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School supportiveness and innovative abilities in vocational education: the mediating role of motivation to innovate among vocational teachers

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Creativity and innovation have become essential elements for vocational teachers to drive advancements in education. This study aimed to explore the innovative capabilities of vocational teachers and compare these abilities across the different levels of classes they teach. Furthermore, a causal model of innovative educational capabilities (IEC) was developed and validated to investigate the innovation that vocational teachers in Northern Thailand can employ. We utilized data from a cross-sectional survey of 560 vocational teachers to estimate and validate the causal model using Analysis of Moment Structures (AMOS). The results revealed that the overall innovative capability levels were high. There were statistically significant differences in innovative capabilities across class levels of teaching. Ultimately, the causal model demonstrated a good fit to the data and showed that motivation to innovate can mediate the relationship between school supportiveness (SCS) and innovative educational capabilities.

KEYWORDS

innovative ability, school supportiveness, motivation, vocational teacher, mediating role

1 Introduction

Creativity and innovation have emerged as core components in education, driving progress in the Education 4.0 era (González-Salamanca et al., 2020). In Thailand, a key reason for emphasizing innovation and creativity as core elements in the 13th National Economic and Social Development Plan (2023–2027) is the significant transformation in global conditions, including economic, social, and environmental factors, and natural resources, both domestically and internationally (Office of the National Economic and Social Development Council, 2022). These developments place pressure on Thailand to adapt more broadly, necessitating proactive initiatives that capitalize on the country's strengths (Office of the National Economic and Social Development Council, 2022). Therefore, the development plan prioritizes innovation, aiming to integrate it across all dimensions to enhance the country's capabilities. In particular, innovation is viewed as a significant tool for promoting national development through education.

The education landscape is undergoing a transformative shift with the advent of the Education 4.0 era. This new phase of learning extends beyond traditional knowledge dissemination to emphasize the development of essential 21st-century skills. It promotes the nurturing of teachers' abilities to think critically, solve problems, and tackle challenges with

innovative solutions (Lamb et al., 2017; Tan, 2015). Especially, fostering teaching innovations among teachers is important for effective learning management (Stasewitsch et al., 2022). Innovation serves as a tool for enhancing the efficiency of learning processes and improving students' learning outcomes (Sintaphanon, 2010). Teachers are required to be capable of creating innovations in line with Thailand's educational reforms for the second decade, which mandate that modern educators facilitate learning, manage instruction effectively, and meet national quality standards (Office of the Education Council, 2010). It is essential for teachers to engage in continuous self-development themselves and pursue new knowledge. Furthermore, the ability to implement innovations is considered a critical skill for teachers in the 21st century (Dechakupt and Yindeesuk, 2014).

The development of creative and innovative abilities in modern education is closely linked to the application of information technology, which serves as an effective means to enhance the quality of classroom teaching management at all levels (Mubarak and Selimin, 2023). These methods within educational organizations are identified as educational innovations, which are divided into product and process innovations (Vincent-Lancrin et al., 2019). However, educators play a crucial role in implementing these innovations effectively. Therefore, teachers' creativity and innovation are essential for fostering educational development. Many scholars have identified key aspects of teachers' creativity and innovative abilities (Chumkesornkulkit and Na-Wichian, 2018; Nijenhusi, 2015; De Bes and Kotler, 2011; Dyer et al., 2011; Kanter, 1988; Gkontelos et al., 2023). After synthesizing the elements of creativity and innovative abilities within the framework, three key elements were identified: idea generation, idea promotion, and idea realization (Chumkesornkulkit and Na-Wichian, 2018; Nijenhusi, 2015; De Bes and Kotler, 2011; Kanter, 1988). The following sections will discuss each of these three components of innovative abilities and specify the components to be examined in this study.

