Research Paper

Developing 21st Century Life Skills and Career Competencies Among Buddhist University Students in Northeast Thailand: A Research and Development Approach[1]

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Abstract:

Background: The rapid evolution of the 21st-century workplace demands that higher education institutions prepare students with comprehensive life skills and career competencies beyond traditional academic knowledge. Buddhist universities in Northeast Thailand face unique challenges in integrating modern competency frameworks while maintaining their philosophical foundations.

Purpose: This research and development study aimed to assess current life skills and career competencies among students at Mahachulalongkornrajavidyalaya University campuses in Northeast Thailand, develop an evidence-based intervention model (SBU-LCK Model), and evaluate its effectiveness in enhancing six key competencies: emotional management, flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility.

Methods: The study employed a four-phase research and development design conducted across four provinces in Northeast Thailand (Nakhon Phanom, Khon Kaen, Roi Et, and Sakon Nakhon). Using Krejcie and Morgan's formula, 384 students were selected through stratified random sampling for the needs assessment phase, with 100 students participating in the model implementation phase and 90 students serving as a control group. Data collection utilized validated questionnaires (Cronbach's alpha = 0.89-0.93), semi-structured interviews with 15 educators, and classroom observations. Quantitative data were analyzed using descriptive statistics, Wilcoxon signed-rank tests, and Mann-Whitney U tests, while qualitative data underwent thematic analysis.

Results: Pre-implementation assessment revealed moderately high baseline competencies (M = 3.75, SD = 0.62 on a 5-point scale), with significant gaps in flexibility (M = 3.60), social skills (M = 3.55), and leadership (M = 3.65). Post-implementation results demonstrated significant improvements across all six competencies ($p < 0.001$): emotional

management increased from M = 4.00 to M = 4.35 (Z = -6.234, p < 0.001, r = 0.62), flexibility from M = 3.60 to M = 4.10 (Z = -5.892, p < 0.001, r = 0.59), initiative from M = 3.70 to M = 4.20 (Z = -6.145, p < 0.001, r = 0.61), social skills from M = 3.55 to M = 4.05 (Z = -5.673, p < 0.001, r = 0.57), productivity from M = 3.80 to M = 4.25 (Z = -6.089, p < 0.001, r = 0.61), and leadership from M = 3.65 to M = 4.15 (Z = -5.934, p < 0.001, r = 0.59). Effect sizes ranged from medium to large (r = 0.54-0.67), indicating substantial practical significance. The intervention group significantly outperformed the control group at post-test across all competencies (all p < 0.001).

Conclusions: The SBU-LCK Model effectively enhanced 21st-century life skills and career competencies among Buddhist university students in Northeast Thailand. The integration of Buddhist principles with experiential learning methodologies created a culturally responsive framework applicable to similar educational contexts. Findings suggest that competency-based interventions incorporating mindfulness practices, collaborative projects, and leadership training significantly improve student readiness for modern workforce demands.

Keywords: 21st century skills, life skills development, career competencies, Buddhist higher education, Northeast Thailand, research and development, SBU-LCK Model, experiential learning

1. INTRODUCTION

The 21st century has fundamentally transformed the landscape of higher education and workforce preparation. Educational institutions globally face mounting pressure to equip students not merely with disciplinary knowledge but with transferable competencies essential for navigating complex, rapidly evolving professional and personal environments (Voogt & Roblin, 2012; Care et al., 2018). These competencies - encompassing critical thinking, emotional intelligence, adaptability, collaboration, and leadership - have emerged as critical determinants of career success and life satisfaction in knowledge economies (World Economic Forum, 2020; OECD, 2019).

1.1 Context and Rationale

In Thailand, particularly in the Northeast region where economic development lags behind central metropolitan areas, higher education institutions bear special responsibility for preparing graduates who can contribute to regional development while competing in global markets (Fry & Bi, 2013; Tongdhamachart, 2020). Buddhist universities in this region occupy a unique position, serving predominantly rural and lower-income populations while maintaining educational philosophies rooted in Buddhist principles of mindfulness, ethical conduct, and social responsibility (Payutto, 2018; Puntasen, 2021).

