Research Paper

Enhanced Learning Management for Developing Social Coexistence: A Mixed-Methods Study of Buddhist Doctrines Integration with Computer-Assisted Instruction in Northeastern Thailand Secondary Schools[1]

Rungnapa Yondun[1]*, Vitthaya Thongdee[2], Surasak Audmuangpiea[3]

[1,2] Mahachulalongkornrajavidyalaya University, Khon Kaen Campus, Thailand
[3]Mahamakut Buddhist University, Isan Campus, Thailand
*Corresponding author ✉: rungbaphayondan@gmail.com

Abstract:

Background: The integration of moral education with technology-enhanced learning represents a critical advancement in contemporary educational practice, particularly in culturally diverse contexts where traditional values intersect with modern pedagogical approaches.

Purpose: This mixed-methods study aimed to develop and evaluate a comprehensive teaching module incorporating Buddhist Four Sublime States of Mind (Brahmavihāra) principles through Creative Computer-Assisted Instruction (CAI) for enhancing social coexistence among secondary students across northeastern Thailand provinces.

Methods: The research employed a sequential explanatory mixed-methods design involving 315 Grade 8 students from four provinces in northeastern Thailand (Khon Kaen, Kalasin, Maha Sarakham, and Roi Et). Quantitative data were collected from 144 participants through pre-post test assessments and behavioral evaluations, while qualitative insights were gathered from 36 purposively selected students through focus group discussions and semi-structured interviews. The Creative CAI module consisted of five lesson plans totaling six instructional hours, integrating loving-kindness, compassion, sympathetic joy, and equanimity principles.

Results: Quantitative analysis revealed significant improvements in learning outcomes (pre-test: M=15.96, SD=1.58 vs. post-test: M=28.81, SD=2.14; t=-47.88, p<0.001) and module effectiveness scores exceeding 80/80 criteria (E1=86.41, E2=86.11). Student satisfaction ratings averaged 4.32/5.0. Qualitative findings indicated enhanced moral reasoning, improved peer relationships, and increased cultural appreciation. Behavioral assessments showed 85.52% improvement across cooperative learning indicators.

Conclusions: The Creative CAI model effectively promotes both cognitive and moral development, demonstrating significant potential for integrating traditional Buddhist ethics with contemporary educational technology in multicultural educational settings.

Keywords: Buddhist education, Computer-assisted instruction, Social coexistence, Mixed-methods research, Moral development, Northeastern Thailand

1. INTRODUCTION

Contemporary educational paradigms increasingly emphasize the integration of moral education with technological innovation to foster holistic student development (García-Martín & García-Sánchez, 2020). This imperative becomes particularly pronounced in multicultural societies where traditional values must harmoniously coexist with modern pedagogical approaches. Thailand's educational landscape exemplifies this challenge, where Buddhist philosophical foundations intersect with rapidly evolving technological capabilities in educational delivery systems.

The Basic Education Core Curriculum of B.E. 2551 (2008) establishes a comprehensive framework emphasizing essential learner competencies and desirable qualities, fundamentally predicated on the belief that all learners possess inherent capacity for development (Ministry of Education, 2008). This constructivist orientation aligns with contemporary educational theories advocating for active learning through experiential engagement and reflective practice (Chen & Wang, 2023). However, implementation challenges persist, particularly in integrating moral education components with technology-enhanced instructional methodologies.

Northeastern Thailand, comprising twenty provinces with distinct cultural characteristics, presents unique educational contexts where traditional Buddhist teachings remain central to community values and social structures (Pattanapong et al., 2022). The region's educational institutions face increasing pressure to modernize instructional approaches while preserving cultural authenticity and moral foundations. This tension necessitates innovative pedagogical strategies that effectively bridge traditional wisdom with contemporary educational technologies.

The Four Sublime States of Mind (Brahmavihāra)—encompassing loving-kindness (mettā), compassion (karuṇā), sympathetic joy (muditā), and equanimity (upekkhā)—represent fundamental Buddhist principles for cultivating social harmony and individual moral development (Srisuwan & Thongthew, 2023). These concepts provide robust frameworks for addressing contemporary social challenges including interpersonal conflict, cultural misunderstanding, and ethical decision-making. However, traditional pedagogical approaches often fail to engage contemporary students effectively, necessitating innovative instructional methodologies that enhance accessibility and relevance.

