

Creative and Innovative Skills of Thai Students: A Causal Mediation Analysis of Learning Attitudes

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Abstract: In recent years, creative and innovative skills have been essential in promoting learning and fostering learner development. This research aimed to investigate the influence of the learning environment and learning management on students' creative and innovative skills in secondary demonstration schools, with learning attitude serving as a mediating variable. The sample comprised 6th-grade students at a demonstration school in Thailand. Using a stratified sampling method, 300 students were selected. The research instrument was a questionnaire. Data analysis employed descriptive statistics and composite-based structural equation modeling. The findings indicate that the learning environment and learning management had a statistically significant positive influence on learning attitudes, and learning attitudes had a statistically significant positive impact on creative and innovative skills. Learning attitude fully mediated the relationship between the learning environment and creative and innovative skills and partially mediated the relationship between learning management and creative and innovative skills. This research proposes that school administrators, teachers, parents, and related stakeholders should organize activities that enhance learning management and the learning environment, fostering positive attitudes toward learning and developing learners' creative and innovative skills.

Keywords: Creative and Innovative Skills, Learning Attitude, Secondary School Students.

Received: 02-08-2025

Accepted: 22-12-2025

1. Introduction

Creative and innovative skills are fundamental competencies for the 21st century, imperative for advancing human resources and transforming a nation's economy and society through the application of knowledge in research and innovation (Office of the National Economic and Social Development Council, 2019). It is paramount for educational institutions and educators to encourage creative thinking and innovation among students, as these are principal objectives of education and academic development (Dilekçi & Karatay, 2023; Gregory et al., 2013). Creative skill denotes the

capacity to generate novel ideas and engage in imaginative thinking, encompassing unconventional thinking beyond traditional boundaries, brainstorming, and perceiving issues in unconventional ways while employing specialized techniques in practice. It involves amalgamating existing notions or elements to foster valuable innovations. Conversely, innovation skill consists of applying creativity to yield tangible results that enhance the value of processes and products (Amabile et al., 1996). Consequently, cultivating creative and innovative skills is vital for preparing learners to possess the audacity to think critically, act decisively, and innovate continuously, and to demonstrate analytical thinking and problem-solving capabilities to comprehend and address intricate challenges within their respective fields (Kivunja, 2015). Creative thinking and innovation are vital for driving positive transformations and boosting efficiency across diverse professional domains. Educational institutions must prioritize and champion creative thinking throughout learners' academic journey (Yusup et al., 2023).

Schools are pivotal in endorsing and nurturing students' creative and innovative skills by establishing learning environments that foster these proficiencies (Dilekçi & Karatay, 2023). This encompasses classroom settings, school atmospheres, and external surroundings (Fraser, 2015). Learning environments are strategically designed to create spaces for learning that ignite students' passion, foster collaboration, and position students at the center of the learning experience through diverse pedagogical approaches, thereby equipping them with 21st-century learning competencies (Cansoy, 2018; Johnson, Adams, & Cummins, 2012). The management of student learning, ranging from curriculum design, teaching methodologies, evaluation, and assessment (Lynch, 2012), along with advocating for student engagement in the learning process (Balakrishnan, 2022), plays a pivotal role in nurturing creativity and innovation (Davies et al., 2013). Proficient learning environments and adept instructional management empower students to acquire pertinent skills and attitudes toward learning, encompassing perception, knowledge, and conduct (Stangor, Jhangiani, & Tarry, 2014), thereby facilitating the application of knowledge and creative skills that culminate in innovation (Great School Partnership, 2013).

Attitudes toward learning motivate students to engage in practices that enhance creative and innovative skills (Anaktototy, 2023). These attitudes are vital for the success of educational institutions and learners in nurturing students' abilities. The existing literature highlights the role of learning attitudes as mediators, facilitating the transmission of the effects of the learning environment and instructional management on students' creative and innovative skills. This is attributed to the influence of the learning environment and instructional management on shaping students' attitudes toward comprehending learning objectives, motivating them to employ creative thinking for successful innovation (Kwon & Park, 2022; Schweder et al., 2019). Additionally, students with learning goals strive to engage with environments that support creativity, particularly those who can adapt flexibly to varying educational settings. Such students are inclined to utilize goal-oriented learning strategies and possess creativity skills (Wang et al., 2023).

