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Challenges of Teaching Thinking Skills in Middle School Settings: Teachers' Perspectives

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Abstract: Background: Teaching thinking skills prepared students in middle school settings for future jobs through training them on how to solve problems and collaborate with their peers. **Aim:** The purpose of this study was to identify the challenges teachers face in teaching thinking skills and to propose a model that describes the relationship among these factors. **Methodology**: A sequential mixed-methods approach was employed to develop and evaluate the proposed model. The participants included 336 teachers working in middle school settings in the Sultanate of Oman. Confirmatory factor analysis was conducted to determine the loading coefficients of the model. **Results**: The findings indicated that self-efficacy and facilitation conditions significantly contribute to the effective teaching of thinking skills. Furthermore, teachers' attitudes and beliefs about teaching thinking skills positively impact their effectiveness in this area. Various external and internal factors, such as facilitation conditions, social support, and individual characteristics, influence these attitudes. However, this study did not explore the impact of teaching thinking skills on students' performance, which is an important area for future research. **Recommendations**: The study recommended that teacher training should strengthen self-efficacy and provide supportive conditions to improve the teaching of thinking skills. Future studies should explore how teaching thinking skills affects students' learning outcomes.

Keywords: : Thinking Skills, 21-Century Skills, Mixed-Methods Approach.

تحديات تعليم مهارات التفكير في مدارس المرحلة المتوسطة: وجهات نظر المعلمين

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الملخص: خلفية البحث: بلا شك أن تعليم طلبة المدارس في المرحلة المتوسطة يساعد في إعدادهم للوظائف المستقبلية وذلك من خلال تدريبهم على كيفية حل المشكلات والتعاون مع أقرانهم. **الهدف**: هدفت هذه الدراسة للتعرف على التحديات التي يواجهها المعلمون في تعليم مهارات التفكير، وكذلك تحديد العوامل المؤثرة في ذلك واقتراح نموذج يصف العلاقة بين هذه العوامل. **المنهجية**: تم استخدام المنهج المختلط (الكمي والنوعي) لتطوير وتقييم النموذج المقترح. وتكونت عينة الدراسة من 336 معلمًا يعملون في مدارس الحلقة الثانية بسلطنة عمان. وأُجري تحليل عاملي تأكيدي لتحديد ثقة معاملات النموذج. **النتائج**: أظهرت النتائج أن الكفاءة الذاتية وتوفير الموارد اللازمة تساهم بشكل كبير في تعليم مهارات التفكير. علاوة على ذلك، فإن اتجاهات ومعتقدات المعلمين نحو تعليم مهارات التفكير تؤثر بشكل إيجابي على كفاءتهم الذاتية في هذا المجال. كما أن هناك عوامل داخلية وخارجية تؤثرعلى تعليم مهارات التفكير، مثل توفير الظروف والإمكانات اللازمة وكذلك المساندة الاجتماعية والخصائص الشخصية للمعلم، على هذه المواقف. ومع ذلك، لم تستكشف هذه الدراسة تأثير تعليم مهارات التفكير على أداء الطلبة التحصيلي، وهو مجال مهم للبحوث المستقبلية. **التوصيات**: أوصت الدراسة بأن يعزز تدريب المعلمين الكفاءة الذاتية ويوفر ظروفًا داعمة لتحسين تدريس مهارات التفكير. يجب أن تستكشف الدراسات المستقبلية كيف يؤثر تدريس مهارات التفكير على نتائج تعلم الطلاب.

الكلمات المفتاحية: مهارات التفكير، مهارات القرن الواحد والعشرون، المنهج المختلط

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Background

Rapid technological advancements and evolving teaching strategies have transformed how students learn and how teachers prepare them for future jobs. As societies move toward globalization and knowledge-based economies, education systems must adapt to ensure learners acquire the competencies needed for lifelong learning (Office of the National Economic and Social Development Council [ONESD], 2016; UN, 2020). This shift requires educators to design learning activities that promote students' thinking skills in an era where information and technology play a central role (Khlaif, 2018; Jabali et al., 2024).

Globally, the 21st century has brought increasing recognition of the importance of higher-order skills. The U.S. Department of Education, for example, emphasizes the "4Cs"—collaboration, communication, creativity, and critical thinking—as essential competencies from early schooling through grade 12 (Alhanai & Almanthari, 2021; Joma, 2022; Kettler, 2014). They believe in 4Cs, individuals who can communicate well with their peers and collaborate with their environment in harmony can also think creatively and critically to face new environments (Al-Qawasmeh, 2024; Bağ & Gürsoy, 2021). Among these, critical thinking is particularly vital, as it involves disciplined processes of interpretation, analysis, evaluation, and inference that prepare individuals to navigate complex and dynamic environments (Facione, 1990; Joma *et al*., 2022a).