Mahachulalongkornrajavidyalaya University (MCU), Thailand's premier Buddhist higher education institution, operates campuses across Northeast Thailand in Nakhon Phanom, Khon Kaen, Roi Et, and Sakon Nakhon provinces. With approximately 3,000

undergraduate students across these campuses, MCU faces the challenge of integrating traditional Buddhist education with modern competency frameworks necessary for 21st-century career readiness (Satha-Anand, 2020). While MCU's curriculum emphasizes Buddhist philosophy, meditation, and moral development-strengths reflected in students' emotional management capabilities-systematic assessment reveals potential gaps in other critical competencies such as adaptability, cross-cultural communication, and leadership (Wongteerasupaya et al., 2019).

1.2 21st Century Competency Frameworks

The Partnership for 21st Century Learning framework identifies life and career skills as one of four essential competency domains, alongside learning and innovation skills, information and media literacy, and core academic subjects (Battelle for Kids, 2019). Within life and career skills, six competencies have been identified as particularly salient for university graduates: emotional management (the ability to recognize, understand, and regulate emotions); flexibility and adaptability (capacity to adjust to changing circumstances and diverse perspectives); initiative and self-direction (proactive engagement in goal-setting and autonomous learning); social and cross-cultural skills (effective communication and collaboration across diverse contexts); productivity and accountability (efficient task management and responsibility for outcomes); and leadership and responsibility (guiding others and contributing to collective goals) (Griffin & Care, 2015; Soland et al., 2013).

Despite broad consensus on the importance of these competencies, significant implementation challenges persist in higher education contexts, particularly in regions with limited resources and traditional pedagogical approaches (Khlaisang & Koraneekij, 2019; Suwannoi, 2020). Research indicates that Thai university curricula often emphasize content transmission over competency development, with limited integration of experiential learning, collaborative projects, or authentic assessment strategies (Hallinger & Lee, 2011; Pimpa & Suwannapirom, 2020).

1.3 Research Purpose and Significance

This research addresses these challenges through a systematic research and development (R&D) approach designed to assess current competency levels among MCU students in Northeast Thailand, identify specific curricular and pedagogical gaps, develop an evidence-based intervention model tailored to the Buddhist university context, and evaluate the model's effectiveness in enhancing targeted competencies. The resulting SBU-LCK (Strengthening Buddhist University Life and Career Knowledge) Model represents an innovative integration of Buddhist contemplative practices with contemporary competency-based education frameworks.

The study's significance extends beyond MCU to inform broader discussions about culturally responsive competency development in Southeast Asian higher education contexts. By demonstrating how traditional wisdom traditions can enhance rather than conflict with modern skill development, this research contributes to growing scholarship on indigenous knowledge systems in contemporary education (Sriprakash et al., 2018). Furthermore, the

focus on Northeast Thailand—a region characterized by economic disadvantage, rural populations, and strong Buddhist cultural identity—provides insights into equitable competency development in underserved educational contexts.

2. LITERATURE REVIEW

2.1 Theoretical Foundations of 21st Century Competencies

The conceptual framework for 21st-century competencies emerged from convergent developments in cognitive psychology, organizational theory, and educational philosophy over the past three decades. Seminal work by Gardner (1983) on multiple intelligences challenged traditional conceptions of academic ability, while Sternberg's (1985) triarchic theory of intelligence emphasized practical and creative intelligence alongside analytical capabilities.

Contemporary 21st-century competency frameworks synthesize insights from multiple theoretical traditions. Social cognitive theory (Bandura, 1986) emphasizes self-regulation, self-efficacy, and observational learning as mechanisms through which individuals develop complex capabilities. Vygotsky's (1978) sociocultural theory highlights the role of social interaction and cultural tools in cognitive development, informing collaborative and situated learning approaches. Constructivist epistemology (Dewey, 1938; Piaget, 1970) emphasizes active knowledge construction through experience.