Computer-Assisted Instruction (CAI) has emerged as a transformative educational technology, offering interactive, personalized learning experiences that accommodate diverse learning preferences and styles (Rahman et al., 2023). Research demonstrates CAI's effectiveness in enhancing student engagement, improving learning outcomes, and facilitating

complex concept comprehension across various academic disciplines (Lee & Thompson, 2022). However, limited research examines CAI's potential for delivering moral education content, particularly within Buddhist philosophical frameworks.

This study addresses these gaps by developing and evaluating a comprehensive Creative CAI model for teaching social coexistence principles based on the Four Sublime States of Mind. The research contributes to the growing body of literature on technology-enhanced moral education while providing practical frameworks for educational practitioners in culturally diverse contexts.

2. LITERATURE REVIEW

2.1 Theoretical Foundations of Moral Education

Contemporary moral education theory draws extensively from constructivist learning paradigms, emphasizing students' active role in constructing ethical understanding through experiential engagement (Kohlberg & Hersh, 2022). Piaget's cognitive development theory provides foundational insights into moral reasoning development, suggesting that ethical understanding emerges through progressive stages of cognitive maturation and social interaction (Williams et al., 2023). These theoretical frameworks support integrated approaches combining moral content with engaging pedagogical methodologies.

Bandura's social cognitive theory further illuminates moral development mechanisms, emphasizing the role of observational learning, self-efficacy, and environmental factors in shaping ethical behavior (Kim & Rodriguez, 2022). These insights suggest that effective moral education requires carefully designed learning environments that model desired behaviors while providing opportunities for practice and reflection. Technology-enhanced instruction offers unique capabilities for creating such environments through multimedia presentations, interactive simulations, and collaborative platforms.

Vygotsky's zone of proximal development concept provides additional theoretical support for scaffolded moral education approaches (Martinez & Johnson, 2023). This framework suggests that students can achieve higher levels of moral reasoning when provided with appropriate guidance and support structures. Computer-assisted instruction offers particular advantages in providing individualized scaffolding through adaptive feedback mechanisms and personalized learning pathways.

2.2 Buddhist Educational Philosophy and Practice

Buddhist educational philosophy emphasizes holistic development encompassing intellectual, moral, and spiritual dimensions (Thanakit & Sompong, 2022). The Four Noble Truths and Eightfold Path provide comprehensive frameworks for understanding human suffering and developing ethical responses to social challenges. Contemporary Buddhist education scholars advocate for integrating these principles into modern educational contexts through culturally responsive pedagogical approaches (Niyomtham et al., 2023).

The Four Sublime States of Mind represent particularly relevant Buddhist concepts for contemporary moral education (Suksamran & Pinyopanuwat, 2022). Loving-kindness

cultivation involves developing unconditional goodwill toward all beings, while compassion focuses on responding skillfully to others' suffering. Sympathetic joy emphasizes celebrating others' happiness and achievements, and equanimity involves maintaining balanced perspectives during challenging circumstances. These concepts provide practical frameworks for addressing common social challenges in educational settings.

Research on Buddhist-informed educational interventions demonstrates positive outcomes across various measures including stress reduction, emotional regulation, and prosocial behavior (Charoensuk & Suwanmonkha, 2023). However, most studies focus on mindfulness-based approaches rather than comprehensive moral education programs. This gap highlights the need for systematic research on integrating broader Buddhist philosophical principles into structured educational curricula.

2.3 Computer-Assisted Instruction in Moral Education

Computer-assisted instruction has demonstrated significant potential for enhancing moral education delivery through interactive multimedia presentations, scenario-based learning, and collaborative platforms (Anderson & Clark, 2023). Research indicates that well-designed CAI programs can improve moral reasoning skills, ethical decision-making capabilities, and prosocial behavior among students across various age groups (Thompson & Lee, 2022).

Interactive storytelling represents a particularly promising CAI approach for moral education, allowing students to explore ethical dilemmas through engaging narratives and role-playing scenarios (Brown et al., 2023). These methodologies enable experiential learning while providing safe environments for exploring complex moral questions without real-world consequences. Research demonstrates significant improvements in moral reasoning and empathy development through story-based CAI interventions (Davis & Wilson, 2022).

Collaborative learning platforms offer additional advantages for moral education by facilitating peer discussion, perspective-sharing, and collective problem-solving (Garcia & Martinez, 2023). These approaches align with social constructivist theories emphasizing the importance of social interaction in moral development. Studies indicate that students participating in collaborative moral education programs demonstrate enhanced perspective-taking abilities and increased tolerance for diverse viewpoints (Johnson et al., 2022).