Research on students' creativity and innovative skills predominantly comprises experimental studies that explore teaching methodologies and innovations within educational settings to enhance creative and innovative capabilities (Azizah, Dafik, & Susanto, 2018; Chen & Chen, 2021; Gregory et al., 2013). However, there is a notable absence of studies focusing on students' creativity and innovative skills in specialized educational settings, such as demonstration schools, which serve as practice-based laboratories and research centers for teacher education (Demonstration School of

Silpakorn University, 2020). Furthermore, limited research utilizing causal relationship models exists to comprehensively investigate the mediating role of learning attitudes. Addressing these gaps not only provides empirical evidence from an understudied educational context but also enables a critical examination of prevailing theoretical assumptions, specifically, whether established models of learning environments, instructional management, and creativity operate similarly within demonstration schools. By testing the mediating role of learning attitudes in this unique setting, the present study extends existing theories of creativity development. It may challenge the uniform applications of these theories across different school types. Hence, there is a need for research inquiries that explore the impact of learning management and environments on students' creative and innovative skills in Thai secondary demonstration schools, with a specific focus on learning attitudes as crucial mediating variables that facilitate effective skill development.

2. Literature Review

2.1. Creativity and Innovative Skill

Creativity and innovative skills involve generating novel ideas by utilizing existing knowledge to cultivate fresh insights or by instigating original thoughts, resulting in advantageous innovations not previously generated by any individual (Partnership for 21st Century Skills, 2004). Within the educational realm, creative and innovative skills refer to learners' ability to offer solutions and problem-solving strategies, enabling them to engage in unrestricted thinking, explore diverse interests, enhance problem-solving skills, and equip themselves for success in future endeavors (Azizah et al., 2018). The components of creativity and innovative skills encompass: 1. Engaging in creative thinking, which includes the selection of techniques for generating new ideas, such as brainstorming, fostering fresh and comprehensive ideas, both building upon and diverging from existing knowledge, exploring, refining, scrutinizing, and assessing existing knowledge to enhance and advocate for it. 2. Collaborating creatively with others, involving the cultivation of innovative ideas that can be effectively utilized and conveyed to others, opening avenues and embracing new viewpoints, diversity in collaborative settings, demonstrating both conventional and innovative practices, perceiving reality through novel perspectives, interpreting failure as a learning opportunity, and recognizing that creativity evolves through learning from errors, which constitutes a part of achieving success. 3. Executing innovations, which entails utilizing creative concepts to develop advantageous and ethical innovations within their respective domains (Partnership for 21st Century Skills, 2004).

2.2. Learning Environment

The learning environment encompasses a school's educational, social, and cultural conditions within a wide range of learning experiences, both in and out of the classroom (Great School Partnership, 2013). Fraser (2015) categorized the elements of the learning environment into two main categories: Classroom environment, which denotes the learning atmosphere within the classroom, the evaluation of educational advancements, and the results of student cooperation; and school environment, which relates to the school's ambiance concerning personnel, including teachers and academic staff. This entails evaluating factors such as interpersonal connections,

supportive elements, interaction with students, student growth, dimensions of the educational system, staff independence, participatory decision-making, advancement in innovation, adequacy of resources, and work satisfaction.

2.3. Learning Management

Smith and Lynch (2010) elucidated the concept of learning management as the capacity to develop instructional approaches to attain students' learning objectives. In contrast, Lynch (2012) characterized learning management as the planning, development, and implementation of instructional strategies. The notion of learning management, viewed as a systematic endeavor, encompasses four key dimensions: First, curriculum, which pertains to educational aims, understanding of subject-matter goals, and explicit learning management targets, including the curation of content suitable for learners' environments. Secondly, instruction involves selecting appropriate teaching methodologies and learning management strategies to help students achieve the established learning goals. Thirdly, measurement involves selecting appropriate assessment techniques and analyzing learning management outcomes. Lastly, evaluation pertains to educators' capacity to assess all facets of learning management and to foster students' knowledge, competencies, and future perspectives. This process entails formulating pedagogical insights and instructional competencies for educators to adapt to the evolving societal dynamics in the age of globalization, thereby transforming teachers into learning facilitators and assessing the efficacy of learning management endeavors.

2.4. Learning Attitude

Learning attitude encompasses the cognitive, affective, and behavioral aspects of individuals' beliefs and behaviors during the learning process, including motivation, expectations, anxiety levels, openness to new experiences, and engagement (Liu et al., 2019). Stangor et al. (2014) categorized the elements of learning attitude into three dimensions: firstly, the cognitive component, which pertains to how individuals perceive situations and others, influencing their attitude; secondly, the affective component, which involves emotions and feelings towards experiences shaping attitude characteristics and orientations; and finally, the behavioral component, which focuses on individuals' actions in response to situations, determined by their attitude. Consequently, fostering a positive learning attitude leads to appropriate perceptions, emotions, and behaviors toward learning, thereby impacting creative and innovative thinking skills.