In the 21st century, jobs need workers to have skills that weren't needed in the past. Because of such differences, the way we teach and learn needs to alter so that students can learn the skills they need to improve and change their surroundings. It's clear that teachers are still having trouble getting today's kids to pay attention and learn, which will help them in the future. This is because the emphasis is on what people can do with the knowledge they have gained to analyze, evaluate, and synthesize information in order to address real-world issues. Jobs that need analysis, creativity, and problem-solving skills are more and more looking for people who can think critically (Ananiadou & Claro, 2009; Rimini & Spiezia, 2016).

Today's children, unlike former generations, grow up with rapidly changing technologies that make them less receptive to traditional modes of learning (Roehl *et al*., 2013). The adoption of active learning processes is essential to better prepare learners for the future. The capacity to engage in critical thinking enables an individual to proffer solutions to challenges in real-world contexts, rather than just equipping them with only specific knowledge of a set of concepts (Doerfert, 2011; Brierton *et al*., 2016). Critical thinking skills demand deep conceptual change and the reconceptualization of information to promote lifelong learning.

Despite the necessity for these skills, research reveals that teaching strategies that encourage the development of lower-order thinking are still being practiced globally (Obiete *et al*., 2015; Lee and Lai, 2017; Cañas *et al*., 2017). There is a resounding interest in the utilization of blended learning, particularly in higher education (Bergmann and Sams, 2012). Recent studies found that blended learning with collaborative inquiry-based learning, demonstrated favorable effects on the development of students' cognitive processes (Bidzan-Bluma *et al*., 2018).

Researchers defined thinking skills as a group of mental processes that are related to cognition. For example, Hitchcock (2018) considered it as perception, the formation of judgment based on previous knowledge and

information, attention, and concepts, which is characterized by direct and indirect relations between objects and phenomena in reality. Furthermore, Reshetnikova's (2019) thinking is based on the following procedures: "analysis, concretization, generalization, comparison, abstraction, and synthesis" (pp. 24-25). Djamas *et al*. (2021) mentioned that development of thinking skills is one of the crucial aspects of learning, as it influences and affects learners' activities.

Accordingly, the cultivation of thinking skills at the primary school level is important in the context of the current development. Efforts to promote and develop thinking skills should begin at the primary school level because this level is considered the best time to cultivate the basic foundation for further education (Seman *et al*., 2017; Joma *et al*., 2022c). However, the findings on the implementation of thinking skills in teaching and learning still indicated that teachers lacked knowledge in thinking skills and were unskilled in applying thinking skills (Kurniawan, 2020). Teachers also lacked practice in creative thinking skills, graphic management, asking high-level open questions, and teaching HOTS as a whole (Sukiman *et al*., 2013). This gap in teacher preparation emphasizes the critical need for professional development programs aimed at improving these competencies. By providing educators with the essential skills and tactics, we can create a climate that stimulates critical and creative thinking among students, resulting in better educational outcomes.

Problem statement

Previous studies have primarily examined specific cognitive talents, such as critical thinking and higher-order thinking skills in older adults, rather than focusing on the cognitive development of younger individuals (Yeung, 2012; Leung, 2013; Lee & Lai, 2017). Additionally, there is a lack of emphasis on how educators can effectively instruct and provide activities to enhance children's cognitive abilities (Kettler, 2014).

In a knowledge-driven culture, it is crucial for students to learn critical thinking skills (Yeung, 2012; Leung, 2013; Lee & Lai, 2017). The importance of these skills has grown significantly as robots and other technological devices increasingly replace jobs that involve repetitive tasks (Murnane and Levy, 2004; Cañas *et al*., 2017; Joma *et al*., 2022a). Therefore, it is essential for students to develop these skills.

Teaching children how to think critically during elementary and middle school is vital for preparing them for higher education and the job market (Seman *et al*., 2017). However, research indicates that many educators lack sufficient knowledge and practical strategies to effectively integrate thinking skills into their classrooms (Kurniawan, 2020; Sukiman *et al*., 2013).

This study addresses this gap by investigating how thinking skills are taught in Omani middle schools. It aims to provide evidence-based insights that can improve both the national curriculum and teacher training. The findings will contribute to a more profound understanding of current teaching practices and highlight areas for improvement. By equipping educators with the necessary tools and strategies, the study aspires to enhance the overall educational experience for students in Oman.

Ultimately, this research seeks to foster a more effective learning environment that nurtures critical thinking and problem-solving abilities among students. Such improvements are essential for preparing them to meet the challenges of a rapidly changing world. The study seeks to identify the barriers to teaching thinking skills from the perspectives of elementary school teachers and to explore the

relationships among these factors. Enhancing students' thinking skills could serve as an effective strategy to engage them in future employment and support community development.

Contribution

Developing thinking skills among students in public education has an important role in creating creative people, encouraging them to solve problems, fostering self-awareness of deep thinking among them and satisfying them with their education, and improving the quality of their societies' lives (Suwandari *et al*., 2019).

