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Predicting pre-service mathematics teachers' intentions to integrate real-life tasks: the roles of knowledge and beliefs

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ABSTRACT

In response to Vietnam's ongoing educational reforms, there is a growing emphasis on using practical materials to teach mathematics. This study explores how the knowledge and beliefs of pre-service mathematics teachers affect their intention to use real-life tasks in their teaching, addressing an underexplored issue in Vietnam's ongoing educational reform context. A quantitative design was employed, with survey data collected from 746 pre-service teachers across 11 pedagogical universities. The data were analyzed using partial least squares-structural equation modeling (PLS-SEM) to test both direct and mediating relationships. The results show that constructivist beliefs (CB) and self-efficacy beliefs significantly predict instructional intention, with CB being the strongest predictor. Content knowledge (CK) indirectly influences intention through its positive effects on both belief constructs, while pedagogical content knowledge (PCK) shows no significant effect. These findings highlight the central role of beliefs in enabling integration of real-life context in mathematics education, alongside the contribution of knowledge. The study suggest that teacher education should address both knowledge and beliefs, particularly CB and self-efficacy, to support the reform-oriented teaching. Implications for improving PCK in teacher education are also discussed.

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1. INTRODUCTION

Mathematics education in Vietnam, especially at the K-12 level, has always been highly valued and well invested. However, teaching mathematics in Vietnam has long been criticized for being too mechanical, overly focused on abstract logical thinking, and not empowering students with flexibility or practical application skills [1], [2]. Teaching mathematics in Vietnam often focuses on abstract mathematical concepts without showing their practical applications in daily life, which can lead to disengagement and difficulty in understanding the utility of mathematics [3]. Instead, instructional approaches should integrate real-world contexts, aligning with the core mission of mathematics education to foster students' problem-solving skills, critical thinking, and the ability to apply concepts in everyday life [4], [5].

In response to these concerns, the Vietnamese government has introduced several policies that emphasize practical application and life skills. In particular, resolution No. 29-NQ/TW on fundamental and comprehensive innovation in education and training issued by the central steering committee in 2013 underscores the importance of enabling students to apply knowledge in real-life situations [6]. Subsequently, the Vietnam National Qualifications Framework was introduced to provide a structural foundation for this reform [7]. Furthermore, the 2018 General Education Curriculum, issued under Circular No. 32/2018/TT-BGDDT by the Vietnam Ministry of Education and Training (MOET), requires that 7% of mathematics instruction be devoted to practical activities and experimental scenarios. These changes not only align with national reform efforts but also resonate with global educational trends and reforms.

Prior studies have identified several benefits of embedding real-world contexts into mathematics learning and teaching, as well as its impacts on students' outcomes and achievement. Specifically, incorporating real-world contexts into mathematics teaching significantly enhances student engagement (SE) and motivation, as it makes learning more relevant and related [8]. When students can connect mathematical concepts to everyday life or practical applications, they find the subject more meaningful, which in turn boosts their intrinsic motivation and self-efficacy [8]. Additionally, using familiar or student-generated problems further increases the perceived usefulness of mathematics. Real-world contexts also help bridge the gap between abstract concepts and their practical applications, deepening students' understanding and fostering critical thinking and problem-solving skills [8]. Moreover, such approaches encourage students to transfer prior knowledge to new situations, enhancing mathematical literacy and promoting transferable skills like reasoning and justification [9]. Studies have shown that contextualized learning methods, such as realistic mathematics education (RME), positively impact student achievement, particularly for younger learners, by improving their grasp of mathematical concepts [10].

However, the implementation of these policies has faced many challenges. Much of the focus has been placed on textbook reform rather than on strengthening teacher training in pedagogical education institutions [11]. A significant trend in Vietnam's educational vision is the shift from teacher-centered to student-centered approaches in all disciplines [12]. In line with this reform, the current teacher educational program has integrated constructivist paradigms and practices from RME [4]. These approaches position teachers as facilitators and guides, creating opportunities for students to engage in cognitively demanding tasks that are meaningful and relevant to real-life contexts [13].

However, these pedagogical approaches, which are rooted in the Western educational traditions, contrast sharply with the context of Vietnam, where the Confucian heritage shapes educational values. The Confucian culture emphasizes respect for the authority of teachers and structured learning by receiving knowledge from teachers [14], [15]. As a result, the cultural context in Vietnam can significantly influence how these educational theories are interpreted and implemented in practice.

In evolving educational contexts, teachers' psychological traits, particularly their beliefs, significantly shape classroom practices [16], [17]. Teacher's knowledge alone may not guarantee implementation. For pre-service teachers, applying knowledge in practice is often constrained by limited classroom experience, uncertainty, and lack of confidence [18]. Teachers with higher self-efficacy are adaptive instructional choices, open to reform, and more likely to employ innovative methods [19], [20]. Similarly, constructivist beliefs (CB) of teachers about the nature of mathematics–viewing mathematics as dynamic rather than static - predict their adoption of real-world materials and active learning strategies [21]. Together, these traits drive teacher pedagogical innovation and responsiveness to challenges.