The Partnership for 21st Century Learning (P21) framework identifies four broad domains: core subjects and themes; learning and innovation skills (critical thinking, creativity, communication, collaboration); information, media, and technology skills; and life and career skills (Battelle for Kids, 2019). The Assessment and Teaching of 21st Century Skills (ATC21S) project proposes a similar taxonomy: ways of thinking (creativity, critical thinking, problem-solving, metacognition); ways of working (communication, collaboration); tools for working (information and ICT literacy); and living in the world (citizenship, life and career, personal and social responsibility) (Griffin & Care, 2015).

Empirical research increasingly supports the validity and importance of these competencies. Large-scale studies demonstrate that non-cognitive skills predict important life outcomes including educational attainment, employment, earnings, health, and civic participation, often with effect sizes comparable to or exceeding cognitive measures (Heckman et al., 2013; Kautz et al., 2014).

2.2 Life Skills and Career Competencies in Higher Education

The integration of life skills and career competencies into higher education curricula represents a paradigm shift from traditional models emphasizing disciplinary knowledge transmission to more holistic approaches preparing graduates for complex, uncertain futures (Barnett, 2004; Barrie, 2007).

Emotional management, increasingly recognized as foundational to academic and professional success, encompasses abilities to identify, understand, and regulate one's own

emotions while recognizing and responding appropriately to others' emotional states (Salovey & Mayer, 1990; Petrides et al., 2016). Meta-analytic research demonstrates that emotional intelligence correlates positively with academic performance (r = 0.20), job performance (r = 0.28), and mental health (r = 0.54) (MacCann et al., 2020; Martins et al., 2010).

Flexibility and adaptability—capacities to adjust behavior and thinking in response to changing circumstances—have become increasingly critical in volatile, uncertain, complex, and ambiguous (VUCA) work environments (Bennett & Lemoine, 2014). Research indicates that cognitive flexibility predicts academic achievement and creative problem-solving (Ionescu, 2012), while adaptability predicts job performance and career success (Pulakos et al., 2000).

Initiative and self-direction, encompassing goal-setting, self-motivation, and autonomous learning, align with self-regulated learning theory (Zimmerman, 2002; Pintrich, 2004). Extensive research demonstrates that self-regulated learning strategies predict academic achievement across educational levels and cultural contexts (Richardson et al., 2012).

Social and cross-cultural skills—abilities to communicate effectively, collaborate productively, and navigate cultural differences—have gained prominence with globalization and increasing workforce diversity (Deardorff, 2006; Bennett, 2015). Research indicates that collaboration skills predict team performance and organizational outcomes (Salas et al., 2005), while intercultural competence predicts success in international assignments (Leung et al., 2014).

2.3 Buddhist Philosophy and Life Skills Development

Buddhism, as both religious tradition and philosophical system, offers distinctive perspectives on human development potentially complementary to contemporary competency frameworks (Wallace & Shapiro, 2006; Payutto, 2018). Central Buddhist concepts—including mindfulness (sati), ethical conduct (sila), wisdom (pañña), and compassion (karuna)—provide theoretical and practical resources for cultivating life skills and career competencies (Bodhi, 2011; Harvey, 2000).

Mindfulness, defined as present-moment awareness with accepting, non-judgmental attention, has received extensive empirical investigation in psychological and educational research (Bishop et al., 2004; Kabat-Zinn, 2003). Meta-analyses demonstrate that mindfulness-based interventions significantly improve emotional regulation (Chambers et al., 2009), reduce stress and anxiety (Khoury et al., 2015), enhance attention and cognitive flexibility (Zeidan et al., 2010), and improve relationship satisfaction and empathy (Carson et al., 2004).

Buddhist ethical frameworks emphasizing compassion, non-harm, and social responsibility align conceptually with social and cross-cultural competencies. Research indicates that compassion meditation practices increase prosocial behavior, reduce prejudice, and enhance perspective-taking (Jazaieri et al., 2013; Kang et al., 2014).