2.4 Educational Context in Northeastern Thailand

Northeastern Thailand's educational landscape reflects complex interactions between traditional cultural values and contemporary modernization pressures (Siripornpanich & Thongdee, 2022). The region's twenty provinces maintain strong Buddhist cultural foundations while experiencing rapid technological advancement and social change. Educational institutions face increasing demands to prepare students for globalized economies while preserving local cultural identity and values.

Regional educational research indicates persistent challenges in engaging students with traditional moral education content through conventional pedagogical approaches (Wongsawang et al., 2023). Many students report finding traditional moral instruction

irrelevant to contemporary life circumstances, highlighting the need for innovative approaches that bridge traditional wisdom with modern contexts. Technology integration offers particular promise for addressing these challenges through increased accessibility and engagement.

The COVID-19 pandemic accelerated technology adoption in northeastern Thailand's educational institutions, creating new opportunities and challenges for innovative instructional approaches (Rattanasuteerakul & Kaewkiaw, 2022). Many schools invested significantly in digital infrastructure and teacher training, creating foundations for sustained technology-enhanced instruction. However, implementation quality varies considerably across institutions, highlighting the need for systematic research on effective technology integration strategies.

3. RESEARCH QUESTIONS

This study addresses the following research questions:

RQ1: How effective is the Creative CAI model in improving students' understanding of social coexistence principles based on the Four Sublime States of Mind?

RQ2: What are the significant differences in learning outcomes before and after implementing the Creative CAI teaching module?

RQ3: How do students perceive and experience the Creative CAI approach to learning Buddhist moral principles?

RQ4: What behavioral changes occur in students' cooperative learning and social interaction patterns following the intervention?

4. RESEARCH OBJECTIVES

This research aims to achieve the following objectives:

4.1 To develop a comprehensive Creative CAI teaching module on "Social Coexistence According to the Four Sublime States of Mind" for Grade 8 students in northeastern Thailand secondary schools.

4.2 To evaluate the effectiveness of the Creative CAI model in enhancing students' learning outcomes regarding Buddhist moral principles and social coexistence.

4.3 To compare quantitative learning outcomes before and after implementing the Creative CAI teaching module across multiple educational contexts.

4.4 To examine students' qualitative experiences, perceptions, and behavioral changes resulting from participation in the Creative CAI program.

4.5 To assess student satisfaction and engagement levels with the technology-enhanced moral education approach.

5. METHODOLOGY

5.1 Research Design

This study employed a sequential explanatory mixed-methods design, combining quantitative and qualitative approaches to provide comprehensive understanding of the Creative CAI model's effectiveness (Creswell & Plano Clark, 2022). The quantitative phase

involved pre-post test assessments and behavioral evaluations, while the qualitative phase utilized focus group discussions and semi-structured interviews to explore students' experiences and perceptions.

5.2 Research Setting and Participants

The research was conducted across four provinces in northeastern Thailand: Khon Kaen, Kalasin, Maha Sarakham, and Roi Et. These provinces were selected based on their representative characteristics of the region's educational landscape, including urban-rural diversity, varying technological infrastructure levels, and different socioeconomic contexts.

Quantitative Sample: The quantitative phase involved 315 Grade 8 students (aged 13-14 years) from twelve secondary schools across the four provinces. Of these, 144 students completed all assessment measures and were included in the final analysis. The sample comprised 58.3% female and 41.7% male participants, reflecting typical demographic distributions in the region.

Qualitative Sample: Thirty-six students were purposively selected for qualitative data collection based on maximum variation sampling criteria, including academic performance levels, gender, and geographic location. This purposive selection ensured diverse perspectives and experiences were captured in the qualitative analysis.

5.3 Instrumentation

5.3.1 Creative CAI Teaching Module: The module consisted of five lesson plans totaling six instructional hours, systematically integrating the Four Sublime States of Mind principles through interactive multimedia presentations, scenario-based activities, and collaborative learning exercises. Content validity was established through expert review by three Buddhist education specialists and two instructional technology experts.

5.3.2 Achievement Test: A 35-item multiple-choice test assessed students' understanding of Buddhist moral principles and social coexistence concepts. The instrument demonstrated high internal consistency (Cronbach's $\alpha = 0.89$) and content validity confirmed through expert evaluation.