Despite their importance, the relationships between knowledge, beliefs (including constructivist and self-efficacy beliefs), and intention to integrate real-life tasks in teaching remain under-researched and inconsistent, especially among pre-service mathematics teachers and in emerging countries like Vietnam. For instance, Thomson *et al*. [22] found mathematics and science preservice teachers in United States (US) pedagogical content knowledge (PCK) was significantly associated with their efficacy beliefs, whereas their content knowledge (CK) did not predict their self-efficacy beliefs. Meanwhile, Smit *et al*. [23] found that, among preservice biology teachers in Germany and Switzerland, PCK developed through training predicted later intentions to teach scientific inquiry, whereas prior CK had no effect on such intentions.

To address this gap, this study aims to examine the direct and indirect relationships between pre-service mathematics teachers' knowledge (CK and PCK), beliefs (CB and self-efficacy beliefs), and their intention to integrate real-life tasks into teaching within Vietnam's educational reform context. The study is expected to contribute to the literature on the interplay among knowledge, beliefs, and intentions to integrate real-life tasks into mathematics teaching by providing empirical evidence from a Confucian-influenced, non-Western educational context. It also aims to offer practical implications for key stakeholders, including policymakers, leaders of pedagogical universities, school principals, mathematics teachers, and preservice teachers.

2. LITERATURE REVIEW

2.1. Teacher knowledge

Teacher knowledge is a concept that has been modelled into various multifaceted structures [24], [25], but can be described in two components: subject matter knowledge (SMK) and PCK. Shulman argued that "*teaching necessarily begins with a teacher's understanding of what is to be learnt and how it is to be taught*" [26]. In general, SMK is related to the subject matter content of a particular subject (mathematics in this study) and PCK includes effective ways to construct and organize teaching of the subject so that students can learn effectively at different levels [26].

CK refers to a teacher's deep understanding of a subject, encompassing facts and the conceptual principles that unify the discipline. For mathematics teachers, this involves procedural skills and a sense of the logical structures and reasoning that define mathematics [27], [28] Ernest's model in 1989 describes CK as the integration of "what" (facts and procedures) with "why" (underlying principles and connections). Ball *et al.* [29] further divided CK into common CK, the mathematical knowledge used in everyday settings, and specialized CK, which is unique to teaching and involves understanding, analyzing, and representing mathematical ideas in ways that support student learning (analyzing students' method, and explaining why it works or not). This knowledge allows teachers to situate mathematics within real-world contexts, for example, applying graphs in economics or statistics in public health [30].

PCK, introduced by Shulman [31], represents the intersection of content and pedagogy. PCK refers to the PCK necessary to teach a subject, making the content understandable and relevant to learners. It is an important aspect in research on teaching methods and teacher education. The two central components of PCK for teachers in general (and mathematics in particular) are knowledge of specific teaching strategies (specific teaching strategies for mathematics; and knowledge of students' abilities and learning processes (respectively, students' abilities and learning processes for mathematics)) [30]. PCK is particularly critical in mathematics education due to the abstract and cumulative nature of the subject. It involves anticipating student misconceptions, choosing suitable examples, and structuring lessons to promote understanding [27]. Ball *et al*. [29] also broke down PCK into knowledge of content and students, which focuses on anticipating student thinking and misconceptions, and knowledge of content and teaching, which involves selecting instructional strategies and examples appropriate to the content. These distinctions clarify how teachers can use PCK to tailor instruction and deepen student understanding [29].

2.2. Teachers' beliefs

Beliefs refer to "*psychologically held understandings, premises, or propositions about the world that are considered true*" [32]. In mathematics education, teacher beliefs typically address two primary aspects: i) the nature of mathematics and ii) the appropriate methods for teaching and learning it [14], [28]. Teachers' beliefs about the nature of mathematics encompass their "*conscious or unconscious beliefs, conceptions, meanings, rules, mental images, and preferences regarding the discipline of mathematics*" [33], [34]. Specifically, it can be separated into four aspects as: i) formalism-related view; ii) scheme-related view: these two views mainly describe mathematics as static, consisting of precise results and infallible procedures, or as a set of process-oriented facts and formulas [34], [35]; iii) process-related view; and iv) application-related view: these two perspectives conceptualize mathematics as a dynamic and continuously expanding domain of knowledge based on meaning-making and pattern-seeking [34].

Beliefs about mathematics teaching and learning refer to the preferred instructional approaches of teachers and views on how students learn. For example, they believe that certain teaching activities are ideal in the classroom, what behaviors and mental activities are associated with learning mathematics, and what constitutes typical and appropriate mathematics learning activities [27], [34]. Teachers' beliefs about mathematics teaching and learning are mainly distinguished between two perspectives on mathematics teaching and learning: i) the knowledge transfer (or "traditional") perspective, in which mathematics teaching is seen as a process of transferring knowledge and students passively receive knowledge from teachers; and ii) the constructivist perspective, in which mathematics teaching is seen as supporting students in constructing knowledge [35].