First, idea generation involves the application of existing knowledge, skills, and experience, combined with the consideration of diverse stakeholder perspectives. This process facilitates the expansion of ideas beyond conventional frameworks, including the creation of potential products or the processing of ideas (Chumkesornkulkit and Na-Wichian, 2018; Nijenhusi, 2015; De Bes and Kotler, 2011; Kanter, 1988). These represent individual perspectives for the initiation of innovative ideas. These skills contribute to the creation of new ideas that are instrumental in improving and modifying products, services, and processes that are beneficial to an organization. Second, idea promotion involves a combination of actions that create interaction and direct the attention of others to understanding new ideas (Gammelgaard, 2009). Moreover, it includes connecting and retrieving information from various resources and evaluating the validation and accuracy of the information obtained. This also involves seeking support and sponsorship, building collaboration, and persuading others to agree with certain ideas through cooperative efforts (Chumkesornkulkit and Na-Wichian, 2018; Nijenhusi, 2015; De Bes and Kotler, 2011; Kanter, 1988). Idea promotion is a major aspect of connecting and retrieving skills, supporting idea development and problem-solving. It involves analytical and judgmental capabilities that are used to evaluate the value of an idea and solution (Scott et al., 2004). This is a significant sub-skill for promoting creativity and innovation. Third, idea realization involves transforming ideas into reality, which leads to practical applications. Innovation begins with the recognition of a problem and the generation of ideas or alternative solutions. Subsequently, the process involves seeking resources that support these ideas and strives to create solutions. Ultimately, innovators finalize their concepts by developing prototypes or models of the innovative product. Therefore, innovation can be either tangible or intangible, offering an experience that can be diffused, mass-produced, and put to productive use (Chumkesornkulkit and Na-Wichian, 2018; Nijenhusi, 2015; De Bes and Kotler, 2011; Kanter, 1988). These three elements of innovative abilities are explored in the investigation.

The environment also serves as a significant external indicator to teachers, which can be defined as the degree to which individuals perceive that their colleagues or school actively promote innovation (Cai and Tang, 2022; Park, 2012). According to organizational climate theory, the work environment is characterized by a set of attributes perceived by employees, which, in turn, shape their behavior within the organization (Reichers and Schneider, 1990; Schneider et al., 2013). One key dimension of this phenomenon is perceived organizational support (POS). There are significant influences on worker's behavior and attitudes (Schneider et al., 2013). A supportive internal environment, known as an organizational climate for innovation (OCI), is essential for organizations to harness innovation, create a competitive advantage, and improve performance (Volery and Tarabashkina, 2021; Kissi et al., 2012). In addition, the characteristics of a school's organization and context significantly influence the sustainability of educational innovations within a school (Prenger et al., 2022). Environmental favorability can be demonstrated by the level of practical support for innovation, specifically through the provision of time and resources for teachers to explore and develop innovative ideas (Birdi et al., 2016). A supportive climate is a vital element that enhances information exchange and facilitates collaborative problem-solving. Furthermore, an environment characterized by mutual support is positively associated with innovative capabilities (Zhou and Verburg, 2020; Arif et al., 2012) and with teachers' perceptions of principal learning support and change-oriented work behavior (Lee et al., 2020). Therefore, supportiveness in schools was included to investigate the magnitude of its impact on teachers' innovative abilities. The variables likely to influence these abilities are detailed in the following section.

Motivation to innovate (MTI) is an important factor. Empirical studies and theory support this effect. Von Stamm (2008) states that innovation cannot be commanded, it must arise from an individual's internal motivation, and it is driven by enthusiasm, inspiration, and knowledge. According to Bhaduri and Kumar (2011), it is important to recognize an individual's intrinsic desire to innovate. Therefore, inspiring innovation within an organization must be a primary concern in fostering human relationships, along with motivation and hope (Von Stamm, 2008; Bhaduri and Kumar, 2011; Seidler and Hartmann, 2008). Furthermore, the theory extends this idea by emphasizing that motivation plays a crucial role in driving desired behaviors. Expectancy value theory (EVT) verifies that motivation for a given behavior is determined by two factors. First, there is expectancy, which refers to how probable it is that an anticipated outcome is achieved through behavior. Second, there is value, which reflects how much the individual values the desired outcome (Vroom, 1964). Moreover, EVT provides a framework for explaining whether and how learners choose to engage in learning tasks for