Research questions

The study sought to address the primary research question: (1) What are the factors influencing teachers teaching thinking skills? (2) What is the relationship among these factors? (3) What is the best-fitting model for exploring and explaining the relationships among the constructs of the challenges teachers face while teaching thinking skills?

Related studies

Developing and improving thinking skills are significant educational aims in public education, which fits the United Nations' sustainable development goals. Kettler (2014) considered it as one of the competencies essential for the 21st century. Earlier research concentrated on examining the enhancement of cognitive functions in the elderly population. The researchers assert that there is a deficiency of studies focused on the development of thinking skills within middle school environments (Sonmez *et al*., 2018). As technology advanced, educators utilized mobile devices to create and execute activities aimed at enhancing children's cognitive skills (Sonmez *et al*., 2018).

Several studies have been undertaken to explore various ways for enhancing the thinking skills of middle school children. (Bashith and Amin, 2017; Migdad *et al*., 2021) for example, studied the effect of employing a problem-based learning and project-based learning strategies on the development of thinking skills among students in six grades. The results of the study showed that the problem-based learning method worked well to improve the students' thinking skills. Numerous studies have examined the enhancement of students' thinking skills through the utilization of advanced technologies, including robotics (Bilbao *et al*., 2021) and collaborative robotics (Stewart *et al*., 2021), which improved their cognitive abilities and provided them with advanced competencies in computational thinking. In the other hand, a study by Sihaloho *et al*. (2017) demonstrated that problem-based learning significantly enhances the development of critical thinking skills in students when addressing physics problems.

A study by Kanmaz (2022) looked at how well middle school teachers could think critically and how they felt about teaching these skills. It found problems such as an inadequate curriculum, too many students in each class, not enough teacher training, and worries about slipping behind the pace of the program. The Anaktototy (2024) study investigated teachers' attitudes toward teaching thinking skills, identifying solutions they utilize and obstacles they face. The results showed that instructors have favorable attitudes, but they also face problems like not having enough resources and time. Ma (2023) also looked into how middle school teachers engage in critical thinking. It discovered that teachers had different ideas about what critical thinking was, which made it challenging to teach it consistently. Problems included a poor understanding of critical thinking ideas and insufficient professional development. Tee *et al*. (2018) examined the direct influence of three motivational factors—task value and self-efficacy—on the cognitive abilities of students. The results indicated that self-efficacy and task value significantly

impact the development of thinking skills in students' mathematical reasoning abilities. Furthermore, Dwyer (2023) performed an analytical review of obstacles to critical thinking in K–12 education. This review found that several factors hinder critical thinking in K–12 students, including inadequate skills, poor understanding of knowledge application, reliance on intuition, and emotional or biased reasoning. It stressed how important it is for teachers to know about these hurdles to teach critical thinking well. The study by Joma *et al*. (2022d) aimed to assess the challenges teachers face in teaching basic thinking skills and identify ways to overcome them from the teachers' perspective. The results indicated that 79.4% of teachers faced high challenges in employing basic thinking skills, while the need for these skills in schools in the Sultanate of Oman was assessed as medium. The study sample was experienced in estimating the challenges they face in teaching basic thinking skills and the need for their employment in schools in the Sultanate of Oman.

Types of thinking

Researchers identify various types of thinking, including indirect, close connection with speech, generalization, and connection with the solution of problems (Reshetnikova, 2019). Figure 1 represents the type of thinking.

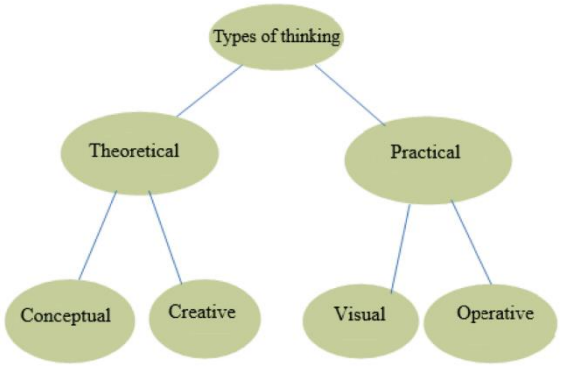

Figure (1): presents type of thinking adapted from Cai (2021).

Teachers' role

Studies have indicated that teachers should explicitly introduce and provide opportunities for students to practice various thinking strategies (Ben-David & Orion, 2013; King, Goodson, & Rohani, 2012; Zohar, 1999; Joma, 2022). However, simply teaching specific thinking strategies is insufficient. Teachers must also recognize the importance of developing students' habits of mind and metacognition simultaneously within subject content lessons (Joma *et al*., 2022c; Beyer, 2008b; Swartz *et al*., 2008). Only by addressing all three elements can students effectively acquire higher-order thinking skills (HOTS).