2.5. Hypotheses Formulation

A positive learning attitude is correlated with setting higher goals, problem-solving abilities, and appropriate skills (Liu et al., 2019). It enables learners to develop effective learning strategies and cultivate appropriate learning behaviors, thereby supporting innovative abilities (Zhang & Chen, 2021). Learners with a positive learning attitude tend to engage in creative thinking (Nasution, Al Muhdhar, & Sari, 2023), thereby enhancing learning efficiency and developing creative and innovative skills (Chen & Chen, 2021). Thus, the proposed hypothesis is:

Hypothesis 1: Learning attitude directly influences creative and innovative skills.

Creating a learning environment that promotes critical thinking and problem-solving, and the development of problem-solving approaches using innovation to foster creative thinking in education (Mishra, 2018). Chen and Chen (2021) found

that a positive learning environment stimulates creative, critical, and problem-solving thinking, thereby cultivating learners' creative and innovative skills. Similarly, Wang et al. (2023) found that the learning environment promotes learners' creative thinking. Thus, the proposed hypothesis is:

Hypothesis 2: The learning environment directly influences creative and innovative skills.

The learning environment is correlated with learning attitudes, where positive learning environments, teacher support, task significance, and inquiry-based learning positively influence students' learning (Su, 2023). Similarly, Dilekçi and Karatay (2023) found that providing an appropriate learning environment enables students to build upon existing ideas, develop numerous new perspectives from practical experiences, and diversify their perspectives on events and situations. Liu et al. (2019) discovered that teachers play a crucial role in shaping students' learning attitudes by creating supportive learning environments, promoting student involvement, and fostering enthusiasm for learning. Thus, the proposed hypothesis is:

Hypothesis 3: The learning environment directly influences learning attitudes.

Learning management enables learners to achieve creativity and develop creative thinking and decision-making skills. Engaging students in project-based learning enhances their ability to demonstrate creativity (Yusup et al., 2023). It also prepares learners for future challenges and develops their problem-solving skills. Chen and Chen (2021) proposed a learning management approach that integrates students' interests into the design of an interdisciplinary curriculum across various subject areas related to teaching and learning. This enables learners to apply their knowledge to enhance their creative thinking. Thus, the proposed hypothesis is:

Hypothesis 4: Learning management directly influences creative and innovative skills.

Learning management has a positive correlation with learning attitudes. A systematic learning management system facilitates learning experiences through interactive teaching management, communication between teachers and students, and access to contemporary teaching media (Palve & Palve, 2023). Notably, using technology in learning management helps learners become more enthusiastic, motivated, and cooperative in the learning process. It fosters satisfaction and a positive learning attitude (Sumardi, 2023). As Ramirez (2023) and Chen, Hsu and Chen (2013) found, learning management, including curriculum design, teaching methods, and assessment, affects the thinking and behavior of learners. Additionally, applying technology in learning management leads learners to accept technology, fostering a positive learning attitude and experiencing positive learning outcomes (Park & Kwon, 2022). Thus, the proposed hypothesis is:

Hypothesis 5: Learning management directly influences learning attitudes.

A supportive learning environment increases students' efforts to achieve learning goals, thereby enhancing creativity and fostering successful innovation (Schweder et al., 2019). The relationship between the learning environment and learning attitudes is crucial for students' skills. A positive learning environment, teacher support, task significance, and inquiry-based learning positively influence students' learning (Su, 2023). Similarly, Wang et al. (2023) found that a learning environment that fosters students' creativity through goal-oriented learning enhances their creative thinking.

Hypothesis 6: The learning environment indirectly influences creative and innovative skills through learning attitude as a mediator.

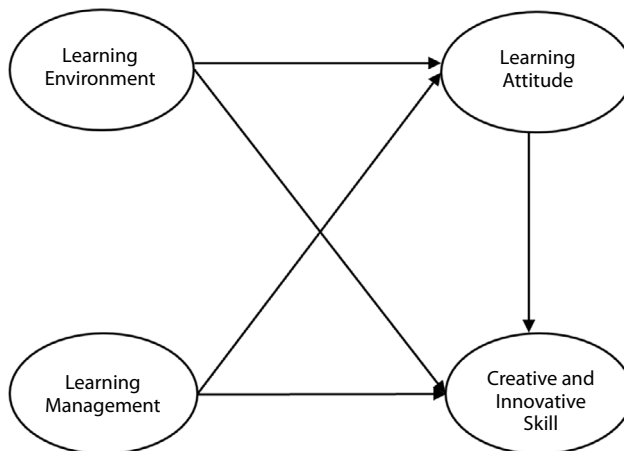
The learning management system (LMS) helps students manage their time and focus on learning, creating space for creativity. Additionally, it stimulates curiosity and challenges students to think critically and solve problems creatively. A learning environment that fosters students' motivation in classroom activities, including teaching methods, interactions with others, and assessments, benefits the development of innovative skills (Anaktototy, 2023). As Dilekçi and Karatay (2023) discovered, engaging in learning activities enhances students' creative thinking skills by fostering a desire to learn and develop innovation skills, including keeping up with technology. Thus, the proposed hypothesis is:

Hypothesis 7: Learning management indirectly influences creative and innovative skills through learning attitude as a mediator.