This study focuses on CB because they align closely with contemporary educational reforms that advocate student-centered instruction, especially in mathematics education. However, holding CB alone may not be sufficient to influence teaching behavior. Teachers must also have the confidence to implement such approaches effectively. High self-efficacy is associated with greater adaptability, persistence, and willingness to adopt student-centered methods [36]. These two concepts (CB and self-efficacy beliefs) will be further elaborated in the next subsections.

2.2.1. Constructivist beliefs

CB about mathematics refer to an individual's view of mathematics as a dynamic, evolving, and creative discipline that is not merely a set of fixed rules or procedures but a human construct subject to

interpretation, reasoning, and problem solving [27]. CB are grounded in the relativist epistemological stance, in which knowledge is seen as context-dependent and constructed through experience. These beliefs challenge traditional views that portray mathematics as a closed system of immutable truths. Instead, constructivist-orientated teachers perceive learning as an active process in which learners engage in constructing meaning through discourse, manipulation of ideas, and collaborative problem solving [37], [38].

CB in mathematics teaching position the subject not as a static set of rules but as an evolving discipline rooted in reasoning, problem solving, and active inquiry. A constructivist teacher is supposed to see mathematical knowledge as being co-constructed through interaction, hands-on engagement, and contextual understanding rather than mere rote memorization [27]. Constructivist-oriented teachers are more likely to adopt real-life tasks as a way of engaging students in meaningful problem solving [39].

2.2.2. Teacher self-efficacy belief

Based on Bandura's social cognitive theory [40]–[42], self-efficacy refers to an individual's belief in his ability to organize and execute the courses of action required to handle prospective situations. In the educational context, teacher self-efficacy refers to teachers' judgments of their abilities to effectively organize and execute instructional tasks necessary for SE and learning [43]. Gibson and Dembo [44] initially proposed a two-factor model consisting of personal teaching efficacy (PTE) and general teaching efficacy (GTE). PTE refers to a teacher's belief in their own ability to teach effectively, while GTE captures beliefs about the overall power of teaching to influence student learning, often shaped by contextual factors such as socioeconomic background or administrative support. However, these models were later criticized for not addressing the multifaceted demands of classrooms [43].

Rather than a static personality trait, self-efficacy is understood as a dynamic, task-specific belief that shapes the goals set, the effort they expend and the persistence they exhibit when faced with challenges [40]. Building on this principle, Tschannen-Moran and Hoy [43] developed a more practical taxonomy that conceptualizes teacher self-efficacy to the specific demands of teaching tasks and identifies three dimensions: i) instructional strategies: the beliefs in one's ability to design, implement, and adapt various pedagogical methods that promote student learning. Teachers with high self-efficacy in this area are more likely to experiment with innovative teaching techniques, differentiate instruction, and tailor their strategies to meet the needs of diverse students; ii) classroom management: the beliefs in one's capacity to establish rules, maintain order, and respond effectively to disruptive behaviors while fostering a positive learning environment. It encompasses both preventive and responsive practices that support student behavior and classroom harmony; and iii) SE: the beliefs in one's ability to motivate students, stimulate interest, and sustain involvement in learning activities, particularly among students who are disinterested, distracted, and come from diverse backgrounds. These dimensions are interrelated but distinct, each corresponding to specific demands that require pedagogical skills and a deep sense of professional agency.

Bandura [40] further posits that self-efficacy is influenced by four primary sources: mastery experiences, vicarious experiences, social persuasion, and physiological and emotional states. In the context of teacher education, especially for pre-service teachers, authentic classroom experiences, including guided teaching practice and mentorship, serve as critical opportunities that can either reinforce or challenge their self-efficacy beliefs [45].

2.3. Intention to integrate real-life tasks in teaching

A key element of reform-based and constructivist approaches in mathematics teaching is the intention to design lessons that engage students with real-life tasks. Such tasks require students to apply mathematical knowledge to situations that mirror everyday experiences, such as interpret data from newspapers or local statistics, calculating the cost of groceries and comparing discounts, scale up a recipe for a large family gathering, thereby making mathematics meaningful and connected to life beyond the classroom. This focus on real-life contexts has gained considerable attention within constructivist pedagogy due to its potential to improve relevance, promote SE, and foster deeper conceptual understanding [46]. Incorporating real-life tasks allows students to apply mathematical knowledge to practical problems, thus supporting the development of mathematical literacy and critical thinking [47]–[49].

The integration of real-world or realistic elements is a central theme in various research and teaching approaches. This includes RME, which uses realistic contexts for developing mathematical understanding through guided reinvention, and the models and modelling perspective (MMP), which views learning as constructing and refining models for real-world problems [50]. Similarly, instructional approaches like project-based learning engage students with real-world challenges through extended inquiry [51], and contextual teaching and learning (CTL) connects content to real-world situations for hands-on meaning-making [52]. A central tenet of these influential approaches is the incorporation of practical elements into mathematics instruction.

