevertheless indicates that the respondents perceive themselves as highly competent in managing classroom behavior and maintaining an environment conducive to learning. The comparatively lower rating may suggest that classroom management remains an area where teachers encounter occasional challenges, particularly in facilitating active and collaborative mathematics instruction while sustaining student engagement and discipline.

Overall, the findings reveal that public junior high school mathematics teachers possess a very high level of pedagogical content knowledge in terms of content knowledge and pedagogy. Their strong competence in integrating mathematical content with appropriate teaching strategies, facilitating meaningful classroom discourse, providing timely and constructive feedback, creating learner-centered learning environments, and engaging in reflective instructional practice demonstrates their readiness to deliver high-quality mathematics instruction.

The present findings corroborate those of Pangan and Magno (2025), who reported that junior high school mathematics teachers demonstrated high levels of pedagogical content knowledge, particularly in content and curriculum knowledge. Their study further revealed that teachers with stronger pedagogical content knowledge exhibited higher levels of instructional management performance. This consistency suggests that a strong foundation in pedagogical content knowledge enhances teachers' instructional decision-making, classroom practices, and overall effectiveness in facilitating meaningful mathematics learning.

Table 3. Level of Pedagogical Content Knowledge of Public Junior High School Mathematics Teachers in terms of Knowledge of Learners and Learning

Items	Mean	Qualitative Description
1. I understand how students' prior knowledge affects their learning of new mathematical concepts	4.53	Strongly Agree
2. I recognize common misconceptions in mathematics and know how to address them.	4.69	Strongly Agree
3. I am aware of the developmental stages of mathematical understanding in students.	4.73	Strongly Agree
4. I can identify individual students' learning needs and adapt my teaching accordingly.	4.71	Strongly Agree

5. I apply methods to increase motivation among students in learning mathematics.	4.76	Strongly Agree
6. I am aware of the different learning styles and can tailor my teaching to accommodate them in mathematics.	4.71	Strongly Agree
7. I create a supportive learning environment that is conducive to mathematics for all students	4.73	Strongly Agree
8. I analyze the impact of cultural and linguistic diversity on learning mathematics.	4.69	Strongly Agree
9. I recognize the signs of math anxiety in students and know how to address it.	4.64	Strongly Agree
10. I am skilled in fostering a growth mindset in students towards learning mathematics.	4.67	Strongly Agree
Grand Mean	**4.69**	**Strongly Agree**

Table 3 presents the level of pedagogical content knowledge of public junior high school mathematics teachers in terms of knowledge of learners and learning. The respondents obtained an overall weighted mean of 4.69, verbally interpreted as "Strongly Agree," which indicates a very high level of competence in understanding students' characteristics, learning processes, and instructional needs. This suggests that the teachers are well-prepared to implement learner-centered mathematics instruction that supports meaningful learning.

Among the indicators, "I apply methods to increase motivation among students in learning mathematics" obtained the highest weighted mean of 4.76 ("Strongly Agree"), indicating that the respondents place great importance on motivating students to actively participate and engage in mathematics learning. In contrast, "I understand how students' prior knowledge affects their learning of new mathematical concepts" obtained the lowest weighted mean of 4.53, although it was likewise interpreted as "Strongly Agree." While still reflecting a very high level of competence, this result suggests that greater emphasis may be placed on activating and building upon students' prior knowledge during instruction.

Overall, the findings demonstrate that public junior high school mathematics teachers possess a very high level of pedagogical content knowledge in terms of knowledge of learners and learning. The results support the findings of Pangan and Magno (2025), who reported that mathematics teachers exhibited high pedagogical content knowledge and emphasized that understanding learners' needs and characteristics contributes to more effective instructional management and improved learning outcomes.