self-development within and across educational fields. According to this theory, learners' decisions regarding engagement are influenced by their expectations of success, the subjective value they place on tasks, and the perceived costs associated with choosing one option over another (Wang and Degol, 2014; Eccles, 2009). When learners believe they can succeed, they are more likely to engage in deeper learning and employ advanced cognitive strategies, which, in turn, are positively linked to academic accomplishment (Wagner and Dintersmith, 2015; Eccles and Wigfield, 2002).

The existing literature suggests that school supportiveness can influence innovative capabilities (Volery and Tarabashkina, 2021; Zhou and Verburg, 2020); however, innovative capabilities may not always align solely with school supportiveness. Therefore, this study posits that the mediating effect of motivation to innovate is an important indicator of an individual's intrinsic desire to innovate (Bhaduri and Kumar, 2011), which is also affected by school supportiveness and innovative capabilities. In summary, to comprehend the factors contributing to the development of innovation, a causal model of innovative educational capabilities (IEC) was developed and validated to motivate vocational teachers in Northern Thailand. In addition, the present research aimed to explore the innovative capacities of vocational teachers in Northern Thailand and compare them across the different class levels they teach. Applying a micro perspective to innovation in vocational colleges may help in understanding the creative and innovative contributions of teachers. Moreover, this will also provide deeper insights into vocational teachers' innovative capabilities.

2 Methodology

2.1 Research design

This study was carried out using quantitative methods with an associative research design, including mediation analysis. One of the research objectives was to investigate the relationship between school supportiveness (SCS), motivation to innovate (MTI), and innovative educational capabilities (IEC) among vocational teachers in Northern Thailand. The research framework is illustrated in Figure 1.

2.2 Participants

A sample of 560 vocational teachers from the Office of the Vocational Education Commission in Northern Thailand participated in this study. The sample size was determined using the ratio of sample size to variables, ensuring at least 15 cases per parameter for causal model analysis (Hair et al., 2010). In addition, multistage sampling was employed in this study. The sample included 258 male (46.07%) and 302 female (53.93%) participants. Among the respondents, 26.07% ($n = 146$) were teaching in the Chiangmai area, 24.46% ($n = 146$) in the Lamphun area, 16.78% ($n = 94$) in the Phrae area, 13.39% ($n = 75$) in the Lampang area, 10.54% ($n = 59$) in the Chiang Rai area, and 8.76% ($n = 49$) in the Phayao area. The majority of the participants were assigned to teach the high vocational certificate curriculum (43.93%, $n = 246$), while 37.86% ($n = 212$) were assigned to teach the vocational certificate curriculum and 18.21% ($n = 102$) were assigned to teach both the high vocational certificate and vocational certificate curricula. Moreover, the majority of the participants have 1–5 years of teaching experience (24.83%, $n = 139$), while 20.36% ($n = 114$) have 5–10 years of teaching experience.

2.3 Measurements

Three scales were employed in this study. We constructed scales that measured content validity, high content validity, and good internal reliability.

