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Exploring in-service university teachers' beliefs about the design of mathematical tasks

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Abstract
An analysis was conducted of university teachers' beliefs regarding the design of mathematical tasks. This mixed-methods research was carried out in three phases: participant selection, data collection, and data analysis. The sample consisted of 100 university mathematics professors. Data collection was conducted using a questionnaire focused on beliefs about the design of mathematical tasks. Exploratory factor analysis and confirmatory factor analysis were used for data analysis and validation. The results revealed two main components of beliefs: cognitive demand, socio-affective and evaluative aspects (C1), and accessibility and adaptability (C2). In conclusion, it was observed that university professors, when designing mathematical tasks, do not consider the importance of theories in mathematics education, which could limit their students' mathematical understanding.

Keywords: beliefs, university professors, mathematical task design, factor analysis

INTRODUCTION

A topic of great interest in various disciplines, such as psychology and education, is the study of conceptions. These are made up of beliefs, concepts, meanings, rules, and mental representations that a person has about a given subject (Angel-Cuervo et al., 2024; Golafshani, 2002; Saidah et al., 2025; Youssef & Alabdulaziz, 2024). In the educational field, multiple investigations have shown that beliefs have a significant impact on teaching and learning practices (Novikasari & Dede, 2021; Zuljan et al., 2021). Regarding teaching practices, it has been shown that teachers' mathematical knowledge is influenced by their beliefs about teaching in this area (Cormas, 2020). On the other hand, in relation to learning practices, teachers' beliefs can affect their students' academic performance, either positively or negatively (Hamukwaya & Haser, 2021; Zakaria & Mistima, 2012).

The search to characterize teaching acts has driven the realization of studies focused on teachers' reflections (Canogullari & Radmehr, 2025; Hannula, 2020; Liljedahl & Oesterle, 2020; Liljedahl et al., 2021; Morales-García et al., 2022; Novikasari & Dede, 2021). The objective of these investigations has been to explore the beliefs that these professionals have about how the teaching and learning process impacts their pedagogical practice. It is essential to understand that beliefs are judgments that a person makes about the truth or falsity of a proposition or statement (Pajares, 1992). Morales-García et al. (2022) carried out a study to characterize the beliefs of 12 in-service primary education teachers about the use of technology in the teaching and learning process of mathematics. In their research, they identified a total of 14 beliefs, which they grouped into five categories. Most of these beliefs were related to critical and affective aspects, reflecting motivational statements or statements

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Contribution to the literature

- This article contributes to the literature on mathematical task design, highlighting the key aspects that promote meaningful and effective student learning.
- This article presents university instructors' conceptions regarding mathematical task design.
- This article proposes a model for mathematical task design based on university instructors' beliefs.

of interest in integrating technology into mathematics teaching.

For their part, Novikasari and Dede (2021) identified four key components in preservice teachers' beliefs about the operation of multiplication in the area of mathematics. Their findings revealed that preservice teachers' belief system includes the idea that developing individual activities contributes to improving procedures and strategies for solving multiplication. Furthermore, they stated that mathematics textbooks could strengthen the multiplication process in students and consider that multiplication can only be solved using already known (procedural) strategies, which is perceived as ineffective in everyday situations. Research such as this underscores the importance of understanding how preservice teachers' beliefs will impact the teaching and learning processes of mathematical concepts, which can facilitate the implementation of strategies that benefit these educational processes.

Zuljan et al. (2021) suggest that teacher training programs should promote the development of positive beliefs about the mathematics teaching process. These beliefs, in turn, could positively impact student learning when addressing mathematical topics. Research indicates that attitudes and beliefs toward mathematics are crucial, as they influence students' motivation, engagement, and academic performance (Cervantes-Barraza et al., 2016; Koyuncu, 2021; Meza-Cascante et al., 2021). Therefore, fostering a positive educational environment can be crucial in improving perceptions and performance in this discipline (Alhyari et al., 2025).

Now, task design is considered the fundamental core of any teaching and learning process in mathematics, as well as in any educational research (Canogullari & Radmehr, 2025; Radmehr, 2023). Teachers and researchers are responsible for structuring these tasks with the aim of strengthening the teaching and learning processes. However, students have reported a lack of enjoyment towards the assigned tasks. These tasks often generate demotivation, boredom, and difficulties in understanding. The activities often lack interesting challenges and, in many cases, are excessive and irrelevant to the real-life situations students face (Bautista et al., 2023). Furthermore, there is a persistent belief that the process of mathematical comprehension is limited to memorization or the mechanical use of mathematical strategies, without students being able to understand the connection between the task and the underlying mathematical concept (Arenas-Peñaloza et al., 2024).