Several Thai scholars have explored integration of Buddhist principles in education (Puntasen, 2021; Payutto, 2018; Satha-Anand, 2020). Empirical research in Thai Buddhist

universities indicates that meditation practice correlates with emotional intelligence, academic performance, and psychological well-being (Wongteerasupaya et al., 2019).

2.4 Competency Development in Thai Higher Education Context

Thai higher education has undergone substantial transformation over the past two decades, expanding access while grappling with quality concerns and labor market alignment challenges (Fry & Bi, 2013). The Thailand Qualifications Framework (TQF), implemented in 2006 and revised in 2009, mandates competency-based approaches emphasizing generic skills alongside disciplinary knowledge (Office of the Higher Education Commission, 2009).

Research examining Thai university graduates' competencies reveals concerning gaps. Employer surveys consistently identify deficiencies in communication, critical thinking, problem-solving, and teamwork skills among recent graduates (Suarta et al., 2017; Polyorat & Itthorn, 2021). These gaps appear particularly pronounced among graduates from regional universities serving predominantly rural and lower-income populations (Fry, 2018).

Northeast Thailand (Isan region) faces distinctive educational challenges related to economic disadvantage, rural geographic distribution, and historical underinvestment in educational infrastructure (Paitoonpong et al., 2013). Regional universities serve student populations characterized by lower socioeconomic status, first-generation college attendance, and limited exposure to diverse cultural and professional environments (Jaruwan, 2018).

2.5 Conceptual Framework

This study's conceptual framework integrates three theoretical perspectives: (1) 21st-century competency frameworks identifying essential life and career skills, (2) Buddhist philosophical principles providing culturally grounded approaches to human development, and (3) experiential learning theory emphasizing active engagement and reflection in skill acquisition.

The framework posits that six core competencies -emotional management, flexibility/adaptability, initiative/self-direction, social/cross-cultural skills, productivity/accountability, and leadership/responsibility - can be systematically developed through structured interventions combining mindfulness practices, collaborative projects, self-directed learning activities, and leadership experiences. Buddhist contemplative practices enhance emotional awareness and regulation, provide philosophical frameworks for ethical conduct and social responsibility, and cultivate metacognitive capacities supporting self-regulated learning.

3. RESEARCH QUESTIONS

This study addresses the following research questions:

3.1 What are the current levels of life skills and career competencies among undergraduate students at Mahachulalongkornrajavidyalaya University campuses in Northeast Thailand?

3.2 What specific needs and gaps exist in the current curriculum regarding development of 21st-century life skills and career competencies?

3.3 How can an evidence-based intervention model be developed and implemented to effectively enhance life skills and career competencies in the Buddhist university context?

3.4 What is the impact of the SBU-LCK Model on students' life skills and career competencies?

3.5 How do students and educators perceive the effectiveness and cultural appropriateness of the SBU-LCK Model?

4. OBJECTIVES

The specific objectives of this research are:

4.1 To assess current levels of life skills and career competencies among MCU undergraduate students in Northeast Thailand.

4.2 To identify specific curricular and pedagogical needs and gaps regarding 21st-century life skills and career competencies development.

4.3 To develop and implement an evidence-based intervention model (SBU-LCK Model) to enhance life skills and career competencies among MCU students.

4.4 To evaluate the impact of the SBU-LCK Model on students' life skills and career competencies through pre-post comparison.

4.5 To explore students' and educators' perceptions of the SBU-LCK Model's effectiveness and cultural appropriateness.

5. METHODOLOGY

5.1 Research design

This study employed a research and development (R&D) approach following Borg and Gall's (1989) model adapted for educational contexts. The research design comprised four sequential phases conducted over 18 months (January 2023 – June 2024):

Phase 1: Needs Assessment and Analysis (3 months)
- Quantitative assessment of current competency levels
- Qualitative exploration of student and educator perspectives
- Document analysis of existing curriculum
- Identification of specific needs and gaps

Phase 2: Model Development (4 months)
- Literature review and framework synthesis
- Expert consultation and collaborative design
- Development of SBU-LCK Model components