2.3.1 School supportiveness

The school supportiveness scale (SCSS) included six items related to material supportiveness, college supportiveness, and administrator supportiveness, organized into three subscales. This scale was adapted from the one developed by Tracey and Tews (2005). The participants were asked to reflect on school

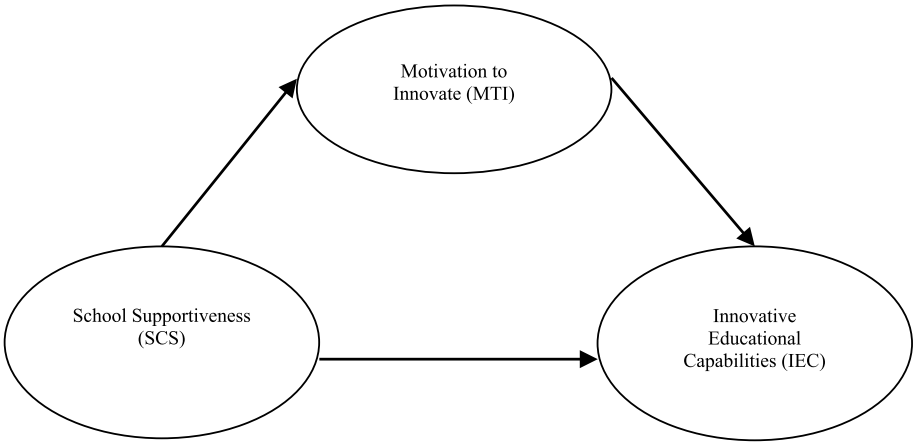

FIGURE 1
Research framework diagram.

supportiveness using a 5-point rating scale, where 1 represented the lowest level of supportiveness and 5 represented the highest level of supportiveness (e.g., "The College has sufficient instruments and equipment for fostering educational innovation."). Higher scores indicated greater school supportiveness. The internal consistency indicated high reliability (α = 0.81).

2.3.2 Motivation to innovate

The motivation to innovate scale (MTIS) included six items related to the anticipation of success in work performance and recognition of the value of work, organized into two subscales (Seidler and Hartmann, 2008; Weiner, 1985). The participants were asked to reflect on motivation using a 5-point rating scale, where 1 represented the lowest level of motivation and 5 represented the highest level of motivation (e.g., "I develop educational innovations to enhance teaching skills and increase my expertise."). The higher the score, the greater the motivation. The Cronbach's alpha reliability coefficient was 0.84 (α = 0.84), indicating high reliability.

2.3.3 Innovative educational capabilities

The innovative educational capabilities scale (IECS) comprised 12 items across three subscales. The subscales were innovative initiation, proposing connected ideas and designing solutions, and transforming ideas into reality and inventing practical applications. These subscales were developed by synthesizing elements of creative and innovative abilities from previous studies by Chumkesornkulkit and Na-Wichian (2018), Nijenhusi (2015), De Bes and Kotler (2011), and Kanter (1988). The IECS assessed the degree to which individuals perceived their own behaviors/capabilities, using a 5-point rating scale, where 1 represented the lowest level of behaviors/capabilities and 5 represented the highest level of behaviors/capabilities (e.g., "I initially studied learning management approaches and material innovation"). Higher scores indicated greater behaviors/capabilities. A pilot study showed that the internal consistency indicated high reliability (α = 0.88). The content validity was measured by eight subject matter experts; the content validity ratio (CVR) was higher than 0.75 (Lawshe, 1975). Therefore, this pilot study demonstrated that the innovative educational capabilities scale (IECS) is a reliable and valid instrument for assessing innovative educational capabilities.

2.3.4 Demographics

Five demographic questions were presented in a checklist format, asking the participants to fill out their information. These questions were about gender, school area, curriculum level, and teaching experience.

2.4 Data collection

A cross-sectional study was performed. The scale was developed using a paper-and-pencil format. The participants were asked to complete the scale. The study details and information regarding informed consent were presented on the first page, and only those who agreed to participate completed the entire scale. The participants were informed that their participation was voluntary and that their data would be handled confidentially for research purposes. All data were collected by the researchers.