Table 4. Level of Pedagogical Content Knowledge of Public Junior High School Mathematics Teachers in terms of Curriculum Knowledge

Items	Mean	Qualitative Description
1. I have a deep understanding of the mathematical concepts I teach.	4.53	Strongly Agree
2. I solve mathematical problems using multiple approaches and can demonstrate these to students.	4.69	Strongly Agree
3. I explain mathematical concepts clearly and effectively.	4.64	Strongly Agree
4. I stay updated with recent developments in mathematics education and research.	4.62	Strongly Agree

5. I connect mathematical concepts to real-world applications to enhance understanding.	4.71	Strongly Agree
6. I am proficient in the use of mathematical language and symbols.	4.78	Strongly Agree
7. I trace the historical development of mathematical concepts.	4.56	Strongly Agree
8. I critically evaluate the accuracy of mathematical information from various sources.	4.71	Strongly Agree
9. I encourage students to appreciate the beauty and logic of mathematics.	4.62	Strongly Agree
10. I have a thorough knowledge of the math content that precedes and follows what I teach.	4.69	Strongly Agree
Grand Mean	**4.66**	**Strongly Agree**

Table 4 presents the level of pedagogical content knowledge of public junior high school mathematics teachers in terms of curriculum knowledge. The table reveals that the respondents obtained an overall weighted mean of 4.66, verbally interpreted as "Strongly Agree." This indicates that the mathematics teachers possess a very high level of curriculum knowledge, which implies a strong understanding of curriculum standards, learning competencies, and the logical progression of mathematical concepts across grade levels. The findings also suggest that the teachers are highly capable of aligning instructional practices with curriculum requirements to promote meaningful and coherent mathematics learning.

Among the indicators, the statement "I am proficient in the use of mathematical language and symbols" obtained the highest weighted mean of 4.78, verbally interpreted as "Strongly Agree." This implies that the respondents demonstrate excellent command of mathematical terminology, notation, and symbolic representations.

Meanwhile, the indicator "I have a deep understanding of the mathematical concepts I teach" obtained the lowest weighted mean of 4.53, although it remained verbally interpreted as "Strongly Agree." This suggests that the respondents possess a high level of confidence in their mastery of mathematics content.

These findings are consistent with the study of Copur-Gencturk and Li (2023), who reported that mathematics teachers' pedagogical content knowledge, including their understanding of curriculum progression and subject matter, develops through teaching experience and plays a significant role in improving instructional quality and supporting students' mathematical learning.

Table 5. Level of Pedagogical Content Knowledge of Public Junior High School Mathematics Teachers in terms of Content Knowledge

Items	Mean	Qualitative Description
1. I am well-versed in the mathematics curriculum and its learning objectives.	4.56	Strongly Agree
2. I can align my teaching objectives with the curriculum goals effectively.	4.67	Strongly Agree
3. I follow the proper sequence and schedule in Math curriculum effectively to maximize student learning.	4.67	Strongly Agree

4.	I integrate other subjects in my math teaching.	4.69	Strongly Agree
5.	I am familiar with the resources and materials that support the mathematics curriculum.	4.62	Strongly Agree
6.	I understand how the mathematics curriculum prepares students for future mathematical learning and real-life application.	4.73	Strongly Agree
7.	I can evaluate and select appropriate instructional materials to support the curriculum objectives.	4.60	Strongly Agree
8.	I am capable of modifying the curriculum to meet the diverse needs of my students.	4.69	Strongly Agree
9.	I regularly update my knowledge of the mathematics curriculum and its changes.	4.69	Strongly Agree
10.	I can effectively communicate the goals and expectations of the mathematics curriculum to students and parents.	4.64	Strongly Agree
	Grand Mean	**4.66**	**Strongly Agree**

Table 5 presents the level of pedagogical content knowledge of public junior high school mathematics teachers in terms of content knowledge. The table reveals that the respondents obtained an overall weighted mean of 4.66, verbally interpreted as "Strongly Agree." This indicates that the mathematics teachers possess a very high level of content knowledge, which may translate to a strong mastery of the mathematics curriculum, learning competencies, and instructional objectives. The findings suggest that the teachers are highly capable of aligning classroom instruction with curriculum standards.