The National Council of Teachers of Mathematics (2000) emphasizes the importance of designing educational tasks that foster mathematical understanding, enabling students to acquire and communicate knowledge in this area. Therefore, several investigations have focused on optimizing mathematical comprehension processes among students (e.g., Arenas-Peñaloza & Rodríguez-Vásquez, 2022; Arenas-Peñaloza et al., 2024; Borji et al., 2023), creating reference frameworks that facilitate the design of mathematical tasks (Canogullari & Radmehr, 2025; Cervantes-Barraza & Aroca-Araujo, 2023; Radmehr, 2023). An example is the work of Radmehr (2023), who proposes a theoretical framework for the design of mathematical tasks, based on four fundamental principles that should structure each activity: inclusion, each task should consider prior knowledge, the student's experience, their cultural identity, and their experiences; cognitive demand: tasks should intellectually challenge students, increasing complexity or rigor without losing sight of inclusion; affective and social aspects: it is essential to incorporate findings from previous research that demonstrate a positive impact on attitudes toward and appreciation of mathematics, and theoretical perspectives on mathematical learning: each task should be supported by a theoretical perspective that promotes effective student learning in mathematics.

After reviewing the literature, we identified the significant influence that teachers' beliefs have on students' mathematics learning, and we highlighted the importance of designing effective mathematical tasks that foster students' development of mathematical knowledge. Therefore, it is assumed that the beliefs, attitudes, and pedagogical approaches adopted by teachers not only determine the teaching strategies used in the classroom but also directly impact how students construct and assimilate mathematical knowledge, which can either facilitate or hinder the development of a deep and meaningful understanding of mathematical content. In this context, the objective of this study is to analyze the profile of university teachers' beliefs regarding the design of mathematical tasks.

METHODOLOGY

This research is classified as a mixed-method study (Hernández-Sampieri & Mendoza, 2018) and is guided by a non-experimental design. This is because no

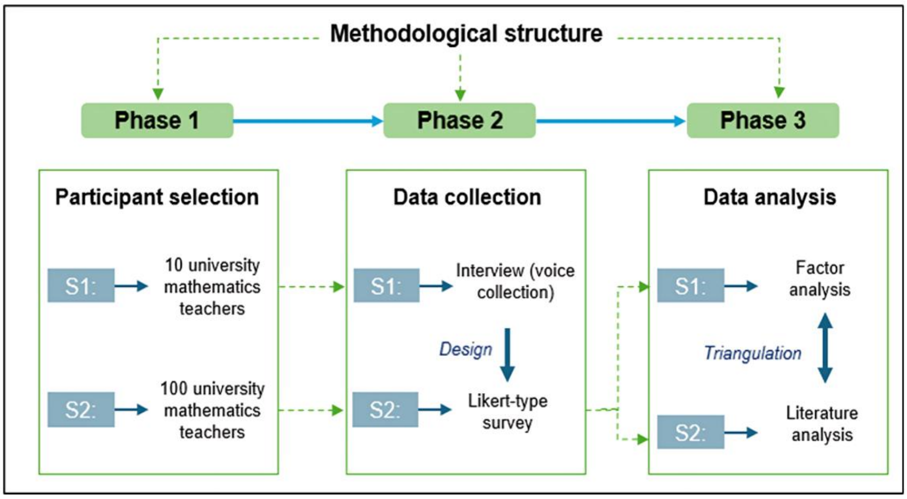

Figure 1. Methodological structure of the research (Source: Authors' own elaboration)

interventions were carried out on the variables within the population, limiting it to the observation of the phenomenon in its natural environment (Hernández-Sampieri et al., 2014). Furthermore, a cross-sectional study was conducted, which allowed for data collection at a specific time point (Hernández-Sampieri et al., 2014). The study has an exploratory and descriptive approach, as it focuses on analyzing the profile of beliefs of university professors in relation to the design of mathematical tasks. To this end, a thorough analysis of the instrument applied was performed, using the statistical software SPSS® (International Business Machines [IBM], 2024), with the aim of evaluating the validity and purpose of the collected data.