2.5 Data analyses

Descriptive statistics were used to examine the level and range of scores, including the mean (M), standard deviation (SD), kurtosis (Ku), skewness (Sk), coefficient of variation (CV), and Cronbach's alpha reliability coefficient (α). A one-way ANOVA was performed to examine the differences in innovative educational capabilities among the three groups, categorized by the level of the classes or the curriculum taught. The effect size was calculated using the eta square statistic $0.01 < \eta^2 < 0.05$, indicating a small effect size, $0.06 < \eta^2 < 0.13$, indicating a moderate effect size, and $\eta^2 > 0.14$, indicating a large effect size (Cohen, 1988). Pearson's correlation analysis was conducted to test the relationships between the variables. In addition, a causal analysis was conducted using Analysis of Moment Structures (AMOS). A two-step approach to structural equation modeling was utilized in this study (Anderson and Gerbing, 1988). First, a confirmatory factor analysis was conducted to determine whether the measurement model fit the data. After confirming an acceptable fit of the measurement model, the structural model was tested. Traditional goodness-of-fit indices were employed to evaluate model fit, including the comparative fit index (CFI) (CFI values of 0.90 or greater indicate that the model adequately fits the data), the Tucker–Lewis index (TLI) (TLI values should be 0.95 or greater), the goodness-of-fit index (GFI) (GFI values should be 0.90 or greater), and the root mean square error of approximation (RMSEA) (RMSEA values of 0.06 or less indicate that the model adequately fits the data) (Bollen, 1989; Hu and Bentler, 1999).

3 Results

3.1 Preliminary analyses

The mean, kurtosis, and skewness scores and the coefficient of variation for three variables (school supportiveness, motivation to innovate, and innovative educational capabilities) were calculated (see Table 1). All Cronbach's alpha reliability coefficients for each variable were greater than 0.80, which indicated high reliability (see Table 1). The means, standard deviations, and Pearson's correlation coefficients for the eight observed subscales are shown in Table 2. All observed subscales were significantly correlated with each other.

3.2 Capability level and comparison of innovative educational capabilities

The capability levels of vocational teachers revealed an overall high score (see Table 3). The majority of vocational teachers were categorized as having a high capability level (65.89%). Then, when considering each teaching level, the teachers who teach the vocational certificate curriculum (65.57%), the high vocational certificate

TABLE 1 Descriptive statistics and reliability coefficients for the variables.

Variable	Range	*M*	SD	Ku	Sk	CV (%)	α
School supportiveness	1.67–4.83	3.61	0.65	−0.45	−0.17	18.01	0.81
Motivation to innovate	1.33–5.00	3.77	0.67	−0.55	0.62	17.77	0.84
Innovative educational capabilities	2.42–5.00	3.96	0.51	−0.44	−0.17	12.88	0.88

Range, range of scores; M, mean; SD, standard deviation; Ku, kurtosis; Sk, skewness; CV, coefficient of variation; α, Cronbach's alpha coefficient.

TABLE 2 Means, standard deviations, and Pearson's correlation coefficients for the observed subscales.

Subscale	1	2	3	4	5	6	7	8
1. MAS	1							
2. COS	0.64**	1						
3. ADS	0.48**	0.55**	1					
4. ASWP	0.33**	0.41**	0.42**	1				
5. REVW	0.46**	0.47**	0.28**	0.48**	1			
6. INI	0.28**	0.25**	0.20**	0.52**	0.44*	1		
7. PCIDS	0.29**	0.29**	0.16**	0.50**	0.41**	0.78**	1	
8. TIRIA	0.48**	0.43**	0.34**	0.46**	0.50**	0.60**	0.64**	1
M	3.41	3.68	3.71	4.11	3.44	4.00	4.02	3.87
SD	0.74	0.70	0.88	0.66	0.89	0.53	0.54	0.50

** $p < 0.01$.
MAS, material supportiveness subscale; COS, college supportiveness subscale; ADS, administrator supportiveness subscale; ASWP, anticipation of success in work performance subscale; REVW, recognition of the value of work subscale.
INI, innovative initiation subscale; PCIDS, proposing connected ideas and designing solutions subscale; and TIRIA, transforming ideas into reality and inventing practical applications subscale.