Recognizing the importance of this practice, this study seeks to understand how future teachers intend to integrate real-life tasks into their teaching. This focus is grounded in Ajzen's theory of planned behavior [53], which posits intention as the most proximal predictor of behavior. In educational contexts, this intention represents a pre-service teacher's motivational plan for future classroom practices. Therefore, this study treats pre-service teachers' intention to use real-world materials or tasks as a key indicator of their potential to implement these reform-based strategies in their actual teaching.

2.4. The conceptual model and hypotheses development

Despite increasing calls for more real-world task integration in mathematics education, actual classroom implementation remains limited, especially among novice teachers [54], [55]. Teachers continue to face uncontrollable challenges, such as curriculum alignment, students' varying levels of prerequisite knowledge, and limited resources. While lesson planning remains within their control, a source of tension arises from the difficulty of balancing mathematically rigorous content with meaningful real-life applications in their lesson plans [56].

Teacher knowledge plays a foundational role in addressing these challenges. Teachers with better CK and PCK are better equipped to select, design, and adapt instructional materials, including real-world tasks, that meet curricular goals and address diverse student needs [57], [58]. However, knowledge alone may not translate into instructional intention. Zbiek and Conner [59] emphasize that such integration requires not only mathematical expertise but also a nuanced understanding of how students learn and which contexts resonate with them. Pongsanon [60] demonstrated that pre-service teachers with well-developed PCK were significantly more confident and capable of embedding real-life contexts into their lesson planning, thereby increasing the likelihood of actual implementation. Accordingly, knowledge is expected to influence instructional intention indirectly through teachers' beliefs. Therefore, we proposed:

- H1: pre-service teachers' mathematical PCK positively predicts their CB.
- H3: pre-service teachers' mathematical CK positively predicts their CB.

Self-efficacy, a specific facet of beliefs, is another critical predictor of effective teaching practice. Teachers with high self-efficacy are more likely to implement student-centered inquiry-based methods, while those with low self-efficacy often default to teacher-centered approaches for control [37], [43]. Self-efficacy influences teachers' persistence, emotional resilience, and adaptability, factors essential for constructivist teaching [61]. Given that self-efficacy is shaped by both knowledge and teaching experience, it is expected that teachers' knowledge contributes to their confidence in implementing instructional practices. Thus, we proposed:

- H2: pre-service teachers' mathematical PCK positively predicts their self-efficacy beliefs.
- H4: pre-service teachers' mathematical CK positively predicts their self-efficacy beliefs

Previous teacher development research frequently positions beliefs as key mediators between knowledge and practice. According to the competence model by Voss *et al*. [62], beliefs form a motivational component that guides how cognitive knowledge influences behavior. This aligns with findings that CB foster student-centered practices such as exploration and real-world application [63]. Tondeur *et al*. [64] contribute the perspective that beliefs act as interpretive filters, shaping how knowledge is understood and enacted, thus influencing intentions. Furthermore, frameworks like the theory of planned behavior [53] have been applied to demonstrate that teaching beliefs, as attitudinal components, significantly predict instructional intentions and mediate the effect of knowledge [65]. Therefore, we proposed:

- H5: pre-service teachers' CB positively predict the instructional intention in integrating real-life tasks in their teaching practices.
- H6: pre-service teachers' self-efficacy beliefs positively predict the instructional intention in real-life tasks in their teaching practices.
- H7: self-efficacy beliefs mediate the relationship between mathematical PCK and instructional intention in integrating real-life tasks in their teaching practices.
- H8: self-efficacy beliefs mediate the relationship between mathematical CK and instructional intention in integrating real-life tasks in their teaching practices.

This study will examine the future mathematics teachers' knowledge of mathematics content (mathematical CK) and PCK in teaching mathematics (mathematics pedagogical CK), their beliefs about teaching mathematics from a constructivist perspective, and their intention to integrate real-life tasks in their teaching practices. The conceptual research model is illustrated in Figure 1.