The integrated use of various thinking strategies, exhibition of relevant habits of mind, and the ability to think at a metacognitive level is called skillful thinking (Swartz & McGuinness, 2014). Swartz (2008) and McGuinness (1999) claim that teaching ST to students is possible through the "infusion" approach. Infusing involves explicitly teaching students relevant thinking strategies and simultaneously encouraging them to apply these strategies to enhance their subject matter knowledge and understanding (Swartz *et al*., 2008). For example, in the abovementioned situation, the teacher had explicitly described the mental steps involved in analyzing (through role-modelling) by looking at parts-whole relationships so that the students would better understand the subject matter, which is the properties of materials. Other thinking strategies (ST) that can be employed to analyze science concepts are looking at similarities and differences of science concepts, making inferences, providing reasons, and giving justifications. These specific strategies would help students break down scientific observations and understand how this information makes sense to them, leading to a better grasp of the subject content. Challenges encountered by teachers in teaching ST This field of research in ST has indicated a gap between the teachers' knowledge and their actual practices of ST (Alwehaibi, 2012;

Aubrey, Ghent, & Kanira, 2012; Beyer, 2008; Colcott, Russell, & Skouteris, 2009; Zohar, 2013; Zohar & Schwartzer, 2005). Actual teaching practices show disassociation between what teachers should teach and what actually takes place in classrooms. This is because teachers face challenges that hinder them from productively teaching ST in their lessons. One of the greatest challenges that teachers encounter is insufficient knowledge about ST; this has led to inadequate knowledge on how to infuse ST elements into content lessons. For example, science teachers were found to have inadequate knowledge about metacognition and how to teach reflective practices (metacognitive processes) and so they encounter difficulties in fostering metacognitive teaching in their science lessons (Ben-David & Orion, 2013; Zohar, 1999; Zohar & Barzilai, 2013). Furthermore, integrating ST with content teaching requires significant time and effort, including time for instructing students and for providing professional development programs for teachers on ST (Nilsson, 2009). Similarly, teachers also faced challenges in acquiring knowledge of students' ability in thinking, lack of educative teaching resources, constant changes in educational policies, school context and culture with high visibility of summative examinations, and teachers' beliefs in teaching ST (Barak & Shakhman, 2008; Yen & Halili, 2015; Zohar, 2013; Joma, 2022b). Although some studies have investigated these challenges, there is still plenty of room for further investigation to obtain information, specifically in primary school environments. This study aims at eliciting the various challenges novice teachers encountered in teaching ST in Year Four science classrooms. When teachers are actively involved in challenging students to think by using questions to guide their thought processes, they become more focused in their desire for knowledge. Effective implementation of inquiry instruction requires teachers to appropriately scaffold activities that will enable their students to understand how to exercise their minds as they collaborate with their peers and how to deeply reflect on their acquired step-by-step knowledge of how to resolve situations (Harris & Rooks, 2010; Gillies & Nichols, 2015). This approach fosters critical thinking and cultivates a classroom environment where students feel empowered to express their ideas and challenge each other's perspectives. As they engage in this collaborative learning process, they develop essential skills that will serve them well beyond the classroom. The study from Seman *et al*. (2017) reveals that the teacher is one of the main factors that influenced success or failure in teaching for HOTS. Moreover, Setyarini *et al*. (2018) state that teachers' perceptions of HOTS play a crucial role in their attitude towards HOTS-based questions. Due to the importance of teachers' ability in developing HOTS-based questions, this study aimed to investigate the challenges faced by in-service EFL teachers in developing HOTS-based questions. This issue is significant for the research because the challenges teachers face in compiling HOTS-based questions directly impact students' HOTS abilities. Teachers play a crucial role in successfully implementing HOTS in schools to produce a generation fit for the 21st century, a generation capable of improving the critical thinking and problem-solving skills necessary for navigating an increasingly complex world. By identifying these challenges, the study seeks to provide insights that can help educators enhance their teaching strategies and ultimately foster a more engaging and effective learning environment. This will not only empower students to excel in their academic pursuits but also equip them with the skills needed for lifelong learning. Furthermore, it emphasizes the importance of continuous professional development for

teachers, enabling them to adapt to new educational methodologies and technologies.

Method

Study Design: This study used an exploratory, sequential mixed-methods approach to achieve its objective. The initial qualitative phase involved in-depth interviews with participants to gather rich, detailed insights. This was followed by a quantitative survey designed to validate the findings and ensure a comprehensive understanding of the research topic. Combining these methods enabled a more nuanced interpretation of the data, uncovering patterns that a single approach might have missed. Ultimately, this research design enriched the findings and provided a robust framework for further investigation. In the sequential mixed methods approach, the findings of the first phase, which was the qualitative approach, were used to develop the second phase, which was the quantitative approach (Creswell & Clark, 2007).

Study population and Setting: The study was performed with Ministry of Education school teachers in the Sultanate of Oman.

Study Sample: The authors used a available sample for survey and the participants were teachers who are teaching in different schools and different grades and topics in Oman. The total number of participants in the study was 336 teachers. Table 1 represents the demographic information for the participants in the study.