TABLE 3 A one-way ANOVA for the differences in innovative educational capabilities across class levels of teaching.

Class level of teaching	Innovative educational capabilities			Test of homogeneity of variances	Source	One-way ANOVA				
	M	SD	level			SS	MS	*F*(2, 557)	*p*-value	η^2
Vocational certificate	3.86	0.51	high	Levene statistics = 0.208	Between group	2.36	1.18	4.733	0.009	0.17
High vocational certificate	3.73	0.49	high	$p = 0.81$						
High and vocational certificate	3.72	0.51	high		Within group	138.94	0.25			
Total	3.78	0.50	high							

SS, Sums of Squares; MS, Mean Squares.

curriculum (63.42%), and the high and vocational certificate curricula (72.55%) were all classified as having a high capability level (see Figure 2).

A one-way ANOVA was conducted to examine the differences in innovative educational capabilities across class levels of teaching. The results revealed statistically significant differences in innovative educational capabilities across class levels of teaching ($F(2,557) = 4.733$, $p = 0.009$). The effect size was large for these effects ($\eta^2 = 0.17$) (see Table 3). A *post-hoc* Scheffe test indicated that the innovative educational capabilities scores of the teacher who teaches the vocational certificate curriculum ($M = 3.86$, SD = 0.52) were statistically significantly higher than the innovative educational capability scores of the teacher who teaches the vocational certificate curriculum ($M = 3.73$, SD = 0.49) (see Table 4).

3.3 Validation of a causal model of the innovative educational capabilities with motivation to innovate mediator

The results of the confirmatory factor analysis for the school supportiveness model indicated an acceptable fit to the data: chi-squared (6, $N = 560$) = 188.21, p-value < 0.001, TLI = 0.78, CFI = 0.83, and RMSEA = 0.11. The model of motivation to innovate revealed a statistically significant chi-squared value, indicating an acceptable fit to the data: chi-squared = 140.281 (14, $N = 623$), p-value < 0.001, TLI = 76, CFI = 0.86, and RMSEA = 0.10. Although the RMSEA showed a slightly higher value, the GFI and TLI were sufficiently high to retain the specified model. All standardized coefficients are shown in Table 5.

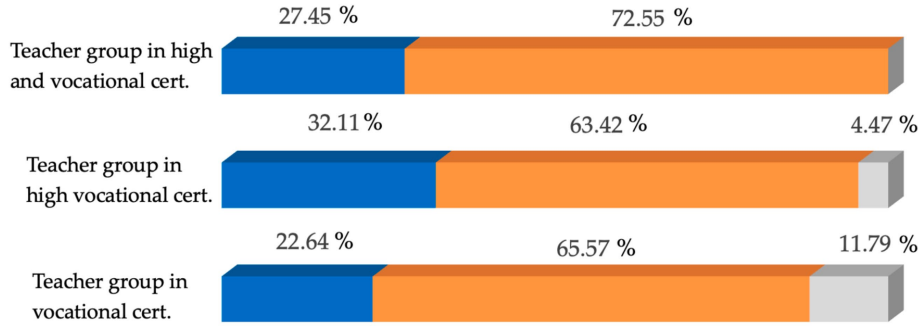

FIGURE 2
Percentages of innovative educational capabilities across class levels of teaching.

TABLE 4 A *post-hoc* Scheffe test for teaching-level differences in innovative educational capabilities.

Method	Teaching levels		*M*-diff	*p*-value
Scheffe test	Vocational certificate	High vocational certificate	0.13	0.022
		High and vocational certificate	0.14	0.062
	High vocational certificate	Vocational certificate	−0.13	0.022
		High and vocational certificate	0.01	0.978

M-diff, Mean difference of innovative educational capabilities.

TABLE 5 Factor loadings for the measurement scale.