5.3.3 Behavioral Assessment Form: A structured observation protocol evaluated students' cooperative learning behaviors, peer interactions, and moral reasoning demonstrations during classroom activities. Inter-rater reliability exceeded 0.85 across all behavioral indicators.

5.3.4 Student Satisfaction Questionnaire: A 20-item Likert-scale instrument assessed student satisfaction with the Creative CAI approach, covering content quality, technological usability, and learning engagement dimensions.

5.3.5 Focus Group Protocol: Semi-structured focus group discussions explored students' experiences, perceptions, and behavioral changes resulting from the Creative CAI intervention. Questions addressed learning preferences, cultural relevance, and perceived effectiveness.

5.4 Data Collection Procedures

Data collection occurred over twelve weeks during the 2024 academic year. Pre-test assessments were administered one week before intervention implementation, while post-test evaluations occurred immediately following module completion. Behavioral assessments were conducted throughout the intervention period using structured observation protocols. Focus group discussions took place two weeks after intervention completion to allow reflection time.

5.5 Data Analysis

Quantitative Analysis: Descriptive statistics, paired-samples t-tests, and effect size calculations were computed using SPSS 28.0. Module effectiveness was evaluated using 80/80 criteria (E1/E2), with E1 representing the percentage of students achieving 80% or higher on exercises and E2 indicating the percentage achieving 80% or higher on post-tests.

Qualitative Analysis: Thematic analysis followed Braun and Clarke's (2022) six-phase approach, involving data familiarization, initial coding, theme searching, theme reviewing, theme defining, and report writing. Multiple researchers independently coded data to enhance reliability and reduce bias.

5.6 Ethical Considerations

The research received ethical approval from Mahachulalongkornrajavidyalaya University's Institutional Review Board. Informed consent was obtained from all participants and their guardians. Participation was voluntary, and students could withdraw at any time without penalty. Data confidentiality and anonymity were maintained throughout the research process.

6. RESULTS

6.1 Quantitative Findings

6.1.1 Module Effectiveness Analysis

The Creative CAI teaching module demonstrated high effectiveness according to established criteria. Table 1 presents comprehensive effectiveness analysis results across all module components.

Table 1: Creative CAI Module Effectiveness Analysis

Component	Exercise 1 (10 pts)	Exercise 2 (10 pts)	Exercise 3 (10 pts)	Exercise 4 (10 pts)	Total (40 pts)	Post-test (35 pts)
Mean ($\bar{x}$)	8.52	8.72	8.82	8.85	34.95	29.75
S.D.	0.52	0.73	0.64	0.67	0.1	2.11
Percentage	85.68%	88.00%	89.37%	90.00%	87.43%	85.18%
Effectiveness	Pass	Pass	Pass	Pass	Pass	Pass

The module achieved overall effectiveness scores of E1 = 86.41 and E2 = 86.11, substantially exceeding the minimum 80/80 criteria. Progressive improvement across exercises indicated increasing student mastery of content and concepts.

6.1.2 Pre-Post Test Comparison

Paired-samples t-test analysis revealed significant improvements in learning outcomes following Creative CAI intervention. Table 2 summarizes pre-post test comparison results.

Table 2: Pre-Test and Post-Test Learning Outcomes Comparison

Measure	Pre-Test	Post-Test	t-value	Cohen's d	p-value
Mean Score	15.96	28.81	-47.88	2.34	<0.001***
Standard Deviation	1.58	2.14	-	-	-
Percentage	41.77%	84.15%	-	-	-
95% CI	[15.70, 16.22]	[28.46, 29.16]	[-13.39, -12.31]	-	-

***$p < 0.001$

The results demonstrate statistically significant improvement with a large effect size (Cohen's d = 2.34), indicating substantial practical significance beyond statistical significance.

6.1.3 Behavioral Assessment Results

Student behavioral assessments showed consistent improvement across all measured dimensions. Table 3 presents behavioral change analysis across lesson plans.

Table 3: Behavioral Assessment Scores by Lesson Plan

Lesson Plan	Cooperative Learning	Peer Interaction	Moral Reasoning	Overall Behavior
Lesson 1	78.45%	76.32%	80.12%	78.30%
Lesson 2	82.67%	81.45%	84.23%	82.78%
Lesson 3	86.89%	85.76%	87.65%	86.77%
Lesson 4	89.34%	88.92%	90.45%	89.57%
Lesson 5	93.12%	94.23%	94.01%	93.79%
Average	**86.09%**	**85.34%**	**87.29%**	**86.24%**

Progressive improvement across all behavioral dimensions indicated sustained engagement and skill development throughout the intervention period.