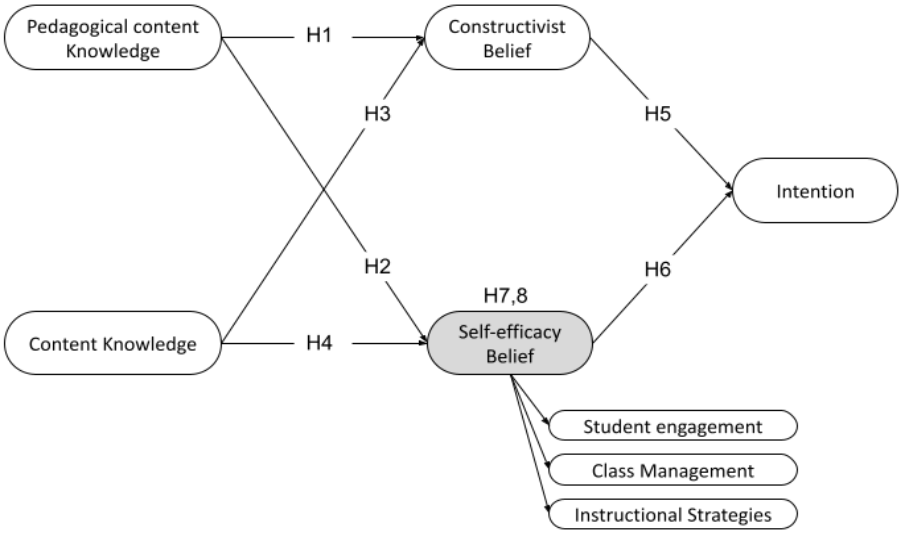


Figure 1. The conceptual research model

3. METHOD

3.1. Data collection and participants

This study investigates the intention of pre-service mathematics teachers in Vietnam to integrate real-life tasks into their teaching practices. To accomplish this objective, an empirical investigation was conducted to examine the relationships between teachers' knowledge, beliefs, and instructional intention. While the integration of real-life context in mathematics education has been increasingly emphasized in Vietnam's educational reform [66], implementation challenges persist in teacher education programs. Consequently, the participants of this study were pre-service mathematics teachers enrolled in pedagogical universities across Vietnam. These participants were selected because they represent future educators at a critical formative stage of their professional development, making their perspectives particularly valuable for understanding how teacher education can better prepare educators for the implementation of curriculum reforms.

Participants were recruited through purposive sampling, targeting third- and fourth-year pre-service mathematics teachers enrolled in pedagogical universities across Vietnam. This group was selected because they represent future educators at a critical formative stage, having already acquired foundational pedagogical and CK through practicum and coursework. While the sampling criterion was purposive in terms of participant characteristics, data were collected through faculty networks at 11 pedagogical universities, which assisted in distributing the online questionnaire via institutional learning management systems–a method that reflects convenience in distribution logistics rather than in participant selection criteria. The final response rate was 78%, yielding 746 completed surveys from 956 invitations, as shown in Table 1.

Table 1. Participants' profile

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

This study was conducted in accordance with the ethical standards of NAFOSTED. Informed consent was obtained from all participants prior to participation. Participants were clearly informed of the voluntary nature of the survey, the confidentiality of their responses, and their right to withdraw at any time without consequence. No personally identifiable information was collected. All data were stored securely and accessed only by the research team.

3.2. Measures

The questionnaire consisted of two main sections. The first section gathered respondents' demographic information, while the second section designed to measure the study's key constructs: PCK and CK, CB, self-efficacy beliefs, and intention to integrate real-life tasks. PCK and CK were assessed through participants' self-reported average academic scores from relevant curriculum columns. While direct assessment using standardized performance measures would ideally be more objective, this approach was adopted for several pragmatic reasons. First, Vietnamese pedagogical university curricula are structured into distinct subject columns (mathematics content subjects vs. pedagogy subjects), providing a clear curricular basis for differentiating CK and PCK [48]. Second, academic grades in Vietnamese higher education are externally assessed and reflect cumulative performance across multiple examinations, reducing purely subjective self-report bias. Third, single-item indicators based on academic achievement have been increasingly validated in structural equation modeling (SEM) research [67], [68]. We acknowledge this as a limitation and recommend that future studies employ validated domain-specific knowledge instruments to strengthen construct validity.

The remaining constructs were measured using items adapted from well-established instruments in mathematics education research. Specifically, CB were assessed using items from Philipp [32], self-efficacy beliefs were measured based on Tschannen-Moran and Hoy [43], and intention to integrate real-life tasks was evaluated using items from Ball *et al.* [29]. Modifications were made to align these instruments with the specific educational context of Vietnam, and a brief definition of real-life tasks, together with illustrative examples, was provided in the questionnaire.

The use of different Likert scale formats was theoretically motivated. The self-efficacy beliefs subscales employed a seven-point scale (1=strongly disagree to 7=strongly agree) to capture finer gradations in self-perceived teaching capabilities, as recommended by Tschannen-Moran and Hoy [43], who originally validated this instrument with a seven-point format. The remaining constructs used a five-point scale consistent with the original instruments from which items were adapted. While this mixed-scale approach may raise concerns about comparability, partial least squares-SEM (PLS-SEM) is robust to violations of scale uniformity as it does not assume interval equivalence across latent constructs [69]. Nevertheless, we note this as a limitation and suggest future studies standardize scale formats.

The Vietnamese translation followed Brislin's rigorous back-translation protocol to ensure comprehension [69]. Prior to full administration, a pilot test with 100 pre-service teachers demonstrated acceptable internal consistency for all constructs (Cronbach's $\alpha>0.7$) [70]. Additionally, two experts in mathematics education and teacher training evaluated the instrument's content validity. Their feedback led to minor refinements in item wording while maintaining the original constructs' theoretical integrity.

3.3. Data analysis

The collected data was analyzed using PLS-SEM in SmartPLS 3.0, which is particularly suitable for examining complex relationships in predictive research models. The analysis first evaluated the measurement model to ensure the reliability and validity of the constructs. Subsequently, the structural model was evaluated by analyzing the path coefficients (β) and their statistical significance based on 1,000 bootstrap samples, along with the determination coefficient (R^2) for endogenous variables. All statistical tests were conducted at a 95% confidence level ($p<0.05$), with results interpreted based on standardized coefficients and significance values to draw conclusions about the relationships between teachers' knowledge, beliefs, and instructional intentions.