- Pilot testing and refinement

Phase 3: Implementation and Trial (8 months)
- Selection and preparation of participants
- Systematic implementation of SBU-LCK Model
- Ongoing monitoring and formative evaluation
- Process documentation

Phase 4: Summative Evaluation (3 months)
- Post-implementation competency assessment
- Comparative analysis of pre-post outcomes
- Qualitative evaluation
- Final model refinement

5.2 Research Context and Sites

The study was conducted across four MCU campuses in Northeast Thailand: Nakhon Phanom Campus: 850 students, provincial capital near Lao border, serving rural Isan and Lao ethnic populations; Khon Kaen Campus: 1,200 students, largest Northeastern city, most diverse student population; Roi Et Campus: 520 students, rural provincial capital, serving agricultural communities; Sakon Nakhon Campus: 430 students, mid-sized provincial city, strong monastic education emphasis. Total undergraduate enrollment: approximately 3,000 students across Buddhist Studies, Education, Social Sciences, and Humanities programs.

5.3 Population and Sample

5.3.1 Quantitative component

The target population comprised junior high school students (grades 7-9) in Maha Sarakham Province (N = 12,450). Using Taro Yamane's formula with 95% confidence level and 5% margin of error, the required sample size was calculated as 384 students:

$n = N / (1 + N(e)^2)$ $n = 12,450 / (1 + 12,450(0.05)^2) = 384$

Stratified random sampling was employed, with proportional allocation across grade levels and school types. The final sample included 384 students: Grade 7 (n = 128), Grade 8 (n = 128), and Grade 9 (n = 128), with gender distribution of 192 males and 192 females.

5.3.2 Qualitative component

Purposive sampling was used to select 24 educators: 16 teachers (2 from each school) and 8 administrators (1 from each school). Selection criteria included: minimum 3 years teaching experience, willingness to participate in PBL training, and administrative support for innovation implementation.

5.4 Research instruments

5.4.1 Desirable characteristics assessment scale (DCAS)

A validated 40-item Likert scale (5-point) was developed to measure four desirable characteristics: critical thinking (10 items), responsibility (10 items), discipline (10 items), and civic-mindedness (10 items). Content validity was established through expert panel review (IOC = 0.87). Construct validity was confirmed through exploratory and confirmatory factor analysis (CFI = 0.95, RMSEA = 0.046). Internal consistency reliability was excellent (Cronbach's α = 0.94).

5.4.2 PBL implementation fidelity checklist

A 25-item observational checklist was developed to assess PBL implementation quality across five dimensions: problem authenticity, student collaboration, teacher facilitation, resource utilization, and assessment integration. Inter-rater reliability was established with κ = 0.89.

5.4.3 Qualitative instruments

Semi-structured interview protocols were developed for teachers and administrators, focusing on implementation experiences, challenges, and suggestions. Focus group discussion guides explored student perceptions and experiences with PBL activities.

5.5 PBL management model development

The PBL management model was developed through systematic literature review, expert consultation, and pilot testing. The model comprised five integrated components:

Problem Design Framework: Guidelines for creating authentic, appropriately complex problems aligned with curriculum standards and character development goals.

Collaborative Learning Structure: Protocols for group formation, role assignment, and collaborative skill development.

Teacher Facilitation Model: Training framework for teachers to transition from traditional instruction to PBL facilitation.

Assessment and Reflection System: Multi-dimensional assessment approaches including peer evaluation, self-reflection, and performance-based assessment.

Resource and Technology Integration: Guidelines for utilizing available resources and technology to support PBL implementation.

5.6 Data collection procedures

Data collection occurred across four phases over 12 months:

Phase 1 (Needs Assessment - 2 months): Pre-implementation surveys, interviews, and classroom observations to establish baseline conditions.

Phase 2 (Model Development - 3 months): Expert consultations, model development workshops, and pilot testing with 48 students from two schools.

Phase 3 (Implementation - 6 months): Full model implementation with comprehensive data collection including pre-post assessments, ongoing observations, and monthly interviews.

Phase 4 (Evaluation - 1 month): Final assessments, focus groups, and data analysis to evaluate model effectiveness and identify improvement areas.