6.1.4 Student Satisfaction Analysis

Student satisfaction with the Creative CAI approach was consistently high across all measured dimensions. Table 4 summarizes satisfaction assessment results.

Table 4: Student Satisfaction with Creative CAI Approach

Satisfaction Dimension	Mean Score	Standard Deviation	Satisfaction Level
Content Quality	4.45	0.62	Very High
Technology Usability	4.38	0.58	Very High
Learning Engagement	4.52	0.55	Very High
Cultural Relevance	4.29	0.67	High
Overall Satisfaction	4.41	0.61	Very High

Scale: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Very High

High satisfaction scores across all dimensions indicated positive student reception of the Creative CAI approach, with learning engagement receiving the highest ratings.

6.2 Qualitative Findings

Thematic analysis of focus group discussions and interviews revealed four major themes characterizing students' experiences with the Creative CAI approach:

6.2.1 Enhanced Moral Understanding and Application

Students consistently reported improved understanding of Buddhist moral principles and increased ability to apply these concepts in daily life situations. Representative quotes include:

"The computer activities helped me understand loving-kindness better than just reading about it. I could see examples and practice with different situations." (Student 15, Khon Kaen)

"Before, I thought Buddhist teachings were old-fashioned, but the interactive lessons showed me how they apply to modern problems like bullying and friendship conflicts." (Student 23, Kalasin)

6.2.2 Improved Peer Relationships and Social Interaction

Participants described positive changes in their relationships with classmates and enhanced social interaction skills following the intervention:

"I learned to be more patient with friends who are different from me. The compassion exercises taught me to understand their perspectives better." (Student 8, Maha Sarakham)

"Working together on the computer activities made our class more united. We started helping each other more instead of competing." (Student 31, Roi Et)

6.2.3 Increased Engagement and Motivation

Students expressed high levels of engagement with the technology-enhanced approach and increased motivation to learn about moral principles:

"The interactive stories and videos made learning fun. I looked forward to these classes more than regular lectures." (Student 12, Khon Kaen)

"Using computers made the Buddhist teachings feel modern and relevant to our lives. It wasn't boring like traditional classes." (Student 27, Kalasin)

6.2.4 Cultural Appreciation and Identity Development

The intervention appeared to strengthen students' appreciation for their cultural heritage while developing positive identity formation:

"I'm proud to be Buddhist now. The program showed me how our traditional wisdom can help solve today's problems." (Student 19, Maha Sarakham)

"Learning about the Four Sublime States through technology made me realize how valuable our culture is for building better communities." (Student 4, Roi Et)

7. DISCUSSION

7.1 Effectiveness of Creative CAI in Moral Education

The quantitative results demonstrate clear evidence of the Creative CAI model's effectiveness in enhancing students' understanding of Buddhist moral principles and social coexistence concepts. The significant improvement in pre-post test scores (Cohen's d = 2.34) represents a large effect size, indicating substantial practical significance beyond statistical significance (Richardson, 2022). These findings align with recent research on technology-enhanced moral education, which demonstrates superior outcomes compared to traditional instructional approaches (Chen & Wang, 2023).

The progressive improvement across exercises (85.68% to 90.00%) suggests that students developed increasing mastery and confidence throughout the intervention period. This pattern aligns with social cognitive theory predictions regarding skill development through scaffolded practice and feedback (Bandura, 2023). The Creative CAI model's interactive features appeared to provide effective scaffolding for complex moral reasoning development.

Module effectiveness scores exceeding 80/80 criteria (E1 = 86.41, E2 = 86.11) indicate robust instructional design that successfully engaged diverse learners across different educational contexts. This consistency across four provinces with varying characteristics suggests the model's potential for broader implementation across northeastern Thailand's educational system.

7.2 Integration of Buddhist Philosophy with Educational Technology

The successful integration of the Four Sublime States of Mind with computer-assisted instruction addresses a significant gap in moral education research. Traditional approaches to Buddhist education often rely on didactic instruction that may not effectively engage contemporary students (Thanakit & Sompong, 2022). The Creative CAI model's interactive multimedia presentations, scenario-based learning, and collaborative platforms provided culturally responsive pedagogy that honored traditional wisdom while utilizing modern educational technology.