Table (1): Demographic information of participants for the pilot study (N=336).

Socio-demographic characteristics		N	%
Gender	Male	185	55
	Female	151	45
Age group	21-26	65	19.3
	27-32	76	22.6
	33-38	62	18.6
	39-44	63	18.7
	>44	70	20.8
Teaching experience	1-3	67	19.9
	4-9	84	25
	10-15	88	26.2
	16-20	45	13.4
	>20	52	15.5

Data Collection Tool: Open-ended question forms were distributed to Omani teachers in Oman for 35 teachers and filled out by 25 teachers from different locations in Oman, recruiting them based on their study at a university in Oman.

A total of 340 responses were collected. Four surveys were excluded from the data analysis due to over 5% of the data being missing. Consequently, the researchers reported data from 336 participants.

***First phase*:** Collecting responses from open-ended question form

The researchers developed the open-ended question form based on the findings of previous studies related to teaching thinking skills. The form included general information about the study, the researchers, and the purpose of the study, and the second part included open-ended questions. A snowball method was used to recruit participants from different locations. The main criteria for inviting and selecting the participant were teaching in middle school settings, using different teaching methods, and being willing to teach thinking skills to his or her students. Participation in the study was on a voluntary basis.

The procedures of Braun and Clarke (2006) were used to analyze the qualitative data. The procedures involved transcribing the audio files, analyzing them line-by-line to identify ideas and concepts related to technology features and technostress, and grouping these concepts into subthemes and themes. The analysis revealed several key themes related to how technology can both enhance and hinder the teaching experience. Participants expressed a range of feelings about the integration of technology, emphasizing that it requires

effective training and support to mitigate technostress.

The findings of the qualitative data analysis revealed two themes: teachers' attitudes and beliefs about teaching thinking skills and the challenges of teaching thinking skills. The first theme describes the teachers' attitudes towards teaching thinking skills. Most of them hold positive attitudes toward teaching it. This theme helps researchers identify teachers' attitudes and the challenges of teaching it, which is reflected in the design of the quantitative data collection tool and the second theme, which was used to develop the tool's dimensions and the items of each construct from the participants' talk. The second theme reveals the importance of professional development in enhancing teachers' understanding and implementation of thinking skills in the classroom. By addressing these dimensions, the researchers aim to create a comprehensive framework that supports educators in effectively fostering critical thinking among their students. This framework will not only provide guidelines for instruction but also facilitate ongoing assessment and refinement of teaching practices. Ultimately, it seeks to empower educators to cultivate an environment where students can thrive as independent thinkers and problem solvers.

To identify the major challenges of teaching thinking skills, researchers counted the frequency of each factor, which helped them determine the most common factors influencing teachers' attitudes towards teaching these skills. Table 2 displays the frequency of the most influential factors affecting teachers' attitudes towards teaching thinking skills.

Table (2): shows the frequency of the most influential factors affecting teachers' attitudes towards teaching thinking skills.

Factor	Frequency
Instructional support	62
Professional development	59
School support	54
Colleagues support	48
Gender	45
Teaching experience	42
Self-efficacy	35
Teachers attitudes and beliefs	30

***Second phase*: Instrument design and development**

Building the dimensions of the survey and the 31 items of each dimension was based on the findings of the qualitative phase and the findings of previous studies. The constructs were facilitation conditions, social support, attitudes, individual characteristics, and self-efficacy. 13 items out of 31 items were adapted from related previous studies. Therefore, the researchers created a pool of items based on the discussions of participants from the qualitative phase and selected items for the survey according to constructs from related prior research.

Procedures for building the survey, first of all, the researchers agreed to include factors of the highest frequency, which were facilitation condition, social support, attitudes, individual characteristics, and self-efficacy. Second, the researchers create a pool of items from the participants' voices. Third, conducted a cognitive interview with five of the faculty members to check the items in terms of wording. Finally, a pilot study was conducted to find out the reliability and validity of the instrument. Exploratory factor analysis was conducted to find out the loading factors of each item on the constructs and the number of the factors. The researchers excluded the items that were loaded on two constructs or had a loading factor less than .40. The number of the factors was found by using an eigenvalue greater than 1 and a scree plot. The final version of the survey is composed of 8 constructs with 27 items.

Third phase: *Building and testing the research model*

In this phase, we tested the proposed model (see Figure 2) to clarify the causal relationships among the impacting factors teaching attitudes and beliefs towards teaching skills, teaching thinking skills, self-efficacy, according to the social influence comprised of school support and colleague support, and facilitation conditions, which consist of instructional support and professional development. In addition, the individual characteristics are categorized by gender and teaching experience. We developed and designed an online survey using Microsoft Forms to collect data from the participants. Participants were invited to take part by sharing a posting link in social media groups for teachers in Oman, and the researchers leveraged their network to distribute the survey to colleagues. The invitation letter included the link to the online survey, a definition of teaching thinking skills, and an explanation of thinking skills in middle schools. A total of 340 responses were collected. Four surveys were excluded from the data analysis due to over 5% of the data being missing. Consequently, the researchers reported data from 336 participants.