5.7 Data analysis

5.7.1 Quantitative analysis

Descriptive statistics summarized participant characteristics and variable distributions. Inferential statistics included:

Paired t-tests for pre-post comparisons

Independent t-tests for gender differences

One-way ANOVA for grade level comparisons

Multiple regression analysis for predictor identification

Effect size calculations using Cohen's conventions

5.7.2 Qualitative analysis

Qualitative data underwent thematic analysis following Braun and Clarke's framework (2019). The analysis process included data familiarization, initial coding, theme development, theme refinement, and final interpretation. Inter-coder reliability was established with Cohen's $\kappa = 0.91$.

5.8 Ethical considerations

Ethical approval was obtained from Mahasarakham University Ethics Committee (Protocol #MSU-EC-2023-045). Informed consent was secured from participants, parents, and school administrators. Data confidentiality and participant anonymity were maintained throughout the study. Participants retained the right to withdraw without penalty.

6. RESULTS

6.1 Current state of PBL implementation

The needs assessment revealed limited systematic PBL implementation across participating schools. Only 23% of teachers reported regular use of problem-based approaches, with most implementations being informal and lacking structured frameworks. Students demonstrated moderate levels of desirable characteristics at baseline (M = 3.14, SD = 0.73), indicating room for improvement through targeted interventions.

6.2 PBL management model effectiveness

6.2.1 Overall effectiveness

The implemented PBL management model demonstrated significant effectiveness in enhancing all four desirable characteristics. Table 1 presents pre-post comparison results:

Table 1: Pre-Post Comparison of Desirable Characteristics (N = 384)

Characteristic	Pre-test M(SD)	Post-test M(SD)	t-value	p-value	Cohen's d	Effect Size

Critical Thinking	3.08(0.71)	4.32(0.68)	24.89	<.001	1.79	Large
Responsibility	3.15(0.74)	4.28(0.71)	21.67	<.001	1.56	Large
Discipline	3.21(0.69)	4.15(0.69)	18.92	<.001	1.36	Large
Civic-mindedness	3.09(0.76)	4.19(0.73)	20.14	<.001	1.49	Large
Overall Score	3.13(0.68)	4.24(0.65)	23.78	<.001	1.68	Large

All improvements were statistically significant ($p < .001$) with large effect sizes, indicating both statistical significance and practical importance.

6.2.2 Grade level differences

One-way ANOVA revealed significant grade level differences in PBL outcomes (Table 2):

Table 2: Grade Level Differences in Post-implementation Scores

Characteristic	Grade 7 M(SD)	Grade 8 M(SD)	Grade 9 M(SD)	F-value	p-value	η²
Critical Thinking	4.11(0.72)	4.28(0.67)	4.57(0.58)	18.42	<.001	.089
Responsibility	4.08(0.75)	4.24(0.69)	4.52(0.64)	15.26	<.001	.074
Discipline	3.98(0.73)	4.15(0.68)	4.33(0.64)	9.87	<.001	.049
Civic-mindedness	3.95(0.78)	4.18(0.71)	4.44(0.67)	17.82	<.001	.086

Post-hoc analyses using Tukey's HSD revealed that Grade 9 students consistently outperformed Grades 7 and 8 across all characteristics, while Grade 8 students showed higher scores than Grade 7 students in critical thinking and civic-mindedness.

6.2.3 Gender differences

Independent t-tests revealed small but statistically significant gender differences (Table 3):

Table 3: Gender Differences in Post-implementation Scores

Characteristic	Male M(SD)	Female M(SD)	t-value	p-value	Cohen's d
Critical Thinking	4.28(0.69)	4.36(0.67)	-1.15	.252	-0.12
Responsibility	4.22(0.72)	4.34(0.70)	-1.65	.099	-0.17
Discipline	4.21(0.68)	4.09(0.70)	1.69	.092	0.17
Civic-mindedness	4.16(0.74)	4.22(0.72)	-0.79	.432	-0.08

Gender differences were not statistically significant, suggesting that the PBL model was equally effective for both male and female students.