Among the indicators, the statement "I understand how the mathematics curriculum prepares students for future mathematical learning and real-life application" obtained the highest weighted mean of 4.73, verbally interpreted as "Strongly Agree." This implies that the respondents recognize the long-term value of mathematics education in preparing learners for higher-level mathematical concepts and practical applications.

Meanwhile, the indicator "I am well-versed in the mathematics curriculum and its learning objectives" obtained the lowest weighted mean of 4.56, although it remained verbally interpreted as "Strongly Agree." Although this indicator received the lowest mean among the statements, the result still reflects a very high level of competence in understanding and implementing curriculum requirements.

Overall, the findings indicate that public junior high school mathematics teachers demonstrate a very high level of content knowledge. The results highlight their competence in curriculum alignment, instructional planning, curriculum adaptation, and the selection of appropriate instructional resources to support mathematics learning. Baumert et al. (2010), found that teachers with strong mathematical content knowledge and pedagogical content knowledge are more likely to deliver high-quality instruction that positively influences students' achievement in mathematics.

Table 6. Level of Pedagogical Content Knowledge of Public Junior High School Mathematics Teachers in terms of Knowledge of Context

Items	Mean	Qualitative Description
1. I adapt my teaching strategies to the specific cultural context of my students.	4.60	Strongly Agree
2. I incorporate local examples into my math teaching.	4.78	Strongly Agree
3. I consider the socio-economic background of my students when planning lessons.	4.51	Strongly Agree
4. I am aware of the impact of community values on math education.	4.71	Strongly Agree
5. I seek to understand and utilize the educational resources available in my community.	4.62	Strongly Agree
6. I align my teaching with the educational policies and regulations.	4.76	Strongly Agree
7. I am sensitive to the cultural norms that may affect students' participation in math.	4.67	Strongly Agree
8. I use community events as opportunities for relevant math lessons.	4.62	Strongly Agree
9. I collaborate with other teachers to create a cohesive learning environment.	4.58	Strongly Agree
10. I understand how global trends in education can impact my teaching practices.	4.67	Strongly Agree
Grand Mean	**4.65**	**Strongly Agree**

Table 6 presents the level of pedagogical content knowledge of public junior high school mathematics teachers in terms of knowledge of context. The table reveals that the respondents obtained an overall weighted mean of 4.65, verbally interpreted as "Strongly Agree." This indicates that mathematics teachers possess a very high level of contextual knowledge, which demonstrates their ability to consider learners' backgrounds, community characteristics, educational policies, and cultural influences when planning and implementing mathematics instruction.

Among the indicators, the statement "I incorporate local examples into my math teaching" obtained the highest weighted mean of 4.78, verbally interpreted as "Strongly Agree." This implies that the respondents consistently connect mathematical concepts to familiar situations and local experiences, which enable students to better understand abstract concepts through authentic and relatable examples.

Meanwhile, the indicator "I consider the socio-economic background of my students when planning lessons" obtained the lowest weighted mean of 4.51, although it remained verbally interpreted as "Strongly Agree." This suggests that the respondents recognize the importance of considering learners' socio-economic circumstances when designing instruction.

Overall, the findings indicate that public junior high school mathematics teachers demonstrate a very high level of competence in integrating cultural perspectives, community resources, educational policies, and learners' backgrounds into mathematics instruction. These practices enable teachers to provide more inclusive, relevant, and responsive learning

experiences that support students' mathematical understanding and engagement. In the same manner, Depaepe, Verschaffel, and Kelchtermans (2013), emphasized that effective mathematics teachers draw not only on content knowledge and pedagogy but also on contextual knowledge of learners, schools, and communities. Their review concluded that understanding the instructional context enables teachers to adapt their teaching practices more effectively to meet students' diverse learning needs and improve the quality of mathematics instruction.