4. RESULTS

4.1. Preliminary data analysis

The possibility of multicollinearity was assessed using the variance inflation factor (VIF) prior to data analysis. According to Hair *et al*. [67], a VIF value below 3 indicates that there is no significant multicollinearity. The VIF values for the variables in the model are reported in Table 2. The VIF values ranged from 1.252 to 1.598, all of which are below the 3 thresholds, indicating that there is no significant evidence of multicollinearity among the variables.

Table 2. VIF

Variable	VIF
CB	1.598
Self-efficacy beliefs	1.598
Intention	1.598

4.2. Measurement model

Before testing the proposed hypotheses, the reliability and validity of the measurement items (indicators) and scales (constructs) were evaluated [70]. First, the loading of each indicator was checked. An indicator with a loading of 0.7 is considered to have acceptable reliability. Table 3 shows that all items have loadings higher than this threshold, indicating that the items are reliable.

Next, two measures were used to assess internal consistency: Cronbach's α and composite reliability (CR). The recommended minimum value for both α and CR is 0.7. Table 3 shows that all the constructs meet this criterion, confirming that internal consistency is present in all the constructs. Finally, convergence validity was tested by examining the average variance extracted (AVE). The minimum acceptable value for AVE is 0.5. As shown in Table 3, the AVE values for all constructs are well above 0.5, indicating that convergent validity holds for all constructs.

The final step at this stage was to assess discriminant validity. According to the Fornell-Larcker criterion, the square root of the AVE of each construct must be higher than the correlation of that construct with any other construct. As shown in Table 4, this condition is satisfied, confirming the presence of discriminant validity [68]. Additionally, the heterotrait–monotrait ratio (HTMT) test results demonstrate that all HTMT values are less than 0.85 [71], further supporting the findings in line with Fornell and Larcker's criterion.

Table 3. Reliability and validity

Construct/item	Cronbach's α	CR	AVE	Loading
CB	0.942	0.958	0.851	
CB1. Teachers should encourage students to explore, discuss and express ideas.				0.910
CB2. Teaching should be flexible to accommodate students' individual differences and progress.				0.902
CB3. Effective teaching should encourage more student discussion and hands-on practice.				0.939
CB4. A good classroom should encourage students to construct knowledge through positive thinking.				0.939
Self-efficacy belief-class management (CM)	0.953	0.966	0.877	
CM1. I can control disruptive behavior in the classroom				0.928
CM2. I am able to get children to follow classroom rules				0.944
CM3. I can calm a student who is disruptive or noisy				0.935
CM4. I am confident in establishing a classroom management system with each group of students				0.939
Self-efficacy belief-instructional strategy (IS)	0.974	0.981	0.928	
IS1. I can craft good questions for students				0.961
IS2. I can use a variety of assessment strategies				0.968
IS3. I can provide an alternative explanation or example when students are confused				0.961
IS4. I can implement alternative strategies in my classroom				0.965
Self-efficacy belief-SE	0.947	0.966	0.903	
SE1. I can motivate students who show low interest in math				0.941
SE2. I can get students to believe they can do well in school work				0.962
SE3. I can help students to value learning Math				0.948
Intention (IN)	0.890	0.932	0.820	
IN1. I believe I will use tasks with real-world context/assignments in my classroom.				0.916
IN2. I have developed lesson plans that incorporate tasks with real-life context/ assignments in my lectures.				0.884
IN3. I plan to incorporate real-world contexts/tasks/assignments into my lessons in the future.				0.916

Table 4. Discriminant validity assessment

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

4.3. Structural model

Figure 2 presents the standardized path coefficients, significance levels, and explanatory power of the endogenous latent variables in the structural model. The results of the PLS-SEM analysis provide insights into the relationships between the key constructs, confirming the robustness of the model. In this model, CK and CB play significant roles in shaping self-efficacy beliefs and instructional intention, with path coefficients that are both strong and statistically significant.

Table 5 presented the detailed results. The relationship between CK and CB was examined, with CK→CB showing a significant positive influence (β=0.145, p<0.01). This confirms that CK positively contributes to CB, supporting H3. Similarly, CK→self-efficacy beliefs also showed a significant effect (β=0.140, p<0.01), validating H4. These results suggest that CK plays a crucial role in shaping both CB and self-efficacy beliefs, which are essential for forming instructional intentions.

The influence of CB and self-efficacy beliefs on intention were also evaluated. The path from CB→intention (β=0.494, p<0.001) was found to be highly significant, supporting H5, indicating that CB have a direct and strong effect on the intention to integrate real-life tasks into teaching practices. Similarly, the path from self-efficacy beliefs→intention (β=0.313, p<0.001) also showed a significant positive influence, confirming H6.

