

Examining the Contributions of Knowledge and Constructivist Beliefs on Filipino Pre-service Mathematics Teachers' Intentions to Use Real-Life Tasks

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In response to current educational reforms in the Philippines, mathematics instruction has increasingly emphasized contextualized learning and the use of practical, real-world tasks. This study examined how pre-service mathematics teachers' knowledge and beliefs relate to their intention to incorporate real-life tasks into future teaching. Participants were 746 pre-service mathematics teachers from 11 teacher education institutions in the Philippines. The results showed that constructivist beliefs and self-efficacy beliefs were significantly associated with pre-service teachers' intentions to use real-life tasks in mathematics instruction. Content knowledge also contributed to instructional intention both directly and indirectly. In contrast, pedagogical knowledge was not significantly related to instructional intention. These findings suggest that pre-service teachers' beliefs may be more influential than their measured knowledge base in shaping reform-oriented teaching intentions. Teacher education programs should therefore move beyond strengthening content and pedagogical knowledge alone and should also cultivate constructivist beliefs and teaching self-efficacy. Recommendations are offered for improving pre-service teachers' preparation to implement real-life tasks in mathematics instruction.

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INTRODUCTION

Recent educational reforms in the Philippines have emphasized contextualized and localized learning, including the use of social, cultural, and real-world experiences in instruction. In mathematics, this emphasis aligns with the broader goal of developing students' critical thinking and problem-solving skills by helping them move beyond procedural knowledge and apply mathematics to everyday situations and community-based problems (Department of Education, 2023; SEAMEO INNOTECH, 2022).

These reforms reflect a sustained national effort to improve basic education by shifting instruction away from rote memorization and toward problem solving, life skills, and practical application. The Enhanced Basic Education Act of 2013 requires the national curriculum to be pedagogically sound, contextualized, and localized, thereby encouraging students to connect classroom learning with real-world Philippine contexts. The Philippine Qualifications Framework, established through Republic Act No. 10968, further supports this direction by linking educational outcomes with national and international standards.

The MATATAG Curriculum, implemented through DepEd Order No. 010, s. 2024, continues this reform agenda by clarifying learning competencies and emphasizing 21st-century skills. In mathematics, the curriculum gives particular attention to numeracy as a tool for solving everyday problems. Related assessment policies also give substantial weight to performance tasks, encouraging learners to demonstrate understanding through hands-on activities, problem solving, and applied tasks. Together, these reforms position mathematics as a practical discipline that supports functional literacy and lifelong learning.

Despite these policy reforms, implementation remains challenging. Earlier reform efforts often emphasized curriculum and textbook changes more than the transformation of teacher preparation (Bernardo, 2004). The current reform movement calls for a shift from teacher-centered instruction toward learner-centered approaches across learning areas (Department of Education, 2023). Within the MATATAG Curriculum, contextualized, problem-based, and constructivist approaches require teachers to act less as transmitters of information and more as facilitators of meaningful learning experiences. Such approaches provide students with opportunities to engage in cognitively demanding, real-world activities that are relevant to their everyday lives (DepEd, 2013; Wilkins, 2008).

The implementation of these approaches is also shaped by cultural context. Although many constructivist and learner-centered pedagogies have been developed largely in Western educational contexts, Philippine classrooms have been influenced by traditions that emphasize respect for teacher authority and structured learning. These cultural expectations may affect how educational reforms are interpreted and enacted in practice (Huang & Asghar, 2018; Lee & Kim, 2019).

Teachers' beliefs are therefore important because they influence how educators respond to reform and how they translate policy goals into classroom practice (Beswick, 2007; Ernest, 1989). Although teacher knowledge contributes to instructional competence, knowledge alone may not determine whether teachers use innovative approaches. Pre-service teachers often face uncertainty, limited classroom experience, and self-

doubt when attempting to apply what they have learned in teacher education programs (Lebala et al., 2024). In contrast, those with stronger self-efficacy are generally more willing to adopt innovative teaching practices and persist when implementation is difficult (Burić & Kim, 2020; Klassen & Tze, 2014). Similarly, pre-service teachers who view mathematics as dynamic and connected to real-world contexts are more likely to support active learning and the use of real-life examples in instruction (Radišić et al., 2024).

The relationship among teacher knowledge, beliefs, self-efficacy, and the intention to use real-life tasks remains underexplored in the Philippine context, particularly among pre-service mathematics teachers. This study addresses that gap by examining how pre-service mathematics teachers' content knowledge, pedagogical knowledge, constructivist beliefs, and self-efficacy beliefs relate to their intention to incorporate real-life tasks into mathematics instruction.

REVIEW OF THE LITERATURE

Authentic and contextualized mathematics instruction can help students connect new concepts with prior knowledge and apply mathematical reasoning to meaningful situations (Ausubel, 1960). However, the effectiveness of contextualized, constructivist, or inquiry-based instruction depends in part on students' current level of skill development. The instructional hierarchy and related models suggest that such approaches are most productive when students have sufficient mastery to generalize and apply skills. During early acquisition or fluency-building stages, students may require more explicit modeling, structured practice, and frequent opportunities to respond (Burns et al., 2010; Haring et al., 1978; Peltier et al., 2023; Skinner et al., 1996). Thus, understanding teachers' intentions to use real-life tasks also requires attention to how teachers judge students' readiness and select instruction appropriate to skill level (VanDerHeyden & Coddling, 2015).

Teacher Knowledge

Teacher knowledge has been conceptualized in several multifaceted ways (Ball et al., 2008; Blömeke & Delaney, 2012). A common distinction is between subject matter knowledge and pedagogical content knowledge. Shulman (1987) argued that teaching begins with a teacher's understanding of what is to be learned and how it should be taught. Subject matter knowledge refers to knowledge of the discipline itself, whereas pedagogical content knowledge concerns how subject matter can be represented, organized, and taught so that students at different levels can understand it.