Table 7. Level of Instructional Effectiveness of Public Junior High School Mathematics Teachers in terms of Objectives

Items	Mean	Qualitative Description
Objectives		
1. Applied knowledge of content within and across curriculum teaching areas	4.58	Outstanding
2. Used a range of teaching strategies that enhance learner achievement in literacy and numeracy skills	4.64	Outstanding
3. Applied a range of teaching strategies to develop critical and creative thinking, as well as other higher-order thinking skills	4.69	Outstanding
4. Used Mother Tongue, Filipino and English to facilitate teaching and learning	4.71	Outstanding
Content Knowledge and Pedagogy		
5. Established safe and secure learning environments to enhance learning through the consistent implementation of policies, guidelines and procedure	4.73	Outstanding
6. Maintained learning environments that promote fairness, respect and care to encourage learning	4.80	Outstanding
Learning Environment		
7. Established a learner-centered culture by using teaching strategies responsive to their linguistic, cultural, socio-economic and religious background	4.71	Outstanding
8. Planned and used culturally appropriate teaching strategies to address the needs of diverse learners	4.73	Outstanding
Diversity of Learners		
9. Used strategies for providing timely, accurate and constructive feedback to improve learner performance	4.71	Outstanding
Grand Mean	**4.70**	**Outstanding**

Table 7 presents the instructional effectiveness of public junior high school mathematics teachers in terms of objectives. The table reveals that the respondents obtained an overall weighted mean of 4.70, verbally interpreted as "Outstanding." This indicates that mathematics teachers demonstrate an outstanding level of instructional management performance, reflecting their competence in planning, implementing, and managing instruction that promotes meaningful learning experiences. The findings suggest that the respondents effectively integrate content knowledge, learner-centered pedagogies, inclusive classroom practices, and assessment strategies to enhance students' mathematical understanding and academic achievement.

Among the indicators, the statement "Maintained learning environments that promote fairness, respect and care to encourage learning" obtained the highest weighted mean of 4.80, verbally interpreted as "Outstanding." This implies that the teachers consistently establish positive classroom environments characterized by mutual respect, inclusivity, and supportive teacher–student relationships.

Meanwhile, the indicator "Applied knowledge of content within and across curriculum teaching areas" obtained the lowest weighted mean of 4.58, although it remained verbally interpreted as "Outstanding." This suggests that the respondents effectively integrate mathematics with other learning areas to promote interdisciplinary understanding.

Overall, the findings indicate that public junior high school mathematics teachers demonstrate an outstanding level of instructional management performance. The findings are supported by Charalambous & Hill (2012), who emphasized that effective mathematics instruction requires teachers to possess strong instructional knowledge and the ability to employ diverse teaching strategies that promote conceptual understanding and mathematical reasoning. Likewise, Wang and Degol (2016) stressed that positive and inclusive classroom environments enhance student engagement, motivation, and academic success. Furthermore, Brookhart (2017) highlighted that timely, specific, and constructive feedback enables students to monitor their learning progress, correct misconceptions, and achieve higher levels of academic performance.

Table 8. Relationship Between Pedagogical Content Knowledge and Instructional Effectiveness of Public Junior High School Mathematics Teachers

Pedagogical Content Knowledge	Instructional Management Performance	
	r-value	p-value
Pedagogical Knowledge	.975**	<.001
Knowledge of Learners and Learning	.990**	<.001
Curriculum Knowledge	.983**	<.001
Content Knowledge	.982**	<.001
Knowledge of Contexts	.964**	<.001

Table 8 presents the relationship between pedagogical content knowledge and instructional management performance of public junior high school mathematics teachers. The results reveal that all dimensions of pedagogical content knowledge are positively and significantly correlated with instructional management performance ($p < .001$). The correlation coefficients range from .964 to .990, indicating very strong positive relationships. These findings suggest that teachers with higher levels of pedagogical content knowledge also demonstrate higher levels of instructional management performance.

Among the dimensions, Knowledge of Learners and Learning exhibited the strongest relationship with instructional management performance ($r = .990$, $p < .001$), indicating that teachers who possess a deeper understanding of students' developmental characteristics, learning needs, motivation, and individual differences are more effective in planning, implementing, and managing classroom instruction. Conversely, Knowledge of Contexts registered the lowest correlation coefficient ($r = .964$, $p < .001$). Although comparatively lower than the other dimensions, the relationship remains very strong and statistically significant, suggesting that teachers' awareness of learners' cultural, social, and educational contexts also contributes substantially to effective instructional management.