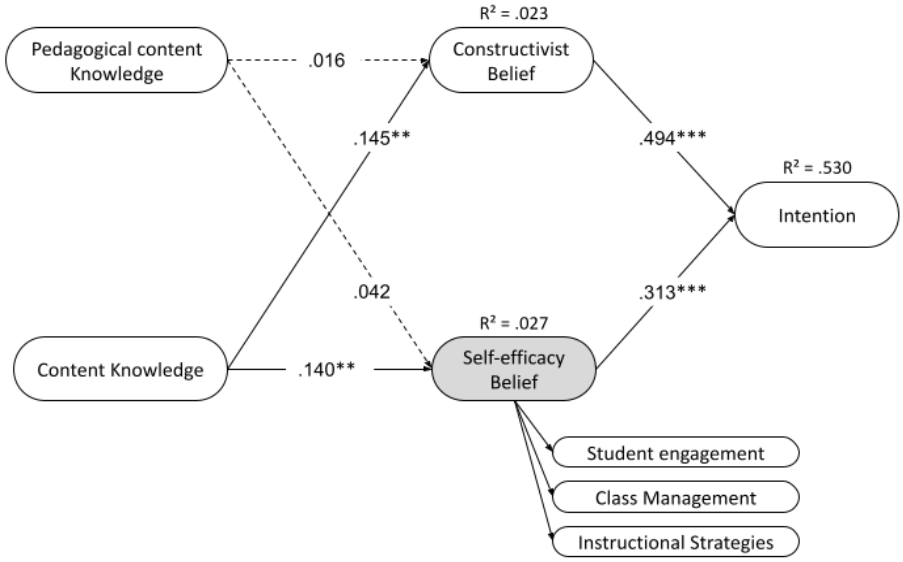


Figure 2. Results of PLS-SEM

Table 5. Direct effects

Hypothesis	β	SD	t statistics	p values	Result
PCK→CB	0.016	0.045	0.362	.718	Not supported
PCK→self-efficacy beliefs	0.042	0.043	0.972	.331	Not supported
CK→CB	0.145	0.047	3.079	.002	Supported
CK→self-efficacy beliefs	0.14	0.046	3.043	.002	Supported
CB→intention	0.494	0.047	10.491	.000	Supported
Self-efficacy beliefs→intention	0.313	0.040	7.782	.000	Supported

4.4. Indirect effect

Hypothesis H7 proposed that self-efficacy beliefs mediate the relationship between PCK and instructional intention. However, the indirect effect of PCK on intention through self-efficacy beliefs was not significant (p>0.05). This suggests that PCK does not influence instructional intention through self-efficacy beliefs in this model.

In contrast, H8, which posited that self-efficacy beliefs mediate the relationship between CK and instructional intention, was supported. The indirect effect of CK on intention through self-efficacy beliefs was significant (β=0.044, p<0.01), highlighting the role of self-efficacy beliefs as a mediator in this relationship. This result underscores the importance of self-efficacy beliefs in bridging the gap between CK and the intention to integrate real-life materials in teaching practices, as detailed in Table 6.

Table 6. Indirect effect

Path	β	SD	t statistics	p values
CK→CB→intention	0.072	0.024	2.958	0.003
PCK→CB→intention	0.008	0.022	0.36	0.719
CK→self-efficacy beliefs→intention	0.044	0.016	2.766	0.006
PCK→self-efficacy beliefs→intention	0.013	0.014	0.948	0.343

4.5. Total effect

Table 7 presents the total effects for the structural model, highlighting the roles of CK and PCK. CK significantly influenced several key outcomes, such as class management (CM), CB, instructional strategy (IS), and intention, underscoring its importance in shaping various aspects of teaching practices. In contrast, PCK did not show significant effects on any of the outcomes measured, indicating that it does not play a substantial role in influencing these variables within the model.

Table 7. Total effect

Path	β	SD	t statistics	p values
CB→intention	0.494	0.046	10.688	0.000
CK→CM	0.118	0.040	2.923	0.004
CK→CB	0.145	0.048	3.010	0.003
CK→IS	0.132	0.045	2.931	0.003
CK→intention	0.115	0.037	3.147	0.002
CK→SE	0.132	0.045	2.937	0.003
CK→SE	0.140	0.048	2.938	0.003
PCK→CM	0.035	0.037	0.967	0.334
PCK→CB	0.016	0.046	0.351	0.726
PCK→IS	0.039	0.041	0.968	0.334
PCK→intention	0.021	0.033	0.639	0.523
PCK→SE	0.040	0.041	0.967	0.334
PCK→SE	0.042	0.043	0.968	0.334
Self-efficacy beliefs→CM	0.843	0.020	42.463	0.000
Self-efficacy beliefs→IS	0.942	0.005	204.740	0.000
Self-efficacy beliefs→intention	0.313	0.040	7.787	0.000
Self-efficacy beliefs→SE	0.945	0.004	231.657	0.000

5. DISCUSSION

This study aimed to address a significant research problem: how Vietnamese preservice mathematics teachers' knowledge, beliefs, and self-efficacy beliefs jointly shape their intention to integrate real-life tasks into mathematics teaching. In particular, it explored the distinct roles of CK, PCK, CB, and self-efficacy beliefs in influencing instructional intentions within the context of Vietnam's educational reforms. First, self-efficacy beliefs are a second-order construct composed of three first-order constructs: SE, CM, and instructional strategies. This modeling approach acknowledges the multifaceted nature of teaching self-efficacy and reflects the diverse competencies required for effective classroom practices.