The study was conducted in three phases, each of which consisted of two stages (**Figure 1**). Regarding the first phase, participant selection, ten university professors with more than five years of experience teaching mathematics were selected, who correspond to the first stage. These professors shared their beliefs about the design of mathematical tasks. This information was essential for the development of the data collection instrument, which was implemented in the second phase. In the second stage, one hundred mathematics professors from various Colombian universities were selected and administered the designed survey. It is important to note that this sample was different from the one selected in the first stage.

For the second phase, which focuses on data collection, the first stage consists of an interview with the ten university professors selected in the first stage of phase one. The objective of this interview was to gather their opinions on the main concerns they face when planning or designing a mathematical task. The second stage of this phase involves the design of a Likert-type survey, based on the analysis of the ten professors' opinions using IRAMUTEQ software. This analysis allowed us to identify similarities in the professors' responses and construct a cluster map with three main classes, which were named according to characteristic textual segments. This created the instrument used in the study, whose purpose is to understand university professors' beliefs when designing mathematical tasks.

In the final phase of the study, data analysis, the first stage consisted of analyzing the information collected from one hundred university professors through a Likert-type survey. To carry out this analysis, an exploratory factor analysis (EFA) was performed to identify the underlying structures related to the instrument's dimensions and calculate the factor loadings and variance. Subsequently, a confirmatory factor analysis (CFA) was conducted to validate the bases and factor structure obtained during the EFA. For these quantitative analyses, SPSS® software (IBM, 2024) was used, which facilitated advanced statistical processing of the data and provided useful and accurate information for the discussion and conclusion of the study. This process corresponds to the second stage of this phase, in which the researchers triangulated the information.

Data Collection Instrument

The data collection instrument used was a Likert-type survey (https://forms.office.com/r/9apT9fJ5aJ). This survey was designed based on the characteristic text segments identified using IRAMUTEQ software in the interview transcripts of the ten university professors (time point one of phase 1). The IRAMUTEQ analysis grouped the responses into three main classes, defined within clusters: contextual structure of the mathematical task, planning of the mathematical task, and execution of the mathematical task. These names were assigned by the researchers after analyzing the results provided by the software. Consequently, the survey was structured into three categories, each with 10 items designed as statements (**Table 1**). The main objective of this survey is to explore university professors' beliefs regarding the design of mathematical tasks, based on their own experiences and perspectives.

Table 1. Affirmative items asked of university teachers in the Likert-type survey, related to the design of mathematical tasks

Statements
Category 1. Contextual structure of the mathematical task.
Item 1. It must be easy for the student to understand.
Item 2. It must be novel and engaging for the student.
Item 3. It must be easily memorable for the student.
Item 4. It must be interesting, challenging, and adapted to the student's context.
Item 5. It motivates the student to consolidate their knowledge.
Item 6. It must connect different mathematical concepts.
Item 7. It is designed to help the students' progress in their learning.
Item 8. It must make the student feel that the time they dedicate to its development is valuable.
Item 9. It must challenge the student's abilities to develop it.
Item 10. It is designed with a short time to complete.
Category 2. Planning of mathematical tasks.
Item 11. Have a direct connection to the course syllabus.
Item 12. Reflect the learning objectives.
Item 13. Promote constructive feedback.
Item 14. Be inclusive of the cultural and linguistic diversity of my students.
Item 15. Allow students to solve problems from different perspectives.
Item 16. Be challenging, engaging, and motivating for students.
Item 17. Allow for evaluation of my students' progress and performance.
Item 18. Allow for the development of a fair assessment.
Item 19. Enable a comprehensive assessment of the student.
Item 20. Assess the prior knowledge required by the student to complete it.
Category 3. Execution of the mathematical task.
Item 21. Work collaboratively to solve problems.
Item 22. Feel supported to clarify their doubts.
Item 23. Maintain their motivation to achieve the goal.
Item 24. Develop activities according to their pace and learning style.
Item 25. Be able to self-regulate during the activity.
Item 26. Use technological tools when solving proposed problems.
Item 27. Learn new ways to solve math problems.
Item 28. Receive timely feedback on the execution of exercises or problems.
Item 29. Have the necessary prior concepts to successfully complete the activity.
Item 30. Understand the prior knowledge required to complete the activity.