Overall, the findings indicate that pedagogical content knowledge is a critical determinant of instructional management performance among public junior high school mathematics teachers. As teachers strengthen their knowledge of mathematics content, pedagogy, learners, curriculum, and instructional contexts, they become better equipped to deliver effective instruction and manage learning experiences that promote student success. These findings are consistent with Kunter et al. (2013), who reported that teachers with stronger pedagogical content knowledge demonstrated higher instructional quality and were more effective in facilitating student learning. However, the results only partially align with Kleickmann et al. (2013), who argued that while pedagogical content knowledge significantly enhances instructional quality, its influence on classroom practice is also shaped by other factors, including teachers' beliefs, motivation, and opportunities for continuous professional development.

CONCLUSION AND FUTURE WORKS

The study demonstrates that public junior high school mathematics teachers in Echague, Isabela possess a very high level of pedagogical content knowledge across all domains, including pedagogical knowledge, knowledge of learners and learning, curriculum knowledge, content knowledge, and knowledge of contexts. The findings further reveal that the respondents demonstrate an outstanding level of instructional management performance in terms of instructional objectives, content knowledge and pedagogy, learning environment, and diversity of learners, indicating that they are well-equipped to effectively plan, deliver, and manage mathematics instruction. The findings also reveal a very strong and statistically significant relationship between pedagogical content knowledge and instructional management performance, suggesting that teachers with higher levels of pedagogical content knowledge tend to demonstrate better instructional management practices. This implies that pedagogical content knowledge plays a vital role in promoting effective mathematics instruction and enhancing the overall quality of teaching.

It is recommended that school administrators and the Department of Education continue to strengthen and sustain professional development programs that enhance mathematics teachers' pedagogical content knowledge, particularly in innovative teaching strategies, curriculum implementation, assessment practices, and technology integration. Schools may also prioritize the provision of adequate instructional resources, digital technologies, and learning materials that support more engaging, learner-centered, and contextually relevant mathematics instruction. In addition, continuous institutional support may be provided to help teachers address learner diversity, create inclusive learning environments, and respond effectively to the evolving demands of mathematics education. Future researchers are encouraged to continue same kind of study in other school divisions or educational levels and to include additional variables to further validate and expand the present findings regarding pedagogical content knowledge and instructional management performance.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this study. This research was conducted objectively, and no financial or personal relationships have influenced the results and interpretations presented in this paper.

DECLARATION OF AI USE

The author declares that artificial intelligence (AI) tools such as ChatGpt and Grammarly were used solely to assist in language refinement, grammar correction, and formatting of the manuscript. All intellectual content, data analysis, interpretations, and conclusions presented in this study are the original work of the author. The use of AI did not influence the research design, data collection, analysis, or the integrity of the findings.

REFERENCES

Aderinoye-Rabiu, R. A., Bello, A. B., Usman, A. A., Falebita, O. T., & Oloyede, G. O. (2025). Assessing the influence of primary mathematics educators' content knowledge and pedagogical content knowledge on teaching effectiveness. Pedagogical Research, 10(3), em0240. https://doi.org/10.29333/pr/16665

Aldrup, K., Klusmann, U., Lüdtke, O., Göllner, R., & Trautwein, U. (2018). Student misbehavior and teacher well-being: Testing the mediating role of the teacher–student relationship. Learning and Instruction, 58, 126–136. https://doi.org/10.1016/j.learninstruc.2018.05.006

Alhassan, I., Kwakye, D. O., Essuman, I. B., Malik, A. T., Hudu, A., & Iddrisu, A. R. (2024). Junior High school mathematics teachers' perceived knowledge of Problem-Solving and practices of teaching mathematics through Problem-Solving in the Tamale Metropolis. East African Journal of Education Studies, 7(1), 500–516. https://doi.org/10.37284/eajes.7.1.1835