Qualitative findings reveal that students appreciated the model's ability to make ancient wisdom relevant to contemporary challenges. This relevance is crucial for effective moral education, as students must perceive ethical principles as applicable to their lived experiences (Martinez & Johnson, 2023). The technology enhancement appeared to bridge the gap between traditional Buddhist teachings and modern student expectations and learning preferences.

The strong cultural appreciation theme emerging from qualitative data suggests that well-designed technology integration can strengthen rather than undermine cultural identity. This finding contradicts concerns about technology's potentially negative impact on traditional values, instead supporting arguments for thoughtful integration that preserves cultural authenticity while enhancing accessibility (Siripornpanich & Thongdee, 2022).

7.3 Behavioral and Social Development Outcomes

The consistent improvement in behavioral assessments across cooperative learning, peer interaction, and moral reasoning dimensions indicates that the Creative CAI model successfully promoted holistic development beyond cognitive outcomes. These findings align with research emphasizing the importance of experiential learning in moral development (Williams et al., 2023).

The collaborative learning features embedded in the Creative CAI model appeared particularly effective in promoting positive peer relationships and social cohesion. Students' reports of increased unity and mutual support suggest that the intervention successfully addressed common challenges in secondary education, including competition, social isolation, and interpersonal conflict.

The high behavioral scores in lesson 5 (93.79%) indicate sustained engagement and skill development throughout the intervention period. This pattern suggests that the Creative CAI model successfully maintained student motivation and participation, addressing common concerns about technology-enhanced instruction becoming monotonous or losing effectiveness over time (Anderson & Clark, 2023).

7.4 Student Satisfaction and Engagement

The consistently high satisfaction scores across all measured dimensions (overall M = 4.41/5.0) indicate strong student acceptance of the Creative CAI approach. Learning engagement received the highest ratings (M = 4.52), suggesting that the interactive features successfully captured and maintained student attention throughout the intervention period.

High technology usability scores (M = 4.38) indicate that the Creative CAI model was successfully designed for student users, avoiding common pitfalls of educational technology that prioritizes technical sophistication over user experience. This finding is particularly important given the diverse technological backgrounds of students across the four provinces.

The strong cultural relevance ratings (M = 4.29) suggest that the integration of Buddhist principles with modern technology was perceived as authentic and meaningful rather than superficial or tokenistic. This perception is crucial for sustained impact and broader acceptance among educators, parents, and communities.

7.5 Implications for Educational Practice

These findings have several important implications for educational practice in Thailand and similar cultural contexts. First, the successful integration of Buddhist moral principles with computer-assisted instruction provides a model for addressing the persistent challenge of making traditional wisdom relevant to contemporary students.

Second, the consistent effectiveness across diverse educational contexts suggests that the Creative CAI model has potential for broader implementation across northeastern Thailand's educational system. However, successful scaling will require attention to technological infrastructure, teacher training, and ongoing support systems.

Third, the positive behavioral and social outcomes indicate that technology-enhanced moral education can address multiple educational goals simultaneously, including academic achievement, character development, and social cohesion. This efficiency is particularly valuable in educational systems facing resource constraints and competing priorities.

7.6 Limitations and Future Research Directions

Several limitations should be considered when interpreting these findings. The relatively short intervention period (six hours) limits conclusions about long-term impact and sustainability. Future research should examine longer-term outcomes and explore optimal dosage for sustained behavioral change.

The focus on Grade 8 students in northeastern Thailand limits generalizability to other age groups and cultural contexts. Research with diverse populations would strengthen understanding of the Creative CAI model's broader applicability.

Additionally, the study did not include a control group receiving traditional instruction, limiting ability to attribute outcomes specifically to the Creative CAI approach rather than general attention or novelty effects. Future experimental research should include appropriate comparison conditions.

8. CONCLUSION

This mixed-methods study provides compelling evidence for the effectiveness of integrating Buddhist moral principles with computer-assisted instruction in promoting social coexistence among secondary students in northeastern Thailand. The Creative CAI model demonstrated significant improvements in learning outcomes, behavioral development, and student satisfaction across diverse educational contexts.

The research contributes to the growing literature on technology-enhanced moral education by demonstrating successful integration of traditional wisdom with contemporary pedagogical approaches. The Four Sublime States of Mind provide robust frameworks for addressing contemporary social challenges, while computer-assisted instruction offers engaging delivery mechanisms that resonate with modern students' learning preferences.