The survey was digitized to collect as many responses as possible from university mathematics professors. A rating scale of 1 to 5 was used, with 5 representing the highest rating and 1 the lowest. This methodology is based on previous studies that have developed questionnaires to measure the knowledge and teaching practices of university mathematics professors, as evidenced in the research by Castro and Gutiérrez-Santiuste (2021).

Data Analysis

To analyze the collected data, information triangulation was performed. First, a quantitative analysis was conducted using factor analysis (FA) using SPSS® statistical software. This process began with an EFA, followed by a CFA. In both cases, the Kaiser-Meyer-Olkin (KMO) and Bartlett's sphericity tests were applied to assess the suitability of the variables (30 items) in relation to the FA. Subsequently, the principal components extraction method was used to determine the total variance explained by the components. This approach included both extraction and rotation, resulting in a rotated component matrix (RCM). Thus, uncorrelated linear combinations of the variables were formed until the established model was achieved (IBM, 2024).

Regarding the qualitative analysis, an interpretation of the results obtained from the quantitative analysis of the data was carried out, based on the theoretical framework proposed by Radmehr (2023) for the design of mathematical tasks. This framework establishes that every mathematical task must be structured around four fundamental principles:

1. **Inclusion:** It is essential to consider each student's prior knowledge, experience, cultural identity, and life experiences.
2. **Cognitive challenge:** Activities should present a cognitive challenge, increasing complexity and rigor without compromising inclusion.
3. **Affective and social aspects:** It is important to consider affective and social aspects, so findings from previous research that demonstrate a

Table 2. Rotated component matrix of the EFA

Rotated component matrix

Variable	Component		
	1	2	3
Item 13. Promote constructive feedback.	0.903		
Item 18. Allow for evaluation of my students' progress and performance.	0.902		
Item 19. Allow for the development of a fair assessment.	0.875		
Item 20. Enable a comprehensive assessment of the student.	0.842		
Item 12. Reflect the learning objectives.	0.839		
Item 15. Allow students to solve problems from different perspectives.	0.834		
Item 7. Be designed to help students progress in their learning.	0.825		
Item 16. Be challenging, engaging, and motivating for students.	0.823		
Item 5. Motivate students to consolidate their knowledge.	0.809		
Item 11. Have a direct connection to the course plan.	0.789		
Item 9. Challenge students' abilities to develop them.	0.766		
Item 14. Be inclusive of my students' cultural and linguistic diversity.	0.759		
Item 6. Make connections between different mathematical concepts.	0.759		
Item 8. Make students feel that the time they dedicate to developing it is valuable.	0.745		
Item 17. Assess the prior knowledge required by the student to develop it.	0.742		
Item 4. Be interesting, challenging, and adapted to the student's context.	0.670		
Item 3. Be easily memorable for the student.	0.666		
Item 2. Be novel and engaging for the student.	**0.602**		
Item 1. Be easy for the student to understand.	**0.405**		
Item 23. Maintain their motivation to achieve the goal.		0.863	
Item 28. Receive timely feedback on the execution of exercises or problems.		0.853	
Item 29. Develop prior concepts to successfully complete the activity.		0.822	
Item 27. Learn new ways to solve math problems.		0.819	
Item 24. Develop activities according to their pace and learning style.		0.818	
Item 30. Understand the prior knowledge required to complete the activity.		0.810	
Item 25. Be able to self-regulate during the activity.		0.776	
Item 21. Work collaboratively to solve problems.		0.703	
Item 22. Feel supported to clarify their doubts.		0.665	
Item 26. Use technological tools when solving the proposed problems.		**0.616**	
Item 10. Be designed with a short execution time.			**0.834**
Item 13. Promote constructive feedback.	0.903		

Table 3. KMO and Bartlett's CFA tests

KMO measure of sampling adequacy		**0.920**
Bartlett's test of sphericity	Approximate Chi-square	3,020.568
	df	325
	Significance	0.000

positive impact on attitudes toward mathematics should be integrated.

4. **Theoretical perspective:** Each task should be supported by a theoretical perspective that promotes effective mathematics learning.

In this way, by incorporating the researchers' perspective, triangulation is achieved in the analysis of the data present in the study.