Statistical Analysis: To find out the goodness-of-fit indices, the direct, indirect, and total effects of the constructs, and their influence on the continuance intention to continue using mobile technology in online teaching, AMOS 24 was used for path analysis estimations. The pilot study was considered a mini-version of the main study; therefore, various statistical procedures were employed to assess the validity, reliability, and internal consistency of the tools. To identify the primary factor structures, an exploratory factor analysis (EFA) was conducted to describe and summarize the data, thereby clarifying relationships among the data (Gie Young and Pearse, p. 79). Hooper (2012) defined EFA as a set of mathematical procedures used to uncover latent variables within a large number of items (survey responses) and to reduce them into smaller groups. The pilot study informed and guided the development of the final tool and was instrumental in constructing the hypothesized model of the study.

Results

The researcher followed the five steps outlined by Williams, Onsman, and Brown (2010) to conduct exploratory factor analysis (EFA). The first step involves confirming the assumptions of EFA, which include the normal distribution of data, linear relationships among the variables, correlation, and an adequate sample size (Fabrigar, Wegener, MacCallum, and Strahan, 1999). Histograms, Q-Q plots, and kurtosis were utilized to assess these multivariate assumptions. The findings indicated that the skewness and kurtosis values were near zero, suggesting that the distribution of all variables was normal.

To ensure the sample was adequate, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was calculated, yielding a value of 0.82. A KMO value greater than 0.5 indicates an adequate sample size (Field, 2000). According to Miura (2011), maximum likelihood is the appropriate method for factor extraction when the data are relatively normally distributed. Furthermore, Fabrigar *et al*. (1999) note that factor extraction is employed to compute various indices for assessing the goodness of fit of the model (p. 277). Oblique rotation was applied to examine the correlations among the factors. Consequently, maximum likelihood was selected as the extraction method, with oblique rotation utilized in this data analysis. The dataset contained no missing values.

First, the assumptions of factor analysis were examined to confirm that data were appropriate for factor analysis. KMO=0.829 shows that data were suitable to conduct a factor analysis. In addition, Bartlett's test of

sphericity was significant chi-square $\chi 2$ (528) = 3347.79, p = .00. The findings show that the data were suitable for factor analysis.

Table (3): shows the number of factors that emerged in the instrument.

Items	Factor Loadings							
	1	2	3	4	5	6	7	8
Item3	.550							
Item4	.706							
Item9	.775							
Item10	.853							
Item11	.657							
Item12	.843							
Item15	.668							
Item24		.721						
Item25		.562						
Item26		.572						
Item27		.756						
Item28		.922						
Item29		.705						
Item32			471					
Item33			999					
Item34			993					
Item1				947				
Item14				915				
Item21					656			
Item22					830			
Item23					580			
Item17						553		
Item18						957		
Item19						461		
Item30							574	
Item31							917	
Item2								806
Item7								952

Different scholars have mentioned various techniques to address how to decide on the appropriate number of factors in a model (e.g., Ruscio & Roche, 2012; Field, 2000; Rietveld & Van Hout, 1993). These techniques are the screen test and eigenvalues greater than 1. Furthermore, Field (2000) and Rietveld and Van Hout (1993) added an additional technique which is that the number of factors represent about 70-80% of the variance, as well as the maximum likelihood estimation (Hoyle & Duvail, 2004, p. 306). According to the eigenvalue criterion, 8 factors that have an eigenvalue greater than 1 emerged in the instrument with a total variance of 66.429%. Table 3 shows the number of factors that emerged in the instrument. Any item with a factor coefficient lower than 0.4 was deleted from the survey items. No item loaded on more than one factor. Therefore, five items were removed from the survey. The factors are presented in table 3.

The correlation between the variables in the model was conducted by using bivariate correlations in SPSS and presented in Table 4. The criteria to meet the multicollinearity is that the bivariate correlations between two variables should be less than 0.9 (Field, 2000).

Table (4): Pearson product-moment correlations between measures of teaching thinking skills.