Content knowledge refers to teachers' understanding of the facts, concepts, procedures, and organizing principles within a discipline. For mathematics teachers, this includes procedural fluency as well as an understanding of mathematical reasoning, structure, and relationships (Ernest, 1989; Kleickmann et al., 2013). Ball et al. (2008) further distinguished common content knowledge, or mathematical knowledge used in general settings, from specialized content knowledge, which is unique to teaching and includes the ability to analyze students' solution strategies, explain why a method works, and represent mathematical ideas in ways that support learning. Strong content knowledge enables teachers to connect mathematics to real-world contexts, such as economics, public

health, transportation, and community-based decision making (Krauss et al., 2008).

Pedagogical content knowledge, introduced by Shulman (1986), refers to the intersection of content and pedagogy. It includes the knowledge needed to make subject matter understandable and relevant to learners. In mathematics education, pedagogical content knowledge includes knowledge of instructional strategies, students' mathematical thinking, common misconceptions, and learning processes (Krauss et al., 2008). Because mathematics is abstract and cumulative, teachers must be able to anticipate students' difficulties, choose appropriate examples, and sequence lessons to support conceptual understanding (Ernest, 1989). Ball et al. (2008) further distinguished knowledge of content and students from knowledge of content and teaching, thereby clarifying how teachers use pedagogical content knowledge to adapt instruction and deepen students' understanding.

Teachers' Beliefs

Teacher beliefs work with professional knowledge to shape instructional practice (Blömeke & Delaney, 2012; Speer, 2005; Thompson, 1992). Beliefs have been defined as psychologically held understandings, premises, or propositions about the world that individuals regard as true (Philipp, 2007). In mathematics education, teacher beliefs commonly concern the nature of mathematics and the ways mathematics should be taught and learned (Ernest, 1989; Handal, 2003).

Teachers' beliefs about mathematics include conscious and unconscious conceptions, meanings, rules, mental images, and preferences related to the discipline (Thompson, 1992). These beliefs often differ along several dimensions, including whether mathematics is viewed as fixed and procedural or as dynamic, connected, and useful.

A scheme-related view treats mathematics as a structure of precise results, formulas, and procedures. In contrast, a more process-oriented view emphasizes relationships among concepts and the development of mathematical understanding (Blömeke & Kaiser, 2014; Thompson, 1992).

An application-related view emphasizes mathematics as a dynamic and expanding field of human knowledge that supports real-world problem solving, meaning making, and pattern seeking (Felbrich et al., 2012; Thompson, 1992).

Beliefs about mathematics teaching and learning refer to teachers' preferred instructional approaches and assumptions about how students acquire mathematical knowledge. These beliefs influence the kinds of classroom activities teachers value, the forms of student thinking they encourage, and the tasks they consider appropriate (Chan & Elliott, 2004; Ernest, 1989; Thompson, 1992). Teacher orientations are often contrasted as traditional, knowledge-transfer perspectives and constructivist perspectives. The former frames instruction as the delivery of information to students, whereas the latter views instruction as a collaborative process in which students actively construct and contextualize mathematical understanding (Blömeke & Kaiser, 2014; Tatto et al., 2008).

This study focuses on constructivist beliefs because they are closely aligned with reform-oriented, student-centered mathematics instruction. However, constructivist beliefs alone may not be sufficient to influence teaching behavior. Teachers must also believe that they can implement

such approaches effectively. Higher self-efficacy is associated with greater adaptability, persistence, and willingness to adopt student-centered methods (Swackhamer et al., 2009; Zee & Koomen, 2016).

Constructivist Beliefs

Constructivist beliefs about mathematics reflect the view that mathematics is a dynamic, evolving, and creative discipline rather than merely a fixed set of rules and procedures. From this perspective, mathematical knowledge is constructed through reasoning, inquiry, problem solving, and social interaction (Ernest, 1989; Stipek et al., 2001). Constructivist-oriented teachers are more likely to view learning as an active process in which students build meaning through discussion, exploration, manipulation of ideas, and collaborative problem solving (Lau, 2022; Tang & Hsieh, 2014).

In mathematics classrooms, constructivist beliefs support the use of real-life tasks because such tasks invite students to connect abstract ideas with lived experiences. Rather than emphasizing rote memorization alone, constructivist instruction encourages students to investigate, represent, explain, and apply mathematical ideas in meaningful contexts. Teachers who hold these beliefs may therefore be more inclined to use real-life tasks as a way to promote engagement and conceptual understanding.

Teacher Self-Efficacy Beliefs

Grounded in Bandura's social cognitive theory (1977, 1986, 1997), self-efficacy refers to individuals' beliefs about their ability to organize and carry out the actions required to manage prospective situations. In educational contexts, teacher self-efficacy refers to teachers' judgments of their capacity to organize and execute the instructional tasks needed to promote student engagement and learning (Tschannen-Moran & Woolfolk Hoy, 2001).

Early models distinguished personal teaching efficacy from general teaching efficacy (Gibson & Dembo, 1984). Personal teaching efficacy refers to teachers' beliefs in their own ability to teach effectively, whereas general teaching efficacy reflects broader beliefs about the ability of education to influence student outcomes despite external constraints. Later work criticized this two-factor model for not fully capturing the context-specific and multidimensional nature of classroom teaching (Tschannen-Moran & Woolfolk Hoy, 2001).

Self-efficacy is not a fixed personality trait; rather, it is a task-specific belief that influences the goals teachers set, the effort they invest, and their persistence when faced with difficulty (Bandura, 1997). Tschannen-Moran and Woolfolk Hoy (2001) therefore conceptualized teacher self-efficacy in relation to specific teaching tasks and identified three major dimensions.

Instructional strategies refers to teachers' beliefs in their ability to design, implement, and adapt pedagogical methods that promote student learning. Teachers with higher efficacy in this area are more likely to experiment with innovative techniques, differentiate instruction, and adjust strategies for diverse learners.

Classroom management refers to teachers' beliefs in their capacity to establish expectations, maintain order, respond to disruptive behavior, and foster a positive learning environment.

Student engagement refers to teachers' beliefs in their ability to motivate students, stimulate interest, and sustain participation in learning activities, including among students who are reluctant, distracted, or from diverse backgrounds.

These dimensions are related but distinct, and each corresponds to specific instructional demands requiring both pedagogical skill and professional agency.