Anyeta, S. A., & Suglo, E. K. (2024). Assessment of the impact of teachers' pedagogical content knowledge and self-efficacy on senior high school learners' mathematics proficiency. Journal of Education and Teaching Methods, 3(2), 1–19. https://doi.org/10.58425/jetm.v3i2.288

Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., Klusmann, U., Krauss, S., Neubrand, M., & Tsai, Y.-M. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress. American Educational Research Journal, 47(1), 133–180. https://doi.org/10.3102/0002831209345157

Brookhart, S. M. (2017). How to give effective feedback to your students (2nd ed.). ASCD.

Catador, J. A., Jr., & Mame, R. M. (2025). Mathematics Teachers' Competence and Instructional Quality in Senior High Schools in The Province of Laguna. International Journal of Basic and Applied Sciences, 14(8), 154–166. https://doi.org/10.14419/h5jty683

Charalambous, C. Y., & Hill, H. C. (2012). Teacher knowledge, curriculum materials, and quality of instruction: Unpacking a complex relationship. Journal of Curriculum Studies, 44(4), 443–466. https://doi.org/10.1080/00220272.2011.650215

Copur-Gencturk, Y., & Li, J. (2023). Teaching matters: A longitudinal study of mathematics teachers' knowledge growth. Teaching and Teacher Education, 121, 103949. https://doi.org/10.1016/j.tate.2022.103949

De Freitas, G., & Spangenberg, E. D. (2019). Mathematics teachers' levels of technological pedagogical content knowledge and information and communication technology integration barriers. Pythagoras, 40(1). https://doi.org/10.4102/pythagoras.v40i1.431

Depaepe, F., Verschaffel, L., & Kelchtermans, G. (2013). Pedagogical content knowledge: A systematic review of the way in which the concept has pervaded mathematics educational research. Teaching and Teacher Education, 34, 12–25. https://doi.org/10.1016/j.tate.2013.03.001

Fukaya, T., Fukuda, M., & Suzuki, M. (2024). Relationship between mathematical pedagogical content knowledge, beliefs, and motivation of elementary school teachers. Frontiers in Education, 8. https://doi.org/10.3389/feduc.2023.1276439

Fukaya, T., Nakamura, D., Kitayama, Y., & Nakagoshi, T. (2024). A systematic review and meta-analysis of research on mathematics and science pedagogical content knowledge: Exploring its associations with teacher and student variables. Teaching and Teacher Education, 155, 104881. https://doi.org/10.1016/j.tate.2024.104881

Galimova, E. G., Zakharishcheva, M. A., Kolomoets, E. N., Chistyakov, A. A., Prokopyev, A. I., Beloborodova, A. V., & Ilaeva, R. A. (2023). A review of research on pedagogical content knowledge in science and mathematics education in the last five years. Eurasia Journal of Mathematics Science and Technology Education, 19(2), em2223. https://doi.org/10.29333/ejmste/12837

Grigaliūnienė, M., Lehtinen, E., Verschaffel, L., & Depaepe, F. (2025). Systematic Review of Research on Pedagogical Content Knowledge in Mathematics: Insights from a Topic-Specific Approach. ZDM, 57(4), 777–794. https://doi.org/10.1007/s11858-025-01684-1

Kleickmann, T., Richter, D., Kunter, M., Elsner, J., Besser, M., Krauss, S., & Baumert, J. (2013). Teachers' content knowledge and pedagogical content knowledge: The role of structural differences in teacher education. Journal of Teacher Education, 64(1), 90–106. https://doi.org/10.1177/0022487112460398

Kumi, E. M., & Wonu, N. (2021). Senior high school student perception of mathematics teacher pedagogical content knowledge. FNAS Journal of Mathematics and Science Education, 3(1), 1–10.