Measures	1	2	3	4	5	6	7	8
Teaching thinking skills	1							
Self-efficacy	.553**	1						
Teachers' attitudes	.230**	.468**	1					
Instructional support	.326**	.305**	.168**	1				
Colleague's Influence	.276**	.397**	.075*	.397**	1			
Professional development	.368**	.198**	.080*	.696**	.434**	1		
School support	-.002	-.112**	-.108**	.014	.088*	-.021	1	
Teaching experience	.249**	.082*	.144	.104**	-.031	.082*	-.030	1

Estimations of the model

Cronbach's alpha values were calculated to evaluate the reliability of the factors and their associated items. The researchers adhered to the criteria proposed by Fornell and Larcker (1981) to assess convergent validity. According to these criteria, factor loading must be significant and equal to or greater than 0.5; composite reliability should exceed 0.7, and the average variance extracted (AVE) should be greater than 0.5. The model estimations indicate a strong fit between the model and the

data, with a Chi-Square ($\chi 2$) value of 33.568, degrees of freedom (df) of 13, a $\chi 2/df$ ratio of 2.582, and $p < 0.05$. The reliability of the factors was found to be acceptable, with values ranging from 0.73 to 0.87 (Abu Al-Aish & Love, 2013; Hair *et al*., 2006). Figure 2 presents the estimations of the path coefficients.

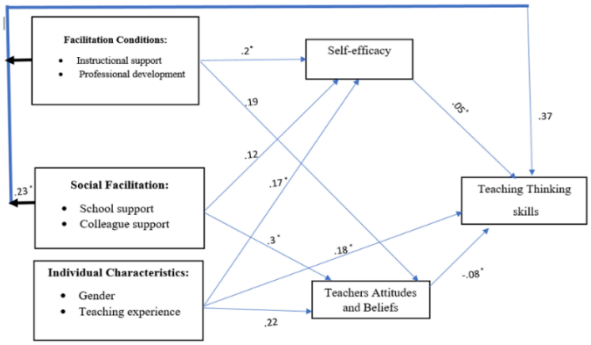

Figure (2): presents the estimations of the path coefficients.

Path Modelling

Figure 1 illustrates the exogenous variables in the model, which include social influence—comprised of school support and colleague support—and facilitation conditions, which consist of instructional support and professional development. In addition, the individual characteristics are categorized by gender and teaching experience. Figure 2 displays the estimations of the path coefficients. Moreover, the model fit was evaluated using various fit statistics, which are detailed in Table 5.

Table (5): The fit indices of the model

Chi-square ($\chi 2$)	**35.568, *df*=7**
Root Mean Square Error of Approximation (RMSEA)	.012
Normed Fit Index (NFI),	.956
Comparative Fit Index (CFI)	.956
Tucker-Levis Index (TLI)	.948

The findings in table 5 show that the model is a good fit and provides an explanation of the hypothesized model. Other estimations were calculated, such as total effect, direct, and indirect, and presented in Table 6.

Table (6): Direct, indirect, and total effect of each factor.

Variables			
Endogenous (Dependent) Variable Teaching thinking skills			
Exogenous (Independent) Variables	**Direct Effects**	**Indirect Effects**	**Total Effects**
Self-efficacy	.05*	-	.07
Teachers' Attitudes and Beliefs	-	-	-
Individual features	.17	-	.17
Social facilitations	.23	.08	.31
Facilitation conditions	.37	.05	.42
Endogenous (Dependent) Variable Self-efficacy			
Exogenous (Independent) Variables			
Facilitation conditions	.2	-	.2
Teachers' Attitudes and Beliefs	-	-	-
Social facilitations	.12	-	.12
Individual features	.17	-	.17
Endogenous (Dependent) Variable Teachers' Attitudes and Beliefs			
Exogenous (Independent) Variables			
Self-efficacy	-	-	-
Facilitation conditions	.19	-	.19
Social facilitations	.3	-	.3
Individual features	.22	-	.22

Teaching thinking skills

According to Table 6 and Figure 2, eight variables accounted for 41% of the variance in teaching thinking skills in middle school settings. The strongest direct effect was found in teachers' beliefs and attitudes regarding teaching thinking skills (Beta = .422).

These variables had a significant overall impact on teachers' teaching thinking skills. The level of influence was based on teachers' attitudes and beliefs, previous experience, colleagues' influence, and self-efficacy. This highlights the importance of professional development and support systems that foster positive attitudes among educators. By

addressing these key areas, schools can enhance the effectiveness of teaching thinking skills and ultimately improve student outcomes.

Self-efficacy

In general, all the hypothesized paths were significant to explain the self-efficacy, 29% of its variance (see Table 6). Teachers' beliefs and attitudes (Beta=.357) had a significant direct effect on teaching thinking skills, followed by facilitation condition (Beta=.37). These findings suggest that fostering positive beliefs and attitudes among teachers is crucial for enhancing their effectiveness in teaching critical thinking skills. Additionally, the role of the facilitation condition indicates that supportive environments are essential for maximizing educational outcomes.

Teachers' Beliefs and Attitudes

Table 6 shows that the present model clarified 34% of the variance in teachers' beliefs and attitudes regarding teaching thinking skills. Colleagues' influence (Beta = .22) had a strong direct effect, followed by previous experience (Beta = .26) and quality of service (Beta = .191). These findings suggest that fostering a supportive professional environment among colleagues can significantly impact teachers' perspectives on teaching critical thinking. Additionally, enhancing the quality of educational services provided may further contribute to shaping these beliefs and attitudes.