2.6. Conceptual Framework

This research draws on the concepts of creative and innovative skills (Azizah et al., 2018; Partnership for 21st Century Skills, 2004), learning attitudes (Liu et al., 2019; Stangor et al., 2014), learning environment (Fraser, 2015; Great School Partnership, 2013), and learning management (Lynch, 2012; Smith & Lynch, 2010).

Figure 1: Conceptual Framework.



3. Methodology

3.1. Population and Samples

The participants in this study comprised high school students in the final year of a demonstration high school in Thailand. The sample size was determined using Cohen's (1988) formula, with an effect size of .30, a test power of .80, $\alpha = .05$, four latent variables, and 25 observed variables, yielding a sample size of 241 individuals. However, in line with the recommendations of Comrey and Lee (2013) and Tabachnick

and Fidell (2019), the sample size was increased to 300. The sample selection used stratified random sampling and simple random sampling.

3.2. Research Instrument

The research instruments and their validity were assessed using a questionnaire developed under the auspices of the Human Research Ethics Committee at Silpakorn University (Certificate No. Rec 64.0423-052-1649). This questionnaire comprised four items focusing on personal factors, six items on the learning environment, seven on learning management, six on learning attitudes, and five on creative and innovative skills, as shown in Table I. A 5-point rating scale was employed. Content validity was assessed by the index of item-objective congruence (IOC), and reliability testing was conducted with 30 individuals not included in the primary sample, resulting in Cronbach's alpha (α) values of .87, .84, .84, and .82, surpassing the threshold of .70 as per the established criteria.

Table 1: The Questions Used in the Questionnaire.

Latent Variable	Observed Variable	Items	Reference
Learning environment (ENV)	envi01	The school has equipment that promotes learning.	Fraser (2015)
	envi02	The school facilitates learning through real-world practice.	
	envi03	The school uses real-world locations as learning resources.	
	envi04	The school has space for learning exchanges.	
	envi05	The school has supportive staff who support learning.	
	envi06	The school promotes activities that foster creative thinking.	
Learning management (MNGT)	mngt01	The teachers set goals for student development.	Kwon and Park (2022); Lynch (2012)
	mngt02	The teachers use teaching methods based on students' readiness.	
	mngt03	The teachers assess the students' progress and development.	
	mngt04	The teachers use up-to-date teaching technology.	
	mngt05	The teachers use technology to facilitate collaborative learning among students.	
	mngt06	The teachers incorporate community knowledge into teaching.	
	mngt07	The teachers exchange knowledge with the community.	
Learning attitude (ATTI)	atti01	You perceive the benefits of learning.	Stangor et al. (2014)
	atti02	You are satisfied with your learning experience.	
	atti03	You are interested in learning.	
	atti04	You are interested in participating in classroom activities.	
	atti05	You have gained knowledge and skills from learning.	
	atti06	You can apply the knowledge gained from learning for practical use.	
Creative and innovation skill (CREA)	crea01	You have skills in generating new ideas/knowledge.	Partnership for 21 st Century Skills (2004)
	crea02	You have skills in building upon existing knowledge to create new knowledge.	
	crea03	You can use criticism to improve your work.	
	crea04	You can use mistakes as opportunities for learning.	
	crea05	You can apply knowledge to innovate and create beneficial outcomes.	

3.3. Collection of Data

Data collection involved administering questionnaires to 300 high school students in the final year of a demonstration high school in Thailand. Most participants were female (69%), and attended a school affiliated with Silpakorn University (37.3%). These students were part of the Science-Mathematics curriculum (66%) and had cumulative GPAs ranging from 3.51 to 4.00 (57%). Statistical analysis of the variables

revealed mean values between 3.10 and 4.21, standard deviations (S) ranging from 0.77 to 1.13, skewness ranging from -0.73 to 0.11, and kurtosis ranging from -0.83 to 0.38. The variance inflation factor (VIF) for each observed variable ranged from 1.52 to 3.24, which did not exceed 5, indicating no multicollinearity issues within the model (Hair et al., 2020).