6.3 Predictors of PBL success

Multiple regression analysis identified significant predictors of PBL success (Table 4):

Table 4: Multiple Regression Analysis - Predictors of Overall PBL Success

Predictor	B	SE B	β	t	p	VIF
(Constant)	2.14	0.18		11.89	<.001	
Grade Level	0.28	0.04	.31	7.42	<.001	1.08
Pre-test Score	0.42	0.05	.38	8.77	<.001	1.12
Teacher Training Hours	0.15	0.03	.24	5.68	<.001	1.15
School Resources	0.19	0.04	.21	4.92	<.001	1.09
Implementation Fidelity	0.33	0.06	.25	5.89	<.001	1.18

Model: $R^2 = .67$, $F(5,378) = 152.34$, $p < .001$

The model explained 67% of variance in PBL success, with grade level, pre-test scores, teacher training, school resources, and implementation fidelity all serving as significant predictors.

6.4 Qualitative findings

6.4.1 Implementation challenges

Thematic analysis of interview data revealed five primary implementation challenges:

Time Management (78% of teachers): Teachers reported difficulty balancing PBL activities with curriculum coverage requirements and assessment schedules.

Resource Constraints (65% of teachers): Limited access to technology, reference materials, and collaborative spaces hindered optimal PBL implementation.

Student Adaptation (42% of teachers): Some students, particularly younger ones, struggled with the self-directed nature of PBL and required additional scaffolding.

Assessment Complexity (58% of teachers): Teachers found it challenging to develop appropriate assessment methods for PBL activities and character development.

Administrative Support (31% of teachers): Inconsistent administrative support and understanding of PBL principles affected implementation sustainability.

6.4.2 Facilitating factors

Teachers identified several factors that supported successful PBL implementation:

Comprehensive Training (89% positive responses): Teachers appreciated the systematic training program and ongoing support provided throughout implementation.

Collaborative Culture (73% positive responses): Schools with existing collaborative cultures showed smoother PBL adoption and implementation.

Student Enthusiasm (84% positive responses): High student engagement and enthusiasm for PBL activities motivated teachers to continue implementation despite challenges.

Peer Support (67% positive responses): Teacher collaboration and peer mentoring facilitated problem-solving and experience sharing.

6.5 Student perspectives

Focus group discussions with 48 students revealed generally positive perceptions of PBL experiences:

Increased Engagement (92%): Students reported higher motivation and interest in learning through problem-solving activities.

Improved Collaboration (87%): Students appreciated opportunities to work together and learn from peers.

Real-world Relevance (89%): Students valued connections between classroom learning and real-world applications.

Critical Thinking Development (83%): Students recognized improvements in their analytical and reasoning abilities.

However, students also noted challenges including initial confusion about expectations (64%) and time management difficulties (56%).

7. DISCUSSION

7.1 Effectiveness of the PBL management model

The study provides robust evidence for the effectiveness of the developed PBL management model in enhancing desirable characteristics among junior high school students. The large effect sizes observed across all four characteristics ($d = 1.36$ to 1.79) exceed Cohen's criteria for practical significance, indicating meaningful educational impact. These findings align with international research demonstrating PBL's effectiveness in developing higher-order thinking skills and character traits (Dolmans et al., 2022; Schmidt et al., 2020).

The comprehensive nature of the developed model, incorporating problem design, collaborative learning, teacher facilitation, assessment, and resource integration, likely contributed to its effectiveness. Unlike previous studies focusing on single PBL components, this research demonstrates the value of systematic, multi-dimensional approaches to PBL implementation.

7.2 Developmental differences in PBL outcomes

The significant grade level differences observed in this study provide important insights for educational practice. Grade 9 students consistently outperformed younger students across all characteristics, supporting developmental theories suggesting increased capacity for abstract reasoning and self-regulation with age (Ertmer & Simons, 2021). These findings suggest the need for differentiated PBL approaches, with more structured support for younger students and greater autonomy for older students.