RESULTS

The initial FA configuration initially consisted of 30 items (**Table 1**). When applying EFA, it is recommended to use two factors consisting of 26 items, which exceeded the 0.61 explained variance value. This is because, when applying the varimax with Kaiser normalization rotation method, it was observed that item 1 (it must be easy for the student to understand) was not classified in any of the three initial factors yielded by the extraction method. Furthermore, item 10 (it must be designed with a short execution time) was classified only in factor three. Also, it was identified that items 2 (it must be novel and attractive for the student) and 26 (use technological tools when solving the proposed problems) presented minimal loadings in component 1 and component 2, respectively (**Table 2**).

With this result, a CFA was performed, applying the KMO and Bartlett's sphericity tests to the 26 items. Once again, the results of both tests were appropriate and confirmed the feasibility of carrying out the FA. This time, the KMO measure yielded a value of 0.920, closer to the ideal value of 1 than the result obtained in the EFA, which was 0.915. This indicates a better suitability of the data for performing the FA (**Table 3**).

Table 4. CFA comorbidity matrix

Communalities		
Variable	Initial	Extraction
Item 3. It can be easily remembered by the student.	1.000	0.612
Item 4. It is interesting, challenging, and adapted to the student's context.	1.000	0.598
Item 5. It motivates the student to consolidate their knowledge.	1.000	0.735
Item 6. It connects different mathematical concepts.	1.000	0.709
Item 7. It is designed to help the student progress in their learning.	1.000	0.790
Item 8. It makes the student feel that the time they dedicate to its development is valuable.	1.000	0.734
Item 9. It challenges the student's abilities to develop it.	1.000	0.738
Item 11. It has a direct connection to the course work plan.	1.000	0.627
Item 12. It reflects the learning objectives.	1.000	0.713
Item 13. It promotes constructive feedback.	1.000	0.857
Item 14. It is inclusive of the cultural and linguistic diversity of my students.	1.000	0.662
Item 15. Allow students to solve problems from different perspectives.	1.000	0.770
Item 16. Be challenging, engaging, and motivating for students.	1.000	0.734
Item 17. Assess the prior knowledge required by students to develop it.	1.000	0.604
Item 18. Allow for evaluation of my students' progress and performance.	1.000	0.843
Item 19. Allow for the development of fair assessments.	1.000	0.816
Item 20. Enable a comprehensive assessment of the student.	1.000	0.816
Item 21. Work collaboratively to solve problems.	1.000	0.559
Item 22. Feel supported to clarify their doubts.	1.000	0.533
Item 23. Maintain their motivation to achieve the goal.	1.000	0.828
Item 24. Develop activities according to their pace and learning style.	1.000	0.714
Item 25. Be able to self-regulate during the activity.	1.000	0.654
Item 27. Learn new ways to solve math problems.	1.000	0.743
Item 28. Receive timely feedback on the execution of exercises or problems.	1.000	0.802
Item 29. Have prior concepts to successfully complete the activity.	1.000	0.767
Item 30. Understand the prior knowledge required to complete the activity.	1.000	0.807

The comorbidity matrix shows that all items have an extraction value greater than 0.53 (**Table 4**), which is considered adequate. This indicates a significant correlation between the variables, and they are likely categorized into one of the two factors.

Subsequently, the principal components extraction method was applied to determine the percentage of variance accumulated in each factor. It was determined that, with two factors, the total variance explained was 72.17% representing a significant improvement compared to using initial 30 items in the EFA (**Table 5**).

Table 5. Extraction method: CFA principal axis factoring

C	Initial Eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	T	PV	CP	T	PV	CP	T	PV	CP
1	15.283	58.783	58.783	15.283	58.783	58.783	11.789	45.343	45.343
2	3.482	13.391	72.174	3.482	13.391	72.174	6.976	26.831	72.174
3	0.920	3.537	75.711						
4	0.754	2.901	78.612						
5	0.691	2.658	81.269						
6	0.641	2.464	83.734						
7	0.581	2.236	85.970						
8	0.478	1.838	87.808						
9	0.403	1.549	89.357						
10	0.372	1.431	90.788						
11	0.306	1.178	91.966						
12	0.287	1.103	93.070						
13	0.258	0.993	94.062						
14	0.234	0.900	94.962						
15	0.192	0.739	95.701						
16	0.188	0.724	96.425						
17	0.171	0.658	97.084						
18	0.135	0.519	97.603						
19	0.131	0.502	98.105						