Colleagues' Influence

The instructors' influence significantly affected colleagues' support (Beta = .17), and it explained 20% of the variance in colleagues' influence. This highlights the importance of leadership in shaping collaborative environments. Moreover, fostering strong relationships among instructors can further enhance the overall support system within the organization.

Discussion

By using a path analysis approach, a model to describe the relationship between the factors influencing teachers' teaching thinking skills was developed based on the data collected in the present study. The path analysis approach enables us to assess the relationships between the factors influencing teachers' teaching thinking skills in middle school settings in Oman. The factors in the present model explained 41% of the various significant amounts of variance in adapting teaching thinking skills in the Omani context. The results of the present study indicated that most of the hypothesized factors have a significant influence on teaching thinking skills. The present study sheds light on the complex process of teaching thinking skills as a new approach in the Oman educational system to equip middle school students with 21st-century skills. The model provided new strategies to encourage teachers to teach thinking skills by conducting professional development and offering instructional support, while also suggesting future research opportunities for researchers in Oman and other Middle Eastern countries. This initiative not only aims to enhance the pedagogical techniques of educators but also seeks to foster a culture of critical thinking among students. By prioritizing these skills, the educational framework can better prepare young learners to cope with a rapidly changing world.

The most influential factor affecting teachers' readiness to teach thinking skills was their attitudes and beliefs. This finding is consistent with the findings of existing studies (e.g., Briz-Ponce *et al.*, 2017; Cheon *et al.*, 2012; Qteishat *et al.*, 2013; Joma, 2022c) that focus on the importance of the users of any new technology or teaching method. Understanding and addressing these attitudes is crucial for implementing effective training programs. By fostering a positive mindset toward innovative

teaching methods, educators can enhance their confidence and effectiveness in cultivating critical thinking skills among students.

Moreover, the current study identified various factors that influence teachers' beliefs and attitudes towards teaching thinking skills, such as colleagues and social support. Moreover, additional factors related to individual characteristics, such as gender and teaching experience, also play a role. These insights suggest that tailored professional development opportunities could be beneficial in addressing specific needs based on these influencing factors. By recognizing and leveraging these elements, educational institutions can create a more supportive environment that empowers teachers to embrace and implement effective strategies for teaching critical thinking. These findings were consistent with previous studies, including those by Retnawati *et al*. (2018) and Suparman *et al*. (2021).

Professional development plays an important role in mitigating the challenges faced by teachers who are struggling to integrate new teaching methods into their practice, especially regarding the design of suitable activities and materials (Joma, 2022; Borg, 2018; Cai, 2021; Edward, 2020; Sprott, 2019). These findings are crucial for providing guidance on how to change teachers' attitudes and improve their performance in developing suitable materials for teaching thinking skills. This can ultimately lead to enhanced student engagement and better learning outcomes. By fostering a supportive environment for professional growth, educators can more effectively adapt to evolving pedagogical demands.

Conclusion

The purpose of this study was to investigate the challenges faced by Omani teachers in teaching thinking skills in middle school settings and to explore the interrelationship between these factors in order to develop a model that describes this relationship. The study revealed that teachers' attitudes and beliefs significantly impact the development of their thinking skills instruction. These attitudes are shaped by various external and internal factors, including facilitation conditions, social support, and individual characteristics. Professional development is essential for equipping teachers with the skills needed to create effective materials and activities for their students. Additionally, instructional support is vital to the teaching process. A limitation of this study is that it relied on self-reported tools. It is important to investigate how strategies for teaching thinking skills affect students' performance and achievements by conducting empirical and experimental studies that include a larger and more diverse sample of students from different locations in Oman. Such research could provide valuable insights into the effectiveness of various teaching methodologies. Furthermore, it would contribute to the development of tailored instructional strategies that address the unique needs of students across the region. By incorporating a range of educational approaches, educators can better understand the nuances of student learning. This knowledge will ultimately facilitate improved educational outcomes and foster critical thinking skills that are essential in today's complex world.

Disclosure Statement

The authors declare that they have no relevant or material financial interests that relate to the research described in this paper

– **Ethical approval and consent to participate:** The study was conducted following the ethical standards of the A'Sharqiyah University research committee. Informed consent was obtained from all participants ensuring confidentiality and voluntary participation.

– **Availability of data and materials:** The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.
– **Author contribution:** All authors listed have contributed to the work and approved it for publication. The authors have worked in an organized manner. Amjad Joma and Jokha Al-Sawafi prepared the literature review and previous studies. Abdullah Alkhatib and Mohamed Al Sinani are responsible for designing the research instruments. Mohammed Al Tobi and Amur Al-Habsi oversee collecting the data. Sharif Alsoudi and Mohamed Alrabeei are analyzing and interpreting the results. Amjad Joma finalized a draft article and critical review of the article and submitted the final version of the article after the authors read and approved the final manuscript.
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