Teacher self-efficacy is shaped by mastery experiences, vicarious experiences, social persuasion, and physiological or emotional states (Bandura, 1997). For pre-service teachers, guided teaching practice, mentorship, and authentic classroom experience can be especially important because they may either strengthen or challenge emerging beliefs about instructional capability (Koç, 2011; Pendergast et al., 2011).

Intention to Integrate Real-Life Tasks in Teaching

A central feature of reform-based and constructivist mathematics instruction is the use of tasks that allow students to apply mathematical ideas to real-world problems. Such tasks may involve interpreting data from newspapers or local government reports, comparing prices, calculating discounts, estimating costs, or scaling recipes for family or community events. These experiences can help students see the relevance of mathematics and connect classroom learning with life outside school. Real-life problem solving has therefore attracted considerable interest among constructivist educators because it can increase relevance, promote engagement, and support conceptual understanding (Ausubel, 1960, 1963). It may also contribute to mathematical literacy and critical thinking (Arthur et al., 2017; Vos, 2018).

Several instructional approaches incorporate real or realistic contexts into mathematics learning. Realistic Mathematics Education uses meaningful contexts and guided reinvention to support mathematical understanding (Freudenthal, 1991). The models and modeling perspective views learning as the construction and refinement of models for real-world situations (Lesh & Doerr, 2003). Project-based learning engages students in extended inquiry around complex problems (Thomas, 2000), and contextual teaching and learning connects academic content with practical experience (Johnson, 2002). Although these approaches differ, they share an emphasis on using practical contexts to support mathematics learning.

This study examines pre-service teachers' intentions to integrate real-life tasks into future mathematics instruction. The focus on intention is grounded in Ajzen's theory of planned behavior, which identifies behavioral intention as the most immediate precursor of behavior (Ajzen, 1991). In teacher education, intention can be understood as a motivational indicator of whether future teachers are likely to adopt particular instructional practices. Pre-service teachers' intentions to use real-life tasks may therefore provide insight into the likelihood that reform-oriented practices will be enacted in their future classrooms.

The Interplay of Teacher Knowledge, Beliefs, and Intention to Integrate Real-Life Tasks in Mathematics Instruction

Although teachers may have opportunities to use applied mathematics in the classroom, they may be limited by insufficient pedagogical preparation, rigid curricular expectations, lack of resources, or limited field experience. Novice teachers may find it especially difficult to balance mathematically rigorous content with meaningful real-world examples (Bailey, 2022; Dicen Mendoza & Agnes Deri, 2025).

Teachers with stronger content knowledge and pedagogical content knowledge are generally better prepared to identify, develop, and use instructional resources, including real-life tasks, that align with curricular goals and students' needs (Deng, 2018; Van Driel & Berry, 2012). Integrating mathematics into real-world problems requires teachers to understand both formal mathematical content and the contexts through which students can make sense of that content (Zbiek & Conner, 2006). Pre-service teachers with stronger pedagogical content knowledge may also feel more competent when incorporating real-world applications into lesson design (Pongsanon, 2012).

Teacher beliefs may help explain how knowledge is translated into classroom practice. Beliefs are frequently described as motivational and interpretive components of teacher competence that influence how teachers use what they know (Voss et al., 2011). Constructivist beliefs are associated with student-centered strategies, including discovery-oriented learning and localized real-world applications (Pajares, 1992; Richardson, 1996). Beliefs may therefore function as interpretive filters through which formal knowledge is translated into instructional intention and practice (Fives & Buehl, 2012; Tondeur et al., 2017). Consistent with the theory of planned behavior, pedagogical attitudes and beliefs may predict teachers' instructional intentions (Ajzen, 1991; Kim et al., 2013).

Self-efficacy beliefs represent a specific form of belief closely related to teaching practice. Teachers with stronger self-efficacy are more likely to use student-centered and inquiry-based methods, whereas teachers with weaker self-efficacy may be more likely to rely on traditional, teacher-centered approaches to maintain control (Lau, 2022; Tschannen-Moran & Hoy, 2001).

Self-efficacy also supports persistence, emotional resilience, and adaptability, all of which are important for constructivist teaching (Klassen & Chiu, 2010). Teacher education programs that aim to promote instructional change should therefore address both pedagogical beliefs and teachers' confidence in their ability to enact those beliefs in practice.

In summary, knowledge may provide the technical foundation for incorporating real-world applications into mathematics instruction, whereas beliefs and self-efficacy may shape whether teachers intend to use that knowledge in practice.

Hypothesis Development

This study investigates relationships among pre-service mathematics teachers' mathematical content knowledge, mathematics pedagogical content knowledge, constructivist beliefs, self-efficacy beliefs, and intentions to incorporate real-life tasks into mathematics instruction.

Based on prior theory and research, the following hypotheses were proposed:

Hypothesis 1: Pre-service teachers' mathematics pedagogical knowledge is positively related to their constructivist beliefs.

Hypothesis 2: Pre-service teachers' mathematics pedagogical knowledge is positively related to their self-efficacy beliefs.

Hypothesis 3: Pre-service teachers' mathematical content knowledge is positively related to their constructivist beliefs.

Hypothesis 4: Pre-service teachers' mathematical content knowledge is positively related to their self-efficacy beliefs.

Hypothesis 5: Pre-service teachers' constructivist beliefs are positively related to their instructional intentions to include real-life tasks in teaching.

Hypothesis 6: Pre-service teachers' self-efficacy beliefs are positively related to their instructional intentions to include real-life tasks in teaching.

Hypothesis 7: Pre-service teachers' self-efficacy beliefs mediate the relationship between mathematics pedagogical knowledge and instructional intentions to include real-life tasks in teaching.

Hypothesis 8: Pre-service teachers' self-efficacy beliefs mediate the relationship between mathematical content knowledge and instructional intentions to include real-life tasks in teaching.

The research hypotheses model is illustrated in Figure 1.