Table 5 (Continued). Extraction method: CFA principal axis factoring

C	Initial Eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	T	PV	CP	T	PV	CP	T	PV	CP
20	0.107	0.413	98.518						
21	0.090	0.348	98.866						
22	0.081	0.313	99.179						
23	0.074	0.284	99.463						
24	0.056	0.214	99.677						
25	0.048	0.186	99.863						
26	0.036	0.137	100						

Note. C: Component; T: Total; PV: Percentage of variance; & CP: Cumulative percentage

Table 6. Rotated component matrix of the CFA

Rotated component matrix		
Variable	Component	
	1	2
Item 13. Promote constructive feedback.	0.905	
Item 18. Allow for evaluation of my students' progress and performance.	0.885	
Item 19. Allow for the development of a fair assessment.	0.866	
Item 20. Enable a comprehensive assessment of the student.	0.852	
Item 7. Be designed to help students progress in their learning.	0.845	
Item 16. Be challenging, engaging, and motivating for students.	0.834	
Item 5. Motivate students to consolidate their knowledge.	0.830	
Item 15. Allow students to solve problems from different perspectives.	0.828	
Item 12. Reflect the learning objectives.	0.826	
Item 9. Challenge students' abilities to develop them.	0.802	
Item 8. Make students feel that the time they dedicate to their development is valuable.	0.787	
Item 6. Make connections between different mathematical concepts.	0.784	
Item 14. Be inclusive of the cultural and linguistic diversity of my students.	0.784	
Item 11. Have a direct connection to the course syllabus.	0.781	
Item 17. I assessed the prior knowledge required by the student to develop it.	0.723	
Item 3. Be easily memorable for the student.	0.709	
Item 4. Be interesting, challenging, and adapted to the student's context.	0.697	
Item 23. Maintain their motivation to achieve the goal.		0.867
Item 28. Receive timely feedback on the execution of exercises or problems.		0.856
Item 24. Develop activities according to their pace and learning style.		0.825
Item 29. Provide the necessary prior knowledge to successfully complete the activity.		0.813
Item 30. Understand the prior knowledge required to complete the activity.		0.808
Item 27. Learn new ways to solve math problems.		0.803
Item 25. Be able to self-regulate during the activity.		0.786
Item 21. Work collaboratively to solve problems.		0.729
Item 22. Feel supported to clarify their doubts.		0.706

After applying the extraction and rotation methods, a new version of the RCM was obtained (**Table 6**). In this case, the variables (items) were organized into two factors according to their variance loadings. It can be observed that component 1 (factor 1) has 17 related variables (items), and component 2 (factor 2) has 9 related variables (items).

It is important to highlight that for both methods (extraction and rotation), the same analyses established in EFA were used. For the extraction method, principal components analysis was used, while for the rotation method, varimax analysis with Kaiser normalization was applied.

Figure 2 illustrates a model for task design based on the belief profile of university professors. This model relates the 26 identified variables (items) and their respective components. In this way, the model's goodness of fit was assessed, and the grouping of items was organized into each of the two identified components.

A qualitative analysis of the results processed by IBM (2024) SPSS software using the statistical technique of FA established that the beliefs held by university instructors when designing mathematical tasks are grouped into two major components or factors. These components, due to their relationship to the statements established in the items, can be designated as component 1 (C1), which can be assigned the name "cognitive demand, socio-affective and evaluative aspects." Component 2 (C2) can be referred to as "accessibility and adaptability."