Measure	Standardized factor loading (β)
School supportiveness (SCS)	
MAS	0.75***
COS	0.86***
ADS	0.64***
Motivation to innovate (MTI)	
ASWP	1.00***
REVW	0.60***
Innovative educational capabilities (IEC)	
INI	0.73***
PCIDS	0.81***
TIRIA	0.71***

*** $p < 0.01$.
MAS, material supportiveness subscale; COS, college supportiveness subscale; ADS, administrator supportiveness subscale; ASWP, anticipation of success in the work performance subscale; REVW, recognition of the value of the work subscale; INI, innovative initiation subscale; PCIDS, proposing connected ideas and designing solutions subscale; TIRIA, transforming ideas into reality and inventing practical applications subscale.

TABLE 6 Results of the causal model for testing mediated effects.

Exogenous variables Endogenous variables	Path	School supportiveness	Motivation to innovate
Innovative educational capabilities	TE	0.91**	0.93**
$R^2 = 0.617$	IE	0.69**	-
	DE	0.22**	0.93**
Motivation to innovate	TE	0.74**	-
$R^2 = 0.541$	IE	-	-
	DE	0.74**	-

** $p < 0.01$.

The result of the causal model revealed that the chi-squared value of 59.36 was not significant [(11, $n = 560$), $p = 0.94$, CFI = 0.972, GFI = 0.971, TLI = 0.930], and the RMSEA was 0.087. In summary, the model appeared to represent a good fit to the data. The results of the direct effect indicated that the direct paths from school supportiveness (SCS) to innovative educational capabilities (IEC) ($\beta = 0.22$, $p < 0.001$), from motivation to innovative (MTI) to innovative education capabilities (IEC) ($\beta = 0.93$, $p < 0.001$), and from school supportiveness (SCS) to motivation to innovative (MTI) ($\beta = 0.74$, $p < 0.001$) were all significant (see Table 6).

4 Discussion

The capability levels of vocational teachers were overall high. This suggests that many of the vocational teachers placed significant importance on the positive outcomes of self-development to prepare for innovation, ultimately benefiting their students. This is consistent with the policy of cultivating individuals who possess the qualities outlined by the professional teaching standards in Thailand (Office of the National Economic and Social Development Council, 2022; Office of the Education Council, 2017). Moreover, the ability to implement innovation

is considered one of the essential competencies for teachers in the 21st century (Dechakupt and Yindeesuk, 2014). Considering the three domains of vocational teachers' innovative educational capabilities, first, the innovative initiation domain leads to the creation of new ideas and plays a key role in improving and modifying products, services, and processes that benefit the college. Moreover, scholars have highlighted the critical role of teachers as initiators of innovation (Burns, 2013; Pugh and Zhao, 2003). These essential components of teachers' innovative educational capabilities were found to be at a high level. Second, the domain of proposing connected ideas and designing solutions plays a crucial role in facilitating interactions and encouraging others to take note of these ideas. This involves integrating and retrieving ideas through collaborative efforts to promote creative and innovative capabilities (Soto-González et al., 2023; An et al., 2014; Scott et al., 2004; Kanter, 1988). This collaboration helps teachers achieve high levels of innovative educational capabilities. Third, the domain of transforming ideas into reality and inventing practical applications recognizes problems and generates alternatives to resolve them. Therefore, these ideas are transformed into reality and lead to practical applications in the classroom. Ultimately, innovation becomes a useful instrument for specific situations (Kanter, 1988). Therefore, in this study, the teachers showed that they possessed high-level innovative educational capabilities.

Regarding differences in teachers' innovative educational capabilities, the results indicated that there are statistically significant differences in innovative educational capabilities across different teaching levels. Specifically, the teachers who teach the vocational certificate curriculum showed significantly higher innovative educational capabilities compared to those teaching at other class levels. This suggests that the curriculum level may play a crucial role in fostering innovative skills among vocational teachers, potentially due to the specific demands and challenges associated with vocational education at this level. In addition, vocational teachers are committed to enhancing their capabilities to create and develop educational innovations for their students (Phakamach et al., 2023; Messmann and Mulder, 2011). The vocational certificate teachers' motivation to innovate was higher than that of the other teachers. Moreover, these students are at the stage of beginning practice-oriented vocational learning, which requires teachers to seek out and create innovations that lead to highly effective learning management through their own expertise.