3.4. Data Analysis

This research employed Jamovi 2.4.14 (Jamovi Project, 2024) and ADANCO 2.4.2 (Henseler, 2017) for parameter estimation using composite-based structural equation modeling. This method is suitable for estimating parameters even when assumptions of multivariate normal distribution are violated. Hypothesis testing was carried out using the Bootstrap method. The analysis process comprised various stages:

- 1. Descriptive Statistics Analysis:** Descriptive statistics analysis involves computing the arithmetic mean, standard deviation, skewness, and kurtosis.
- 2. Composite-based Structural Equation Modeling (SEM) Analysis** comprises:
 - 2.1 Tests of overall model fit** Evaluation using indices such as standardized root mean square residual (SRMR), which should ideally be less than .08 (Hair et al., 2020). Additionally, unweighted least squares discrepancy (dULS) and geodesic discrepancy (dg) should fall within the 95th percentile (HI95) and 99th percentile (HI99).
 - 2.2. Measurement Model/Outer Model Testing** This involves examining the relationship between latent variables and their reflective constructs, including:

Reliability Using factor loading, α , Dijkstra-Henseler's rho (ρ_A), and Jöreskog's rho (ρ_C). Standardized factor loading, α , ρ_A , and ρ_C should ideally be greater than .70 (Henseler, Ringle, & Sinkovics, 2009).

Convergent Validity Using average variance extracted (AVE) from standardized factor loadings, indicating the relationship between latent and observed variables. Ideally, it should be greater than .70, and the average extracted variance (AVE) should be greater than .50.

Discriminant Validity Using the Heterotrait-Monotrait ratio of correlations (HTMT). Each latent variable should ideally have an HTMT value of less than .85 (Henseler, Ringle, & Sarstedt, 2015).

2.3. Structural Model/Inner Model Testing Examination of the influence among latent variables. Path coefficients, coefficient of determination (R^2), and effect size (f^2) are used. The p value of path coefficients should ideally be less than .05 (Hair et al., 2020). R^2 should be close to 1, and f^2 should be large (Henseler et al., 2015). Acceptable criteria for evaluating the structural equation model are presented in Table 2

Table 2: Criteria for Structural Equation Modeling Evaluation.

Evaluation	Criterion	Acceptable Value	Reference
Overall Model	SRMR	< .08	Henseler et al. (2009)
	dULS, dG	between HI95 and HI99	
Measurement Model	Factor Loading, α, ρ_A, ρ_C	> .50	Henseler et al. (2009)
	AVE	> .50	Fornell and Larcker (1981)
	HTMT	< .85	Henseler et al. (2015)
Structural Model	p value of path coefficients	< .05	Hair et al. (2020)
	R^2	Near 1	Henseler et al. (2009)
	f^2	Large	

4. Results

4.1. Descriptive Statistics

The result revealed that the observed variables in the structural equation model had arithmetic means ranging from 3.10 to 4.21. The standard deviations ranged from 0.78 to 1.13. Skewness values range from -0.73 to 0.11, and kurtosis values range from -0.73 to 0.38. Furthermore, when analyzing the correlation among the 25 observed variables in the structural equation model using variance inflation factors (VIFs), the VIFs ranged from 1.52 to 3.24 and did not exceed 5. This indicates that the model does not have multicollinearity issues (Hair et al., 2020), as shown in Table 3.

Table 3: Descriptive Statistics of the Observed Variable.

Observed Variable	Mean	SD	Skewness	Kurtosis	VIF
envi01	3.53	1.01	-0.27	-0.36	2.37
envi02	3.42	1.00	-0.16	-0.29	2.32
envi03	3.10	1.06	0.11	-0.46	3.18
envi04	3.35	1.06	-0.03	-0.73	2.73
envi05	3.42	1.13	-0.19	-0.70	3.06
envi06	3.58	1.07	-0.35	-0.49	2.22
envi07	3.10	1.09	0.03	-0.44	3.24
mngt01	3.94	0.81	-0.35	-0.44	1.65
mngt02	4.02	0.78	-0.37	-0.46	1.52
mngt03	3.74	0.82	0.08	-0.83	2.38
mngt04	3.92	0.82	-0.35	-0.30	2.07
mngt05	3.56	0.97	-0.22	-0.37	2.20
mngt06	3.49	0.98	-0.17	-0.47	2.41
mngt07	3.83	0.87	-0.44	-0.24	2.17
atti01	3.82	0.87	-0.31	-0.44	2.52
atti02	3.44	0.89	-0.03	-0.22	2.11
atti03	3.71	0.88	-0.25	-0.37	2.23
atti04	3.68	0.90	-0.36	-0.21	1.74
atti05	3.84	0.87	-0.51	0.26	2.33
atti06	3.72	0.87	-0.29	-0.26	2.65
crea01	3.85	0.86	-0.18	-0.65	2.66
crea02	4.05	0.77	-0.49	0.09	2.20
crea03	4.21	0.77	-0.73	0.38	1.89
crea04	3.74	0.94	-0.25	-0.40	2.46
crea05	3.53	1.01	-0.27	-0.36	2.66

4.2. Overall Model Testing

The analysis indicated that the SRMR was 0.064, the dULS was 1.31, and the dG was 0.51. These values fell outside the HI95 and HI99 thresholds; the SRMR remained below 0.08, indicating an overall acceptable level of fit, as shown in Table 4.