Second, both CB and self-efficacy beliefs have significant direct impacts on pre-service mathematics teachers' intention to integrate real-life tasks into classroom instruction. Among these two direct drivers, CB appear to have a greater impact than self-efficacy beliefs (β=0.494*** versus β=0.313***). This result underscores the central role of teachers' philosophical orientations toward mathematics and learning in shaping their motivation to adopt innovative and student-centered instructional practices.

Third, our empirical findings show a contrast between the two antecedents: PCK and CK. While PCK appears to have no significant impact on either of the two mediators (CB and self-efficacy beliefs), CK appears to have a significant impact on both CB and self-efficacy beliefs, resulting in two indirect paths affecting pre-service mathematics teachers' intention to integrate real-life tasks into classroom instruction. Overall, CK has a total impact on intention with β=0.116, though this is still lower than the respective impacts of CB and self-efficacy beliefs.

These findings align with previous studies emphasizing that constructivist teaching beliefs foster greater preparedness for innovative teaching [72]. Moreover, consistent with Huang *et al*. [73], higher self-efficacy beliefs predict greater willingness to engage in new teaching behaviors. Second, regarding the role of knowledge, CK significantly predicted beliefs, which then indirectly influenced intention. Stronger CK may provide pre-service teachers with greater conceptual flexibility in working with mathematical ideas, making exploratory and real-world teaching approaches more cognitively accessible. This resonates with several findings [35], [74], who emphasize the critical role of deep content mastery in supporting dynamic, real-world teaching approaches. Meanwhile, the non-significant role of pedagogical knowledge echoes concerns raised by Huang *et al*. [73] and Yan and Zhao [72] that many pedagogical courses remain theoretical and detached from practice, particularly in Confucian-influenced educational systems.

The insignificant role of PCK diverges from some Western contexts, where pedagogy-focused coursework often predicts innovation readiness [20], [21]. This discrepancy reflects the specific challenges of Vietnam's teacher education system, where PCK might still be taught in a theoretical and examination-driven manner rather than through experiential, practical or reflective approaches. This resonates with findings from

Nguyen *et al*. [4] where Vietnamese educational reforms were found to prioritize curriculum updates without sufficiently transforming teacher preparation models, leading to a persistent gap between reform ideals and classroom realities. Consequently, although policies at ministerial level advocate for real-life mathematics teaching, the effectiveness of such reforms at school level critically depends on deep changes in teacher beliefs systems and instructional confidence, rather than curriculum design alone [75].

6. CONCLUSION

This study investigated how the knowledge, beliefs, and self-efficacy of pre-service mathematics teachers influence their intention to integrate real-life tasks into teaching, against the backdrop of Vietnam's competency-based educational reforms. The results showed that while CK was significantly associated with the formation of beliefs and instructional intention, pedagogical knowledge in its current form had no significant impact. CB of pre-service teachers were found to have a significant direct and indirect relationship with the intention to incorporate real-life tasks into mathematics instruction, with these beliefs exerting a greater influence than both self-efficacy and knowledge-related factors.

These findings have important implications for stakeholders. First, as CB are found to be the most impactful driver of intention, teacher education programs must intentionally foster progressive conceptions of the nature of mathematics and learning. Embedding reflective teaching practices, case-based learning, and inquiry-based field experiences could support this transformation. Second, boosting self-efficacy beliefs, particularly regarding classroom management, instructional strategies, and SE, is equally crucial. Authentic practicum experiences, mentoring models, and scaffolded teaching opportunities may help pre-service teachers develop resilience and adaptive expertise. Third, while enhancing CK remains essential, reforms must go beyond technical proficiency; they must deliberately link content with real-world contexts to foster teachers' confidence in designing meaningful tasks. Finally, for Vietnam's educational reforms to truly succeed, teacher education institutions must prioritize psychological development alongside academic preparation, ensuring that changes in beliefs occur alongside knowledge acquisition through reflective practice, mentoring, and authentic field experiences. Without constructivist integration of this kind, efforts to foster practical, life-connected mathematics education may falter despite strong curricular mandates.

Despite its contributions, this study has certain limitations. The limitations include: i) self-report bias; ii) cross-sectional design precluding causal inference; and iii) single-item knowledge indicators. As an initial attempt to examine these relationships, this study provides a foundation for further research. Moving forward, studies could also explore intervention programs specifically designed to strengthen CB and teaching self-efficacy during teacher education, testing their impact on classroom innovation.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
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Va : **Va**lidation
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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest in this research. The authors ensure that this research paper was done in compliance with ethical standards.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [TNTT], upon reasonable request.

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