Kunter, M., Baumert, J., Blum, W., Klusmann, U., Krauss, S., & Neubrand, M. (2013). Cognitive activation in the mathematics classroom and professional competence of teachers: Results from the COACTIV project. Springer.

Kurniawan, D., Yuwono, I., Irawan, E. B., Susanto, H., Subanji, & Susiswo. (2018). Communication of Prospective Teachers with Students in Mathematics Learning at Senior High School (SMA). arXiv (Cornell University). https://doi.org/10.48550/arxiv.1804.11197

Luna, C. A., & Aclan, E. G. (2015). The influence of teachers' mathematics pedagogy content knowledge training on pupils' mathematics achievement. Copyright © 2015 Science and Education Publishing. All Rights Reserved. https://doi.org/10.12691/education-3-10-16

Mangarin, R. A., & Caballes, D. O. (2024). Difficulties in Learning Mathematics: A Systematic review. International Journal of Research and Scientific Innovation, XI(IX), 401–405. https://doi.org/10.51244/ijrsi.2024.1109037

Mante, A., & Sayao, L. (2025). Pedagogical Content Knowledge and Performance of Education Unit-Earner Teachers in Public Schools. Journal of Interdisciplinary Perspectives, 3(9), 108–115. https://doi.org/10.69569/jip.2025.524

Ma'rufi, Ilyas, M., & Salwah. (2018). Junior high school mathematics teachers' pedagogical content knowledge in teaching of polyhedra. Journal of Physics Conference Series, 1088, 012052. https://doi.org/10.1088/1742-6596/1088/1/012052

Pangan, S. M., & Magno, E. S. (2025). Teachers' pedagogical content knowledge and their instructional management performance in mathematics: Basis for teacher's developmental plan. Psychology and Education: A Multidisciplinary Journal, 37(10), 1044–1054. https://doi.org/10.70838/pemj.371002

Sakaria, D., Maat, S. M., & Mohd. Matore, M. E. E. (2023). Factors influencing mathematics teachers' pedagogical content knowledge: A systematic review. Pegem Journal of Education and Instruction, 13(2), 1–14. https://doi.org/10.47750/pegegog.13.02.01

Shing, C. L., Mohd. Saat, R., & Loke, S. H. (2015). The Knowledge of Teaching – Pedagogical Content Knowledge (PCK). In Institut Pendidikan Guru Kampus Tun Abdul Razak, Faculty of Education University of Malaya, & School of Graduate Studies Asia e-University, The Malaysian Online Journal of Educational Science (Vols. 3–3). https://files.eric.ed.gov/fulltext/EJ1085915.pdf

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4–14.

Silvosa, H. A., & Salimaco, R. A., Jr. (2025). The Impact of Teachers' Pedagogical Content Knowledge and Students' Self-concept on Mathematics Interest among Junior High School Students. Asian Journal of Education and Social Studies, 51(7), 377–386. https://doi.org/10.9734/ajess/2025/v51i72128

Suglo, E. K., Bornaa, C. S., Iddrisu, A. B., Atepor, S., Adams, F. X., & Owuba, L. A. (2023). Teacher's pedagogical content knowledge and students' academic performance in circle theorem. Journal of Education and Teaching Methods, 2(3), 29–41. https://doi.org/10.58425/jetm.v2i3.195

Tuya, J., Masibo, E., Nabwire, C., & Wekesa, P. (2025). Influence of teachers' pedagogical content knowledge on learners' mathematical Problem-Solving competence in junior schools Bungoma County, Kenya. International Journal of Research and Innovation in Social Science, IX(VII), 947–955. https://doi.org/10.47772/ijriss.2025.90700075

Van Driel, J. H., & Berry, A. (2012). Teacher professional development focusing on pedagogical content knowledge. Educational Researcher, 41(1), 26–28. https://doi.org/10.3102/0013189x11431010

Wang, M.-T., & Degol, J. L. (2016). School climate: A review of the construct, measurement, and impact on student outcomes. Educational Psychology Review, 28(2), 315–352. https://doi.org/10.1007/s10648-015-9319-1