Table 4: Overall Model Fit Assessment.

Criterion	Value	HI91	HI95
SRMR	.064	0.047	0.050
dULS	1.31	0.729	0.815
dG	0.51	0.335	0.373

4.3. Measurement Model Testing

Reliability: For latent variables ENV, MNGT, ATTI, and CREA, all observed variables had standardized factor loadings ranging from .65 to .87, which is greater than .50. The values of α range from .88 to .93, ρ_A ranged from .88 to .93, and ρ_C

ranged from .90 to .94, all of which are greater than .70. This indicates that all latent variables have high reliability, as shown in Table 5.

Convergent Validity: The latent variables ENV, MNGT, ATTI, and CREA had AVEs ranging from .58 to .70, all greater than .50. This indicates that the observed variables are consistent with the latent variables, as shown in Table 5.

Table 5: Measurement Model Evaluation.

Latent Variable	Observed Variable	β	R ²	α	ρ_A	ρ_c	AVE
ENV	env01	.80	.64	.93	.93	.94	.70
	env02	.80	.63				
	env03	.87	.75				
	env04	.84	.71				
	env05	.86	.74				
	env06	.81	.65				
	env07	.87	.75				
MNGT	mngt01	.69	.48	.88	.88	.90	.58
	mngt02	.65	.42				
	mngt03	.82	.67				
	mngt04	.76	.58				
	mngt05	.79	.63				
	mngt06	.79	.62				
	mngt07	.79	.63				
ATTI	atti01	.85	.72	.89	.90	.92	.65
	atti02	.81	.66				
	atti03	.80	.64				
	atti04	.71	.51				
	atti05	.82	.67				
	atti06	.85	.72				
CREA	crea01	.84	.71	.87	.88	.91	.67
	crea02	.86	.75				
	crea03	.80	.64				
	crea04	.73	.54				
	crea05	.86	.73				

Discriminant Validity: All pairs of latent variables had HTMT values ranging from .50 to .76, which are below the .85 threshold (Henseler et al., 2015). This indicates that all pairs of latent variables had reasonable discriminant validity, as shown in Table 6

Table 6: Heterotrait-Monotrait (HTMT) Matrix.

Latent Variable	ENV	MNGT	ATTI	CREA
ENV	1			
MNGT	.76	1		
ATTI	.65	.72	1	
CREA	.50	.55	.61	1

4.4. Structural Model Analysis

Testing the Influence Between Latent Variables in The Structural Equation

Hypothesis 1: Learning attitude (ATTI) significantly influenced creative and innovative skills (CREA) with a direct effect of .36 and an effect size of .11.

Hypothesis 2: Learning environment (ENV) does not significantly influence creative and innovative skills (CREA), with a direct effect of .12 and an effect size of .01.

Hypothesis 3: Learning environment (ENV) significantly influenced learning attitude (ATTI) with a direct effect of .29 and an effect size of .08.

Hypothesis 4: Learning management (MNGT) significantly influenced creative and

innovative Skills (CREA) with a direct effect of .17 and an effect size of .02.
 Hypothesis 5: Learning management (MNGT) significantly influenced learning attitude (ATTI) with a direct effect of .44 and an effect size of .19.

Testing the Influence of Learning Attitude as a Mediator Variable

Hypothesis 6: Learning environment (ENV) indirectly influenced creative and innovative skills (CREA) through learning attitude (ATTI) as a mediator.
 Hypothesis 7: Learning management (MNGT) indirectly influenced creative and innovative skills (CREA) through a learning attitude as a mediator.

From Hypothesis 6 and Hypothesis 7, it was found that learning attitude significantly positively influenced creative and innovative skills through the learning environment, with an indirect effect of 0.11, indicating that learning attitude is a full mediator variable.

Learning attitude significantly and positively influences creative and innovative skills through learning management, with an indirect effect of .16, indicating that learning attitude is a partial mediator variable. This conclusion is based on the findings presented in Tables 7 and 8 and Figure 2.