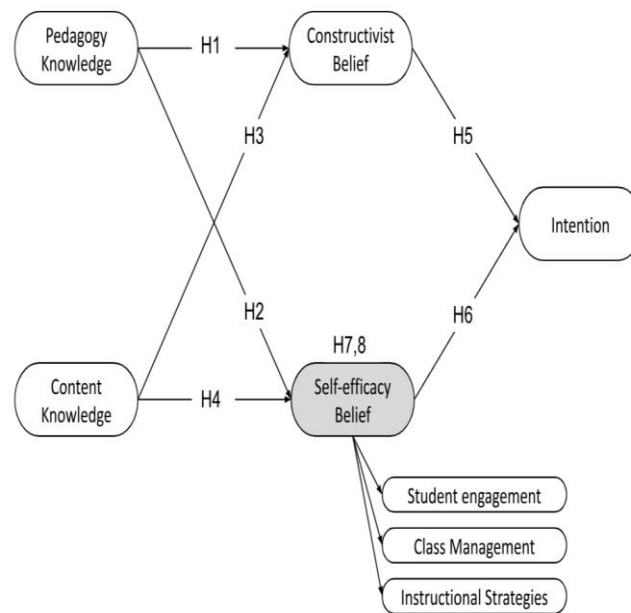


Figure 1. Conceptual Research Model

METHODS

Data Collection and Participants

This study examined pre-service mathematics teachers' intentions to include real-life tasks in their future teaching. Specifically, it assessed relationships among teacher knowledge, teacher beliefs, and instructional intentions. Participants were pre-service mathematics teachers enrolled in teacher education institutions in Central Luzon, Philippines. They were selected because they were in the later stages of professional preparation and were therefore positioned to provide insight into how teacher education programs may support the implementation of mathematics curriculum reforms. A purposive sampling procedure was used. Of the 956 survey invitations distributed, 746 completed surveys were returned, yielding a response rate of 78%. Following the 10-times rule for PLS-SEM sample adequacy (Hair et al., 2019), the recommended minimum sample size was 80, based on the eight structural paths directed toward variables in the model. The final sample exceeded this requirement. Approximately 70% of participants were female and 30% were male, which reflects the typical gender distribution in Filipino teacher education programs. Participants were in their third year (43.7%) or fourth year (56.3%) of training. All participants reported prior teaching experience through practicum placements, tutoring, or related teaching activities.

The online survey was administered through Google Forms from October to November 2024. The questionnaire was distributed to 11 teacher education institutions in Central Luzon. Each institution was asked to circulate the survey to eligible students through its learning management system. Online administration allowed participants from multiple institutions to complete the same instrument in a consistent format. Before

completing the survey, participants were informed of the study's purpose and were told that their responses would be treated confidentially. Faculty members were also asked to remind eligible students to complete the survey in order to improve the response rate.

Table 1.
Demographic Characteristics of Filipino Pre-service Mathematics Teachers

Demographics	Frequency	%
Gender		
Male	222	29.8
Female	524	70.2
Academic year		
Third year	326	43.7
4th year	420	56.3
Classroom Teaching Session		
1	182	24.4
2-3	225	30.2
4-5	143	19.2
6+	196	26.2
Total	746	

Measures

The survey consisted of two sections. The first section collected demographic information. The second section measured the study's primary constructs: mathematical content knowledge, mathematics pedagogical content knowledge, constructivist beliefs, self-efficacy beliefs, and intention to use real-life tasks in mathematics teaching.

Mathematical content knowledge and mathematics pedagogical content knowledge were estimated from students' academic records. In Philippine pre-service mathematics teacher education programs, coursework generally includes general education courses, advanced mathematics courses, and professional education courses. General education courses provide broad academic preparation and transferable skills. Advanced mathematics courses, such as algebra, calculus, geometry, probability, and mathematical analysis, are intended to develop content knowledge. Professional education and mathematics education courses, including educational psychology, general pedagogy, mathematics teaching methods, assessment in mathematics, teaching practice, and technology applications in mathematics education, are intended to develop pedagogical and pedagogical content knowledge.

Although higher education institutions in the Philippines may not uniformly use the term Realistic Mathematics Education, related principles are reflected in teacher education and national curriculum policy through

the emphasis on contextualization and localization. Republic Act No. 10533 requires the national curriculum to be flexible, learner-centered, and grounded in learners' social, local, and cultural contexts. These principles are consistent with approaches that connect abstract mathematical ideas with students' lived experiences and community-based problems.

At the policy level, the Department of Education has emphasized contextualized, student-centered learning through the K to 12 curriculum and the MATATAG Curriculum. These policies support hands-on activities, performance tasks, and the application of mathematics to meaningful contexts. In this study, participants' academic performance in relevant mathematics and pedagogy coursework was used as an indicator of their content and pedagogical knowledge.

Participants were asked to report their average academic performance in the course categories corresponding to mathematical content knowledge and mathematics pedagogical content knowledge.

The remaining constructs were measured with survey items adapted from established instruments in mathematics education and teacher education. Constructivist beliefs were assessed with items adapted from Philipp (2007). Self-efficacy beliefs were assessed with items based on Tschannen-Moran and Woolfolk Hoy (2001). Intention to incorporate real-life tasks into mathematics teaching was assessed with items developed for the present study in relation to the theory of planned behavior (Ajzen, 1991) and the study's conceptual framework.

Items were modified to fit the Philippine schooling context. The survey also included a definition and examples of real-life tasks so that participants would understand the instructional practices being referenced.

The self-efficacy subscales—classroom management, instructional strategies, and student engagement—used a 7-point Likert-type scale ranging from 1 = strongly disagree to 7 = strongly agree. The other survey constructs used a 5-point Likert-type scale ranging from 1 = strongly disagree to 5 = strongly agree.

Before full administration, the survey was pilot tested with 100 pre-service teachers who were enrolled in similar teacher education programs but were not part of the final sample. The pilot results indicated acceptable internal consistency for all constructs, with Cronbach's alpha values above .70 (Hair et al., 2019). In addition, two experts in mathematics education and teacher preparation reviewed the survey for content validity. Based on their feedback, minor wording changes were made to improve clarity while preserving the intended constructs.

Instrumentation

The instrument combined academic performance indicators with a multi-section psychometric questionnaire adapted from established measures. The questionnaire was contextualized to reflect the Philippine education setting and the operational definitions used in the MATATAG Curriculum.

Teacher Cognitive Knowledge Domains

The two teacher knowledge variables were defined using academic performance indicators recorded by participants' universities rather than self-assessments of competence.