Testing the full model of the three variables—innovative educational capabilities, school supportiveness, and motivation to innovate—resulted in a statistically significant chi-squared value, which indicated that the model fit the data well. In addition, the results of the structural equation modeling supported the hypothesis that school supportiveness is positively correlated with innovative educational capabilities. Although this study found only a weak positive correlation, this result aligns with the theoretical characteristics of organizational climate theory, which argues that a positive, supportive climate encourages teachers to take the initiative and engage in innovative practices (Wessels and Grünwald, 2023; Schneider et al., 2013). Teachers should feel valued, and there should be a supportive school environment to assist them by providing the necessary resources and encouragement to innovate effectively (Schneider et al., 2013). Moreover, previous findings indicate that environmental support is positively associated with innovative capabilities (Zhou and Verburg, 2020; Birdi et al., 2016).

More importantly, motivation to innovate can mediate the relationship between the two dimensions of innovative educational capabilities and school supportiveness. This implies that there is a mediator for innovative educational capabilities. Previous findings have shown that school supportiveness can enhance motivation among teachers, which is a crucial factor for fostering innovation in educational settings (Cai and Tang, 2022). Moreover, these findings suggest that intrinsic motivation for innovation is crucial for teachers' innovative behavior, which includes their initial willingness to identify opportunities for innovation, the effort they invest in generating multiple ideas, and the persistence needed to implement the ideas (Cromwell et al., 2023; Birdi et al., 2016; Kissi et al., 2012; Von Stamm, 2008). Motivation to innovate, which plays a mediating role, could potentially increase the likelihood of vocational teachers enhancing their innovative educational capabilities.

5 Conclusion

This study investigated the supportive and motivational mechanisms underlying teachers' innovative capabilities, with a particular focus on these capabilities. The findings indicated that the vocational teachers' innovative capabilities were at a high level. Furthermore, innovative capabilities varied across teaching levels. Specifically, the innovative capabilities of the vocational teachers who taught the vocational certificate curriculum were statistically significantly higher than those of the vocational teachers who taught other curricula. The causal model of innovative educational capabilities demonstrated a good fit to the sample data. Ultimately, school supportiveness and motivation played significant roles in enhancing the teachers' innovative capabilities.

5.1 Limitations and recommendations

There are several potential limitations associated with the current study. First, this study relied on self-reported data from teachers, which may have introduced subjectivity and recall bias, potentially affecting the accurate understanding of the relationship between perceived school supportiveness and innovative capabilities. Second, regarding regional representation, it cannot be assumed that the characteristics of one region will necessarily apply to other regions. Third, regarding sample size, there are two limitations to note. While the sample size met the minimum requirement for structural equation modeling and comparison, the distribution of teachers across the certificate curriculum groups was not entirely equal. This might have slightly impacted the comparison analysis.

Furthermore, in this study, a quantitative method was employed using a questionnaire. The majority of the questions were closed-ended, which resulted in direct answers to very specific questions. To deepen the understanding of the relationship between school supportiveness, motivation to innovate, and innovative capabilities and to enhance the robustness of self-reported data, future research should adopt a mixed-methods research design. This type of design would combine quantitative and qualitative methods, such as in-depth interviews with triangulation, providing a more comprehensive understanding of these relationships.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Institutional Review Board of Chiang Mai Rajabhat University (Decision No. IRBCMRU 2023/250.03.07). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

PF: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Visualization, Writing – original draft, Writing – review & editing. FB: Data curation, Investigation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict.

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