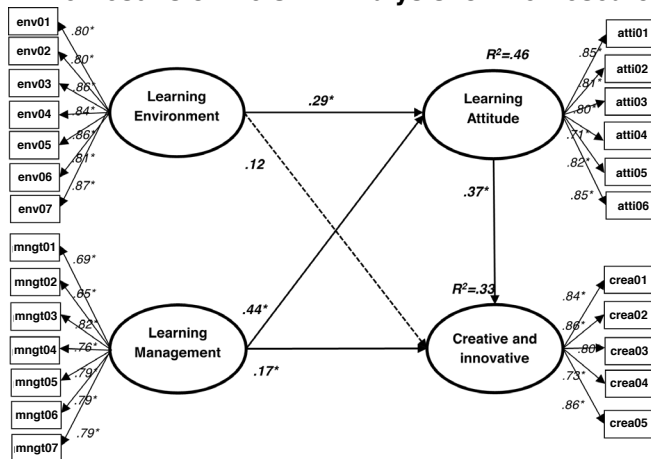
Table 7: Path Coefficient of the Structural Model.

Hypothesis	Path Coefficient	t Statistics	p value	R ²	f ²	Confidence Intervals	Decision
H1: ATTI → CREA	.37	5.14	< .01	.11	.022–0.50	Supported	
H2: ENV → CREA	.12	.175	.080	.33	-0.01–0.26	Not supported	
H3: ENVV → ATTI	.29	4.75	< .01	.46	0.17–0.41	Supported	
H4: MNGT → CREA	.17	2.21	.026	.02	0.02–0.32	Supported	
H5: MNGT → CREA	.44	6.89	< .01	.19	0.31–0.56	Supported	

Table 8: Testing the Influence of Learning Attitude as a Mediating Variable.

Hypothesis	Path Coefficient	t Statistics	p value	Confidence Intervals	Decision
H6: ENV → ATTI → CREA	.11	3.51	< .01	0.05–0.17	Full mediation
H7: MNGT → ATTI → CREA	.16	4.25	< .01	0.09–0.24	Partial mediation

Figure 2: The Results of the SEM Analysis for the Research Model.



Notes *p < .05.

5. Conclusion and Discussion

The study's findings revealed that learning attitude is paramount for the development of creative and innovative skills. This aligns directly with the OECD's emphasis on student agency and learning-to-learn competencies, which highlight the importance of motivation, persistence, and metacognitive engagement in fostering 21st-century skills. A positive learning attitude enables learners to recognize the benefits of learning, actively participate in classroom activities, and apply acquired knowledge and behaviors, which the OECD associates with the development of creativity and critical thinking as core transformative competencies. Such an attitude encourages goal-setting, self-regulation, and reflective learning, thereby strengthening students' capacity for creative problem-solving and innovative thinking (Liu et al., 2019; Zhang & Chen, 2021).

Similarly, the significant direct impact of learning management on creative and innovative skills can be explicitly linked to the OECD's call for effective learning environments and pedagogies that cultivate 21st-century competencies. Learning management, encompassing curriculum design, instructional strategies, assessment practices, and the standardization of learning processes (Lynch, 2012), plays a critical role in structuring opportunities for students to develop the OECD's 4C skills. Through well-designed curricula and learning experiences, educational institutions help learners build the capacity to integrate new knowledge, make connections across contexts, and engage in real-world tasks that promote creativity, collaborative problem-solving, and communication.

Following Yusup et al. (2023) and Chen and Chen (2021), learner-centered approaches such as project-based learning and interdisciplinary knowledge integration directly support OECD-endorsed pedagogies that foster deep understanding, knowledge co-construction, and innovative competencies. These approaches provide students with opportunities to generate original ideas, refine them through iterative inquiry, and articulate solutions, key indicators of the OECD's creative thinking competency. Consequently, educators must intentionally cultivate the conditions that support students' creative and innovative development by encouraging curiosity, open dialogue, diverse perspectives, and active engagement in tasks. This requires the use of logical reasoning, research-based inquiry, innovation-focused activities, authentic community connections, and multimodal assessment practices, all of which are consistent with OECD recommendations for developing robust 21st-century learning skills.

The findings of this study also suggest that the learning environment has no statistically significant direct impact on creative and innovative skills. This indicates that the learning environment, in isolation, is insufficient to nurture learners' skills directly. Creative capacities depend largely on learner characteristics such as curiosity, motivation, and problem-solving ability, as well as on learning processes that involve collaboration, reflection, and open-ended tasks. Social interaction and instructional support also play a critical role. Thus, the learning environment contributes to creativity only when integrated with purposeful learning activities and active learner engagement.

Nevertheless, educational institutions must create learning environments that foster critical thinking and problem-solving, enabling students to cultivate creative and innovative skills (Chen & Chen, 2021; Mishra, 2018). Similarly, in agreement with the Great School Partnership (2013), the significance of the learning environment lies in fostering learning experiences that encourage active student involvement, emotional well-being, and meaningful interactions with the learning content, both directly and

indirectly. Hence, educational institutions must create positive learning settings, encompassing physical infrastructure development and facility enhancements, and establish community-linked relationships to serve as premier learning centers that foster educational innovation and creativity in a contemporary and effective manner. This initiative aims to facilitate knowledge exchange among individuals and to bolster the use of creative thinking and the promotion of innovation.