Mathematical content knowledge refers to pre-service teachers' subject matter knowledge in mathematics. It was measured using grade point averages across core advanced mathematics courses, including linear algebra, advanced calculus, modern geometry, abstract algebra, and probability and statistics. Higher GPA values were interpreted as indicating stronger mastery of the conceptual and logical structures of mathematics.

Mathematics pedagogical content knowledge refers to knowledge at the intersection of mathematics content and pedagogy. It was measured using cumulative GPAs from professional mathematics education coursework, including teaching methods for mathematics, assessment strategies in mathematics, and technology applications in mathematics education.

Latent Psychometric Measures

The psychometric portion of the survey included 19 items representing three latent constructs. To reduce conceptual drift, the survey provided the following definition of a real-life task:

A real-life task in mathematics instruction is an anchor problem or performance assignment that asks students to use mathematical models and reasoning to solve practical, authentic problems related to community-based issues, such as transportation fare changes, local market price fluctuations, or regional agricultural production.

The three latent constructs were measured as follows:

Constructivist beliefs were measured with a four-item scale adapted from Philipp's (2007) work on mathematics teacher beliefs. The scale assessed the extent to which pre-service teachers viewed mathematics as dynamic, inquiry-based, and constructed through learning activity. Items used a 5-point Likert-type response scale. A sample item was:

"Teachers should promote and encourage students to find out, talk about, and share their own thoughts about mathematics."

Teacher self-efficacy beliefs were measured with items adapted from the short form of the Teacher Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001). Because teaching efficacy is multidimensional, self-efficacy was modeled as a second-order reflective construct consisting of three related subscales: classroom management, instructional strategies, and student engagement. Items used a 7-point Likert-type response scale.

Those three subscales were:

Classroom management consisted of four items assessing confidence in establishing and maintaining classroom order. A sample item was:

"I am confident I will have no trouble controlling disruption within the classroom."

Instructional strategies consisted of four items assessing confidence in adapting pedagogy and providing alternative explanations or representations. A sample item was:

"I am confident I can design thoughtful, thought-provoking questions that will stimulate student thinking."

Student engagement consisted of three items assessing confidence in motivating students, including those with low interest in mathematics. A sample item was:

"I am confident I can motivate students who demonstrate little interest in mathematics."

Intention to use real-life tasks was operationalized with three items assessing pre-service teachers' motivation and plans to include contextualized problems in future mathematics teaching. The scale was informed by Ajzen's (1991) theory of planned behavior. A sample item was:

"I intend to use real world examples, context-specific tasks, and performance assignments in my future math lessons."

Validation, Reliability, and Localization Procedures

A cross-cultural translation procedure using Brislin's (1970) back-translation technique was used to reduce potential language bias and construct drift. First, a bilingual educational psychologist translated the items from English into Filipino/Tagalog. Next, an independent linguist who was unfamiliar with the original English items and the research questions translated the items back into English. A third group of reviewers compared the original and back-translated versions and made minor adjustments to clarify semantic differences and align item wording with contemporary DepEd and MATATAG terminology.

An expert validation panel consisting of two senior mathematics education faculty members and one psychometrist evaluated the localized instrument for readability, cultural relevance, and alignment with the K to 12 and MATATAG Curriculum guidelines. Lawshe's (1975) content validity ratio was used for quantitative content-validity analysis. Items with a content validity ratio below .78 were identified for revision. Based on the panel's feedback, wording changes were made to clarify items without altering the intended constructs.

Before the instrument was administered to the full sample, it was pilot tested with 100 students from a university that did not participate in the main study. Reliability was assessed using Cronbach's alpha. Each measure demonstrated acceptable internal consistency before broader administration, with alpha values ranging from .78 to .91.

After data were collected from the full sample ($N = 746$), the measurement model was evaluated in SmartPLS 3.0.

Indicator reliability. Factor loadings for each item are reported in Table 3. Loadings above .70 were considered acceptable, indicating that the indicators shared sufficient variance with their corresponding constructs.

Construct reliability and internal consistency. Cronbach's alpha and composite reliability were calculated for each construct. Values of .70 or higher were interpreted as evidence of acceptable internal consistency.

Convergent validity. Convergent validity was assessed using the average variance extracted. Values above .50 were interpreted as indicating that each construct explained more than half of the variance in its indicators.

Discriminant validity. Discriminant validity was assessed with the Fornell-Larcker criterion and the heterotrait-monotrait ratio.

For the Fornell-Larcker criterion, the square root of the average variance extracted for each construct was compared with its correlations with other constructs. Discriminant validity was supported when the square root of the average variance extracted was greater than the corresponding interconstruct correlations.

The heterotrait-monotrait ratio was also used as an additional test of discriminant validity. Values below .85 were interpreted as supporting discriminant validity (Henseler et al., 2015).

Data Analysis

Data were analyzed using partial least squares structural equation modeling. PLS-SEM was selected because it is appropriate for examining complex predictive relationships among latent variables.

The analysis began with evaluation of the measurement model to determine whether the indicators and constructs demonstrated acceptable reliability and validity. After the measurement model was evaluated, the structural model was assessed using standardized path coefficients, significance tests, coefficients of determination for endogenous variables, and bootstrapping with 1,000 resamples. Analyses were conducted using a 95% confidence interval, with $p < .05$ as the threshold for statistical significance. Results were interpreted using standardized beta coefficients and p values to evaluate relationships among teacher knowledge, beliefs, and instructional intentions.

RESULTS

Preliminary Data Analysis

Variance inflation factors (VIFs) were examined before testing the structural model. Following Hair et al. (2022), VIF values below 3 were interpreted as indicating that multicollinearity was not a concern. As shown in Table 2, the VIF values ranged from 1.252 to 1.598, suggesting no substantial multicollinearity among the variables included in the model.

Table 2.
Variance Inflation Factors

Variable	VIF
Constructivist Belief	1.598
Self-efficacy Belief	1.598
Intention	1.598

Note. All VIF values were below the recommended cutoff of 3.

Measurement Model

Before the hypotheses were tested, the reliability and validity of the measurement model were evaluated (Hair et al., 2019). Indicator reliability was assessed first. As shown in Table 3, all item loadings exceeded .70, indicating acceptable indicator reliability.