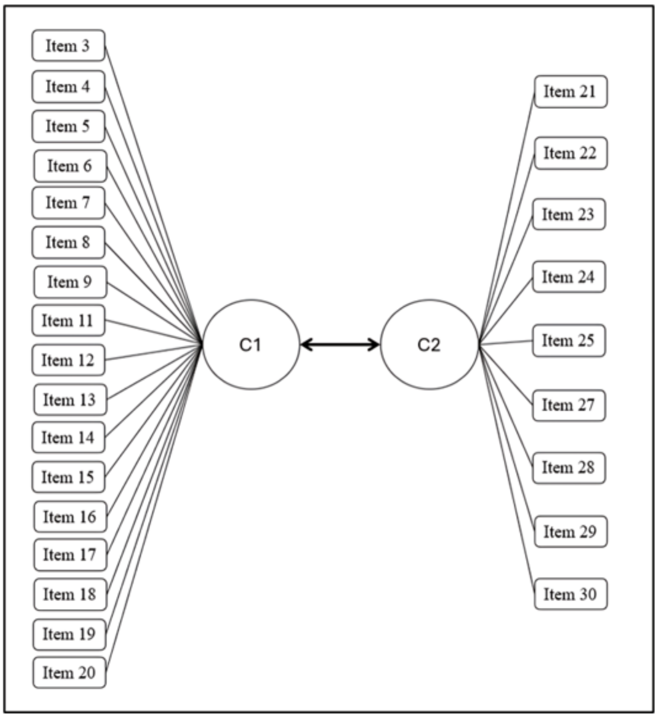

Figure 2. Model on the design of mathematical tasks: beliefs held by university teachers (Source: Authors' own elaboration)

Thus, 26 beliefs were identified, grouped into the two components mentioned above (**Table 7**). This reveals that university professors focus on designing tasks that require mathematical content and adapt to students' conditions, as well as on assessing their mathematical knowledge. However, they appear to neglect theories of mathematics education when creating these tasks.

DISCUSSION

In this research, the results obtained are highly relevant to the teaching and learning process of mathematics, especially with regard to the design of mathematical tasks. University instructors had the opportunity to express their beliefs about the design of these tasks through a Likert-type survey, developed based on the experience of ten educators. These findings will allow instructors to promote more effective pedagogical practices when designing mathematical tasks.

To design a mathematical task, it is essential to consider four elements related to cognitive demand: inclusion, affective and social aspects, and the application of a theory in the field of mathematics education. According to Canogullari and Radmehr (2025), it is essential for university teachers to understand and apply these four principles for the design of mathematical tasks, which will allow them to develop more effective and meaningful activities for their students, thus promoting better understanding and deeper mathematical learning. However, the results of the study indicate that university teachers generally

Table 7. University teachers' beliefs regarding the design of mathematical tasks

Cognitive demand, socio-affective and evaluative aspects	Accessibility and adaptability
They should be easily remembered by students.	Work collaboratively to solve problems.
They should be interesting, challenging, and adapted to the student's context.	Feel supported to clarify their doubts.
They should motivate students to consolidate their knowledge.	Maintain their motivation to achieve the goal.
They should connect different mathematical concepts.	Develop activities according to their pace and learning style.
They should be designed to help students progress in their learning.	Be able to self-regulate during the activity.
They should make students feel that the time they dedicate to their development is valuable.	Learn new ways to solve math problems.
They should challenge students' abilities to develop their knowledge.	Receive timely feedback on the execution of exercises or problems.
They should have a direct connection with the course plan.	Have prior knowledge to successfully complete the activity.
They should reflect the learning objectives.	Understand the prior knowledge required to complete the activity.
They should promote constructive feedback.	
They should be inclusive of the cultural and linguistic diversity of my students.	
They should allow students to solve problems from different perspectives.	
They should be challenging, engaging, and motivating for students.	
They should allow me to evaluate my students' progress and performance.	
They should allow for the development of a fair assessment.	
They should enable a comprehensive assessment of the student.	
I should assess the prior knowledge required by the student to complete it.	

apply only three of the four fundamental principles in the design of mathematical tasks. Similarly, Arenas-Peñaloza et al. (2024) highlight the importance of creating tasks that allow students to achieve an adequate level of formalization of mathematical concepts. At the same time, Bautista et al. (2023) point out that the tasks proposed by teachers lack interesting and engaging challenges. This demonstrates that teachers' beliefs about task design influence their students' mathematical understanding. Therefore, it is crucial for teachers to recognize the relevance of these principles when designing mathematical tasks.

The results revealed that university professors, when designing mathematical tasks, do not focus on guiding them from a theoretical perspective in the field of mathematics education. Instead, they focus on ensuring that the task is challenging and interesting for students, that it assesses their cognitive processes (both previous and new), and that it is inclusive of cultural and linguistic diversity. These are basic aspects that every mathematical task should have, according to other established studies (Cevikbas & Kaiser, 2021; Cervantes-Barraza & Araujo, 2023; Oliveira & Henriques, 2021; Radmehr, 2023).