The consistently positive outcomes across quantitative and qualitative measures suggest that the Creative CAI model addresses critical needs in contemporary education: maintaining cultural authenticity while embracing technological innovation, promoting

academic achievement while fostering character development, and engaging individual learners while building social cohesion.

These findings have important implications for educational policy and practice in Thailand and similar cultural contexts. The successful model provides a framework for addressing the persistent challenge of moral education in rapidly changing societies, offering hope for maintaining cultural values while preparing students for globalized futures.

Future research should explore long-term impact sustainability, optimal implementation strategies for diverse contexts, and potential adaptations for different age groups and cultural settings. The promising initial results warrant continued investigation and development of technology-enhanced approaches to moral education that honor traditional wisdom while embracing contemporary possibilities.

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APPENDICES

Appendix A: Creative CAI Module Structure and Content Framework

Table A1: Detailed Module Content Structure

Lesson	Duration	Core Concept	Interactive Elements	Assessment Methods
1	75 minutes	Loving-kindness (Mettā)	Multimedia scenarios, Peer collaboration exercises	Formative assessment, Peer evaluation
2	75 minutes	Compassion (Karuṇā)	Role-playing simulations, Empathy-building activities	Behavioral observation, Self-reflection
3	75 minutes	Sympathetic Joy (Muditā)	Celebration scenarios, Community service planning	Group projects, Portfolio development
4	75 minutes	Equanimity (Upekkhā)	Conflict resolution cases, Mindfulness exercises	Problem-solving assessment, Stress response evaluation
5	60 minutes	Integration & Application	Real-world problem solving, Action planning	Comprehensive assessment, Behavioral demonstration

Appendix B: Statistical Analysis Results Summary

Table B1: Descriptive Statistics by Province

Province	N	Pre-test M(SD)	Post-test M(SD)	Effect Size (d)	p-value

Khon Kaen	45	16.12(1.45)	28.67(2.08)	2.28	<0.001***
Kalasin	36	15.83(1.67)	28.94(2.15)	2.41	<0.001***
Maha Sarakham	32	15.91(1.52)	28.75(2.22)	2.35	<0.001***
Roi Et	31	15.97(1.71)	28.90(2.06)	2.39	<0.001***
Total	**144**	**15.96(1.58)**	**28.81(2.14)**	**2.34**	**<0.001***

***$p < 0.001$

Table B2: Correlation Matrix of Key Variables

Variable	1	2	3	4	5	6
1. Pre-test Score	1.00					
2. Post-test Score	0.34**	1.00				
3. Behavioral Score	0.28*	0.67***	1.00			
4. Satisfaction Score	0.19	0.58***	0.72***	1.00		
5. Technology Usage	0.12	0.45**	0.56***	0.63***	1.00	
6. Cultural Identity	0.23*	0.52***	0.61***	0.68***	0.41**	1.00

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Appendix C: Qualitative Analysis Coding Framework

Table C1: Thematic Analysis Results - Code Frequency and Distribution

Main Theme	Sub-themes	Code Frequency	Representative Provinces	Participant Demographics
Enhanced Moral Understanding	Practical application (n=28) Conceptual clarity (n=24) Cultural relevance (n=22)	74	All four provinces	Mixed gender, all academic levels
Improved Peer Relationships	Empathy development (n=26) Conflict resolution (n=19) Collaborative behavior (n=23)	68	Khon Kaen (18), Kalasin (16), Maha Sarakham (17), Roi Et (17)	Predominantly female (65%)
Increased Engagement	Technology appeal (n=25) Interactive features (n=21) Motivation enhancement (n=18)	64	Urban schools (38), Rural schools (26)	Mixed academic performance

Cultural Appreciation	Identity strengthening (n=20) Heritage value (n=17) Modern relevance (n=15)	52	Rural schools (32), Urban schools (20)	Varied socioeconomic backgrounds

Appendix D: Research Instruments Validation Results

Table D1: Content Validity Index (CVI) for Research Instruments

Instrument	Number of Items	Expert Reviewers	Item-CVI Range	Scale-CVI	Reliability (α)
Achievement Test	35	5	0.78-1.00	0.92	0.89
Behavioral Assessment	24	4	0.82-1.00	0.94	0.91
Satisfaction Questionnaire	20	3	0.75-0.98	0.89	0.87
Focus Group Protocol	12 questions	4	0.85-1.00	0.96	N/A

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