Internal consistency was evaluated with Cronbach's alpha and composite reliability. Values of .70 or higher were considered acceptable. All constructs exceeded this threshold. Convergent validity was assessed

using average variance extracted (AVE), with values above .50 interpreted as acceptable. As Table 3 shows, all AVE values exceeded .50, supporting convergent validity.

Table 3.

Reliability and Validity

Construct/Item	Cronbach's α	CR	AVE	Loading
Constructivist Belief (CB)	.942	.958	.851	
CB1. Teachers should encourage students to explore, discuss and express ideas.	.910			
CB2. Teaching should be flexible to accommodate students' individual differences and progress.	.902			
CB3. Effective teaching should encourage more student discussion and hands-on practice.	.939			
CB4. A good classroom should encourage students to construct knowledge through positive thinking.	.939			
Self-efficacy Belief-Class Management (CM)	.953	.966	.877	
CM1. I can control disruptive behavior in the classroom	.928			
CM2. I am able to get children to follow classroom rules	.944			
CM3. I can calm a student who is disruptive or noisy	.935			
CM4. I am confident in establishing a classroom management system with each group of students	.939			
Self-efficacy Belief-Instructional Strategy (IS)	.974	.981	.928	
IS1. I can craft good questions for students?	.961			
IS2. I can use a variety of assessment strategies?	.968			

IS3. I can provide an alternative explanation or example when students are confused?	.961		
IS4. I can implement alternative strategies in my classroom	.965		
Self-efficacy Belief-Student Engagement (SE)	.947	.966	.903
SE1. I can motivate students who show low interest in Math?	.941		
SE2. I can get students to believe they can do well in school work?	.962		
SE3. I can help students to value learning Math?	.948		
Intention (IN)	.890	.932	.820
IN1. I believe I will use tasks with real-world context/assignments in my classroom.	.916		
IN2. I have developed lesson plans that incorporate tasks with real-life context/assignments in my lectures.	.884		
IN3. I plan to incorporate real-world contexts/tasks/assignments into my lessons in the future.	.916		

Discriminant validity was assessed using the Fornell-Larcker criterion and the heterotrait-monotrait ratio. Under the Fornell-Larcker criterion, the square root of each construct's AVE should exceed its correlations with other constructs. As shown in Table 4, this condition was met. In addition, all heterotrait-monotrait values were below .85, further supporting discriminant validity (Henseler et al., 2015).

Table 4.
Discriminant Validity Assessment

Variable	CB	IN	SB
Constructivist Belief	0.923	0.685	0.612
Intention	0.746	0.905	0.615
Self-efficacy Belief	0.643	0.667	0.864

Structural Model

Figure 2 presents the standardized path coefficients, p values, and R^2 values for the endogenous latent constructs in the structural model. The direct-effect results are summarized in Table 5. Pedagogical knowledge was not significantly related to constructivist beliefs or self-efficacy beliefs. In contrast, content knowledge was positively related to both constructivist beliefs and self-efficacy beliefs. Constructivist beliefs and self-efficacy beliefs were both positively related to intention to use real-life tasks.

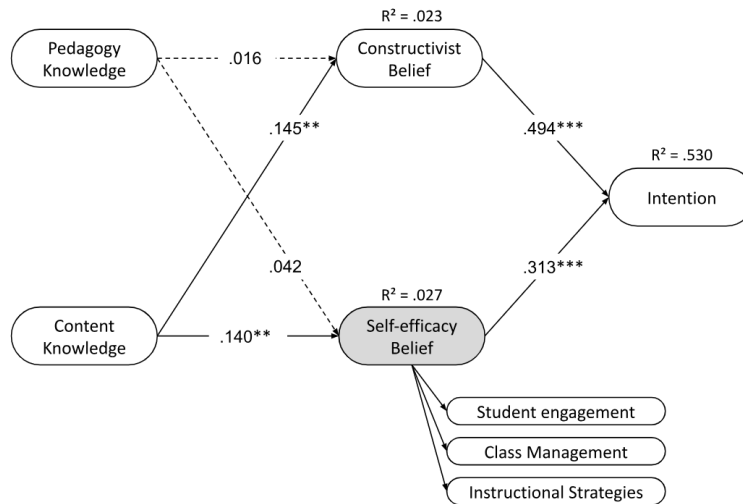


Figure 2. Results of PLS-SEM

Content knowledge was significantly and positively related to constructivist beliefs ($\beta = .145$, $p = .002$), supporting Hypothesis 3. Content knowledge was also significantly and positively related to self-efficacy beliefs ($\beta = .140$, $p = .002$), supporting Hypothesis 4. These findings suggest that stronger mathematical content knowledge was associated with stronger constructivist beliefs and stronger self-efficacy beliefs among the pre-service mathematics teachers in this sample.

Table 5. Structural Model Direct Effects and Hypothesis Testing Results

Hypothesis	β	SD	t statistics	p values	Result
Pedagogy Knowledge $\rightarrow$ Constructivist Belief	0.016	0.045	0.362	.718	Not Supported
Pedagogy Knowledge $\rightarrow$ Self-efficacy Belief	0.042	0.043	0.972	.331	Not Supported
Content Knowledge $\rightarrow$ Constructivist Belief	0.145	0.047	3.079	.002	Supported
Content Knowledge $\rightarrow$ Self-efficacy Belief	0.14	0.046	3.043	.002	Supported
Constructivist Belief $\rightarrow$ Intention	0.494	0.047	10.491	.000	Supported
Self-efficacy Belief $\rightarrow$ Intention	0.313	0.040	7.782	.000	Supported

Constructivist beliefs were significantly and positively related to intention to use real-life tasks ($\beta = .494$, $p < .001$), supporting Hypothesis 5. Self-efficacy beliefs were also significantly and positively related to intention ($\beta = .313$, $p < .001$), supporting Hypothesis 6. Thus, both belief variables were associated with stronger intentions to incorporate real-life tasks into mathematics instruction.

The nonsignificant paths from pedagogical knowledge to constructivist beliefs ($\beta = .016$, $p = .718$) and self-efficacy beliefs ($\beta = .042$, $p = .331$) indicated that Hypotheses 1 and 2 were not supported. Overall, the direct-effect results suggest that content knowledge and belief variables were more closely related to instructional intention than pedagogical knowledge as measured in this study.