Second, research on the mediating role of learning attitude reveals that it serves as a full mediator between the learning environment and creative and innovative skills. Instructional management establishes educational benchmarks to enhance knowledge acquisition and shape learners' mindsets. Therefore, schools are entrusted with improving students' appreciation of the advantages of learning and involving them in collaborative tasks to boost self-directed learning, curiosity, and ongoing self-enhancement. Students showcase systematic thinking, creativity, and problem-solving skills through enhanced learning environments, both within and beyond the classroom. This setting encourages knowledge exchange, facilitates the sharing of exemplary practices, integrates various skills into classroom settings, nurtures a sense of contentment in learning, and instills positive attitudes toward the learning journey. It kindles an interest in learning pursuits and bolsters the practical application of knowledge.

As posited by Great School Partnership (2013), the educational setting is essential for facilitating learning that fosters active student engagement, positive attitudes, and high-quality interactions with the learning process, both directly and indirectly. Similarly, Schweder et al. (2019) observed that providing a conducive learning environment motivates students to exert more effort toward attaining their educational objectives, leading to enhanced creative thinking and successful innovation. The correlation between the learning environment and learning dispositions is paramount for students' academic competencies. According to Su (2023), a favorable learning environment, teacher guidance, task relevance, and inquiry-based approaches all positively impact student learning outcomes. Likewise, Wang et al. (2023) and Su (2023) discovered that a positive learning environment prompts students to prioritize learning objectives that foster creativity. Furthermore, creating an environment conducive to students' needs empowers them to cultivate diverse perspectives on given scenarios and generate novel ideas (Dilekçi & Karatay, 2023).

While learning attitude partially mediates between learning management and creative and innovative skills. Therefore, school instructional management is designed to provide diverse learning opportunities that address students' varied needs, including competency-based, technology-enhanced, and community-integrated learning experiences. For example, instructional management may involve setting clear developmental goals for students and integrating external knowledge or community expertise into classroom practices. Consequently, instructional management not only directly influences students' creative and innovative skills but also shapes other essential learner attributes, particularly learning attitudes, which, in turn, support skill development and effective learning outcomes.

According to the Partnership for 21st Century Skills (2004), the skills demanded in the 21st century necessitate learners to excel in multiple domains, including fundamental subjects, contemporary issues, information literacy, media literacy, technological proficiency, and job-related skills. Educators mold learners' attitudes toward learning by arranging educational activities, encouraging student engagement, and fostering a

passion for learning (Liu et al., 2019). Moreover, Dilekçi and Karatay (2023) and Anaktototy (2023) found that instructional management, encompassing pedagogical approaches and interpersonal connections, fostering creative thinking abilities and evaluation methods, motivates learners, nurtures their thirst for knowledge, and encourages innovation. This proves advantageous in honing creative and innovative capabilities.

However, this study has certain limitations. It focuses primarily on learning attitude, learning management, and the learning environment, without considering other factors such as personality, prior knowledge, or socio-cultural influences. The cross-sectional research design limits the ability to draw causal inferences. Moreover, as the study was conducted in a specific educational context, the findings may not be generalizable to other settings. Additionally, other potential mediators or moderators, such as teacher expertise or peer influence, were not examined and should be addressed in future research.

6. Suggestion

Based on this study's results, it is apparent that attitudes toward learning play a crucial role in shaping students' creative and innovative abilities, both directly and indirectly through intermediary factors. Hence, it is recommended that educators design initiatives that cultivate a favorable learning attitude, including instilling an appreciation for the significance of learning, acquiring knowledge and skills through education, and active involvement in educational and communal undertakings. These endeavors aid students in developing the necessary skills, knowledge, and openness to embrace and respect alternative viewpoints, thereby generating novel concepts. In addition, instructors should be equipped to assist students by promoting inquiry, discourse, exploration of new perspectives, involvement in tasks, logical thinking, investigation, creativity, and social interaction. Furthermore, various assessment techniques should enhance students' creative and innovative capacities.

Furthermore, educational institutions ought to enhance the learning environment within and beyond traditional classrooms, as well as in the broader societal setting, to bolster interactive learning, collaborative group efforts, knowledge-sharing dialogues, engaging learning experiences, acceptance of diverse viewpoints, and cooperative learning initiatives. This approach aims to nurture a constructive learning attitude and hone students' creative and innovative skills.

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