However, Radmehr (2023) has pointed out the importance of supporting the design of a mathematical task from a theoretical perspective in the field of mathematics education. This would allow students to achieve the desired learning objectives and improve the effectiveness of tasks in the development of mathematical learning. However, the lack of this theoretical support in the design of tasks by university teachers could be one of the reasons why students do not achieve a good understanding of mathematical concepts, the latter being evidenced in the literature (García-García, 2024; Rodríguez-Vásquez & Arenas-Peñaloza, 2021; Tohir et al., 2022). Since these tasks do not usually require students to use skills to argue their mathematical processes, identify the nature of mathematical rules and/or structures, or support the veracity of their procedures by constructing quality justifications (Arenas-Peñaloza et al., 2024; Rodríguez-Nieto & Font, 2025).

For their part, teachers' beliefs are fundamental in the design and implementation of educational practices (Novikasari & Dede, 2021). Likewise, Zuljan et al. (2021) mentioned that beliefs play a crucial role in both teaching strategies and learning processes, directly influencing students' academic performance and the quality of mathematics education. At the same time, Cormas (2020) highlights that teachers' beliefs determine how they structure their classes and select content, which, in turn, impacts their students' learning. Therefore, establishing strong mathematical beliefs would lead teachers to improve their pedagogical practices, making them more effective (Zakaria & Mistima, 2012). Therefore, it is essential that these beliefs are aligned with solid theoretical approaches in the field of mathematics education, especially when teachers design mathematical tasks. This alignment could lead to significant improvements in university students' mathematical performance. Furthermore, it would facilitate a more effective interaction between theory and other key components in the design of a mathematical task, something that is often not reflected in the beliefs of university teachers when developing mathematical tasks.

CONCLUSIONS

This research reveals that the design of mathematical tasks involves the integration of various principles, allowing students to acquire or reinforce their mathematical knowledge throughout their development. Therefore, it is essential to continue investigating certain problematic aspects, such as the beliefs that teachers express when designing these tasks, as key factors in the mathematics teaching process. For example, incorporating the four principles of the theoretical framework proposed by Radmehr (2023) can significantly enhance this process. To optimize the design of mathematical tasks, it is crucial to establish the following aspects in order to promote meaningful and effective learning in students.

1. **Connection to prior knowledge:** It is essential that tasks consider students' prior knowledge and cultural experiences, allowing them to make more relevant connections to the content.
2. **Cognitive challenge:** Cognitive demand indicates that tasks should present intellectual challenges to students, thus fostering their critical thinking and problem-solving skills.
3. **Affective and social aspects:** It is essential to consider affective and social factors, as attitudes toward mathematics impact the learning process. Designing activities that promote a positive environment can significantly improve perceptions of this discipline.
4. **Theoretical foundation:** Each task should be supported by theoretical approaches to mathematical learning, which provides a solid foundation for developing competencies in this area.

By incorporating these principles, a more dynamic and effective learning environment is established, in which students not only acquire mathematical knowledge but also develop critical skills for their academic and professional future. It is important to highlight that one of the benefits of this research lies in the rigor of the analysis performed on the collected data, as well as in the design of the data collection instrument. These elements can serve as methodologies for future research in the field of mathematics education.

Furthermore, mathematics teachers could enhance their beliefs about task design that facilitates students' formalization of mathematical concepts when faced with their development. In this regard, future research could focus on the use of the four aforementioned elements to design and implement mathematical tasks, as well as on evaluating their effectiveness.

Finally, it is recommended that future research on task design and mathematical understanding focus on teacher training, promoting the implementation of workshops that allow teachers to learn about various educational theories and acquire tools to design tasks that strengthen students' argumentation and mathematical understanding. Furthermore, it is essential to develop and validate the theoretical model for task design, analyzing its applicability in teaching practice and adjusting its components to ensure its effectiveness in different educational contexts.

Likewise, it is important to continue exploring the design of tasks that promote mathematical understanding in university students, incorporating innovative and adaptive approaches that respond to their needs and learning styles. At the same time, it is essential to promote ongoing teacher training to enrich their understanding of task design and train them to implement effective teaching strategies. This contributes to the development of students' critical thinking and analytical skills, preparing them more solidly for their academic and professional performance.

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