Indirect Effects of Knowledge Dimensions on Intention Through Mediating Beliefs

The indirect effects are reported in Table 6. The hypothesized indirect effect of pedagogical knowledge on instructional intention through self-efficacy beliefs was not statistically significant ($\beta = .013$, $p = .343$). Therefore, Hypothesis 7 was not supported.

The hypothesized indirect effect of content knowledge on instructional intention through self-efficacy beliefs was statistically significant ($\beta = .044$, $p = .006$). Therefore, Hypothesis 8 was supported. This finding indicates that self-efficacy beliefs partially explained the relationship between content knowledge and intention to use real-life tasks.

Table 6 also reports indirect effects through constructivist beliefs. These paths were not stated as formal hypotheses in the preceding section and should therefore be interpreted as additional indirect-effect results. The indirect path from content knowledge to intention through constructivist beliefs was significant ($\beta = .072$, $p = .003$), whereas the corresponding path from pedagogical knowledge to intention through constructivist beliefs was not significant ($\beta = .008$, $p = .719$).

Table 6.

Indirect Effect of Knowledge Dimensions on Intention via Mediating Belief

Path	β	SD	t statistics	p values
Content Knowledge $\rightarrow$ Constructivist Belief $\rightarrow$ Intention	0.072	0.024	2.958	0.003
Pedagogy Knowledge $\rightarrow$ Constructivist Belief $\rightarrow$ Intention	0.008	0.022	0.36	0.719
Content Knowledge $\rightarrow$ Self-efficacy Belief $\rightarrow$ Intention	0.044	0.016	2.766	0.006
Pedagogy Knowledge $\rightarrow$ Self-efficacy Belief $\rightarrow$ Intention	0.013	0.014	0.948	0.343

Total Effects for the Structural Model Paths

Table 7 presents the total effects for the structural model paths. Content knowledge showed significant total effects on several outcomes, including classroom management, constructivist beliefs, instructional strategies, student engagement, and intention. In contrast, pedagogical knowledge did not show statistically significant total effects on the outcomes reported in the model.

The total effect of pedagogical knowledge on intention was not significant ($\beta = .021$, $p = .523$). This result should be interpreted cautiously because pedagogical knowledge was represented by academic performance indicators rather than by a direct assessment of classroom teaching skill. Within the present model, however, content knowledge and belief variables showed stronger relationships with instructional intention than pedagogical knowledge.

Table 7. Total effect for the Structural Model Paths

Path	β	SD	t statistics	p values
Constructivist Belief $\rightarrow$ Intention	0.494	0.046	10.688	0.000
Content Knowledge $\rightarrow$ Class Management	0.118	0.040	2.923	0.004
Content Knowledge $\rightarrow$ Constructivist Belief	0.145	0.048	3.010	0.003
Content Knowledge $\rightarrow$ Instructional Strategy	0.132	0.045	2.931	0.003
Content Knowledge $\rightarrow$ Intention	0.115	0.037	3.147	0.002
Content Knowledge $\rightarrow$ Student Engagement	0.132	0.045	2.937	0.003
Content Knowledge $\rightarrow$ Student Engagement	0.140	0.048	2.938	0.003
Pedagogy Knowledge $\rightarrow$ Class Management	0.035	0.037	0.967	0.334
Pedagogy Knowledge $\rightarrow$ Constructivist Belief	0.016	0.046	0.351	0.726
Pedagogy Knowledge $\rightarrow$ Instructional Strategy	0.039	0.041	0.968	0.334
Pedagogy Knowledge $\rightarrow$ Intention	0.021	0.041	0.639	0.523
Pedagogy Knowledge $\rightarrow$ Student Engagement	0.042	0.043	0.968	0.334
Self-efficacy Belief $\rightarrow$ Class Management	0.843	0.020	42.463	0.000
Self-efficacy Belief $\rightarrow$ Instructional Strategy	0.942	0.005	204.740	0.000
Self-efficacy Belief $\rightarrow$ Intention	0.313	0.040	7.786	0.000
Self-efficacy Belief $\rightarrow$ Student Engagement	0.945	0.004	231.657	0.000

DISCUSSION

This study examined how pre-service mathematics teachers' knowledge, beliefs, and self-efficacy were related to their intentions to use real-life tasks in mathematics instruction. Within the context of current Philippine education reforms, the findings indicate that beliefs were more strongly associated with instructional intention than were the academic performance indicators used to represent teacher knowledge.

Self-efficacy was modeled as a second-order construct composed of student engagement, classroom management, and instructional strategies. This structure recognizes that teaching self-efficacy is multidimensional and that pre-service teachers may need confidence across several domains to implement reform-oriented instruction effectively.

Both constructivist beliefs and self-efficacy beliefs were positively related to pre-service mathematics teachers' intentions to include real-life tasks in future instruction. Of these two predictors, constructivist beliefs showed the stronger relationship with intention ($\beta = .494$), compared with self-efficacy beliefs ($\beta = .313$). This pattern suggests that teachers' philosophical orientation toward mathematics teaching and learning may play an especially important role in whether they intend to adopt student-centered and context-based instructional practices.

The findings also distinguished the roles of content knowledge and pedagogical knowledge. Pedagogical knowledge was not significantly

related to either constructivist beliefs or self-efficacy beliefs. In contrast, content knowledge was significantly related to both belief variables, creating indirect pathways from content knowledge to instructional intention. However, the total effect of content knowledge on intention was smaller than the direct effects of constructivist beliefs and self-efficacy beliefs. Thus, content knowledge appeared to contribute to intention partly through its association with beliefs, whereas pedagogical knowledge, as measured in this study, did not show the same pattern.

These results are broadly consistent with prior research showing that constructivist teaching beliefs are associated with greater readiness to use innovative teaching approaches (Yan & Zhao, 2022). The findings also align with research suggesting that stronger self-efficacy is related to greater willingness to use new instructional practices (Huang et al., 2023). With respect to knowledge, the significant paths from content knowledge to beliefs are consistent with the view that strong subject matter understanding can support more flexible, dynamic, and real-world approaches to teaching mathematics (Blömeke & Kaiser, 2014; Yang et al., 2020).

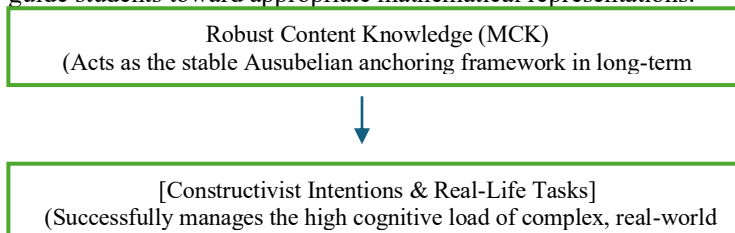
The nonsignificant relationship between pedagogical knowledge and the two belief variables should be interpreted cautiously. It does not necessarily indicate that pedagogical preparation is unimportant. Rather, it may reflect limitations in how pedagogical knowledge was measured, differences in the content of teacher education coursework, or a gap between theoretical coursework and the practical demands of implementing contextualized mathematics instruction. In the Philippine setting, where curriculum reforms emphasize contextualization, localization, and real-life applications, teacher education programs may need to provide more explicit opportunities for pre-service teachers to connect pedagogical theory with classroom practice.

The findings have several implications for teacher education. First, because constructivist beliefs were the strongest predictor of intention, teacher education programs should explicitly foster views of mathematics as meaningful, connected, and applicable to real-world situations. Reflective teaching activities, case-based learning, inquiry-oriented coursework, and supervised field experiences may help pre-service teachers develop such beliefs. Second, teacher education programs should strengthen self-efficacy related to classroom management, instructional strategies, and student engagement. Authentic practicum experiences, mentoring, microteaching, and scaffolded lesson design may help pre-service teachers develop confidence in using real-life tasks. Third, although content knowledge remains important, it should be connected more deliberately to real-world applications so that future teachers learn not only mathematics content but also how to use that content meaningfully in instruction.

Reconciling Cognitive and Constructivist Perspectives

The results also suggest that constructivist approaches and the development of strong content knowledge need not be viewed as competing priorities. From an Ausubelian perspective, meaningful learning depends on the clarity, stability, and organization of prior knowledge (Ausubel, 1960, 1963). Teachers who possess stronger mathematical content knowledge may be better able to connect unfamiliar

real-world problems with students' existing cognitive structures and to guide students toward appropriate mathematical representations.



Real-life mathematics tasks often require students to work with complex, contextualized problems. These tasks can create substantial cognitive demands if students lack sufficient prior knowledge or if teachers are unable to provide appropriate structure. Pre-service teachers with stronger content knowledge may be better positioned to identify the mathematics embedded in real-world situations and to provide explanations, examples, and scaffolds that make those situations instructionally useful.

In this study, content knowledge was positively related to both constructivist beliefs ($\beta = .145$, $p = .002$) and self-efficacy beliefs ($\beta = .140$, $p = .002$). These associations suggest that stronger content knowledge may provide pre-service teachers with a more stable conceptual foundation from which to adopt context-based and student-centered teaching practices.

Thus, the findings support a balanced interpretation: constructivist intentions may be strengthened when pre-service teachers have sufficient subject-matter understanding to use real-life tasks with confidence and precision. Deep content knowledge can help teachers move beyond textbook examples while still maintaining mathematical rigor.

CONCLUSION

This study examined the roles of teacher knowledge, constructivist beliefs, and self-efficacy beliefs in pre-service mathematics teachers' intentions to use real-life tasks in future instruction. In the context of competency-based educational reforms in the Philippines, the findings suggest that beliefs were more closely related to instructional intention than were the academic performance indicators used to represent teacher knowledge. Mathematical content knowledge was positively associated with constructivist beliefs, self-efficacy beliefs, and intention to use real-life tasks. Pedagogical knowledge, however, was not significantly related to the belief variables or to intention in the present model. Constructivist beliefs showed the strongest relationship with intention, followed by self-efficacy beliefs, indicating that pre-service teachers' views of mathematics teaching and their confidence in implementing instructional practices may be especially important for reform-oriented mathematics instruction. Several limitations should be noted. First, the study relied partly on self-report data, which may be affected by social desirability bias. Future research should incorporate classroom observations or teaching-performance evidence to examine whether reported intentions translate

into actual teaching practice. Second, because the study used a cross-sectional design, causal relationships cannot be established. Longitudinal or experimental studies would be needed to clarify how teacher knowledge, beliefs, self-efficacy, and instructional intentions develop over time. Third, the use of grades as indicators of teacher knowledge may not fully capture the breadth or quality of content knowledge and pedagogical content knowledge. Future studies should use or develop direct assessments of teacher knowledge that are better aligned with the demands of contextualized mathematics teaching. Overall, the study provides an initial basis for further research on how teacher education programs can strengthen constructivist beliefs, teaching self-efficacy, and the effective use of real-life tasks in mathematics instruction.

RECOMMENDATIONS

The findings suggest several recommendations for teacher education programs preparing future mathematics teachers in the Philippines. Because constructivist beliefs were the strongest predictor of intention to use real-life tasks, teacher education institutions should provide sustained opportunities for pre-service teachers to view mathematics as meaningful, connected, and applicable to real-world situations. Coursework and field experiences should move beyond memorization of formulas and procedures by incorporating inquiry-based activities, contextualized problems, lesson-design tasks, and opportunities for students to analyze and develop real-life mathematics applications. These experiences may help pre-service teachers connect what they teach with how they teach it.

The findings also suggest that teacher education programs should strengthen pre-service teachers' confidence in implementing competency-based and contextualized instruction. Targeted support may include supervised practicum experiences, microteaching, mentoring, peer feedback, and structured reflection on classroom management, instructional strategies, and student engagement. Future research should extend the present cross-sectional design by using longitudinal studies that follow teachers from university preparation into the early years of teaching. Researchers should also incorporate classroom observations, teaching-performance assessments, and direct measures of content and pedagogical content knowledge rather than relying primarily on academic grades and self-report measures. Finally, additional research is needed to examine the social, cultural, and institutional conditions that support or constrain the development of constructivist beliefs and the use of real-life tasks in Philippine mathematics classrooms.

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