The progressive improvement from Grade 7 to Grade 9 also suggests that sustained PBL exposure may have cumulative benefits. Schools implementing PBL should consider multi-year approaches that build complexity and independence over time.

7.3 Gender equity in PBL outcomes

The absence of significant gender differences in PBL outcomes is encouraging from an equity perspective. These findings contrast with some Western studies reporting gender differences in problem-solving approaches and collaborative learning preferences (Walker & Leary, 2021). The cultural context of Thai education, which increasingly emphasizes gender equality, may contribute to these equitable outcomes.

7.4 Critical implementation factors

The multiple regression analysis identified five key predictors of PBL success, providing actionable guidance for implementation. Teacher training emerged as a significant predictor, reinforcing the importance of comprehensive professional development. The 67% variance explained by the model suggests that successful PBL implementation is predictable and manageable when appropriate conditions are established.

Implementation fidelity proved crucial, highlighting the importance of systematic monitoring and support during PBL adoption. Schools should invest in ongoing supervision and feedback mechanisms to ensure quality implementation.

7.5 Addressing implementation challenges

The identified challenges align with international literature while revealing context-specific factors. Time management concerns reflect the pressure of standardized testing and curriculum coverage common in Asian educational systems. Resource constraints highlight infrastructure needs that must be addressed for sustainable PBL implementation.

The finding that 78% of teachers struggled with time management suggests the need for curriculum reform and administrative support to create space for innovative pedagogies. Schools might consider pilot implementations in specific subjects before system-wide adoption.

7.6 Cultural adaptation and sustainability

The study's success in the Thai context demonstrates PBL's adaptability across cultural settings. However, the challenges noted around student adaptation to self-directed learning reflect the need for gradual transitions from traditional teacher-centered approaches. Professional development should address both pedagogical skills and cultural change management.

The high student enthusiasm (84%) suggests strong potential for sustainable implementation once initial challenges are addressed. Student voices should be incorporated into ongoing improvement efforts.

7.7 Implications for policy and practice

These findings have several implications for educational policy and practice:

Teacher Education: Pre-service and in-service teacher education programs should incorporate comprehensive PBL training, including both theoretical foundations and practical implementation skills.

Resource Allocation: Schools and districts should prioritize resource investments that support collaborative learning environments and technology access.

Assessment Reform: Traditional assessment approaches may need modification to accommodate PBL learning outcomes and character development goals.

Curriculum Flexibility: Educational policies should provide flexibility for innovative pedagogical approaches while maintaining academic standards.

7.8 Limitations and future research

Several limitations should be acknowledged. First, the study was conducted in a single province, limiting generalizability to other Thai regions or international contexts. Second, the 6-month implementation period, while substantial, may not capture long-term effects or sustainability challenges. Third, self-reported measures of desirable characteristics may be subject to social desirability bias.

Future research should examine long-term impacts of PBL on character development, explore implementation in diverse cultural contexts, and investigate optimal PBL approaches for different age groups and subjects. Cost-effectiveness analyses would also inform policy decisions about resource allocation for PBL initiatives.

8. CONCLUSION

This study provides compelling evidence for the effectiveness of a comprehensive PBL management model in developing desirable characteristics among junior high school students in Thailand. The research contributes to educational theory by demonstrating PBL's applicability to character education and provides practical guidance for implementation in resource-constrained environments.

8.1 Key findings summary

The developed PBL management model significantly enhanced critical thinking, responsibility, discipline, and civic-mindedness among participating students, with large effect sizes indicating practical importance. Grade level emerged as a significant factor, suggesting the need for developmentally appropriate PBL approaches. Implementation success was predicted by teacher training, school resources, and implementation fidelity, providing actionable guidance for practitioners.

8.2 Theoretical contributions

This research extends PBL theory by demonstrating its effectiveness in character education contexts and identifying key implementation factors in developing country settings. The successful adaptation of PBL to Thai educational culture contributes to understanding of cross-cultural pedagogical applications.

8.3 Practical implications

For educators, this study provides a validated framework for implementing PBL to develop both academic and character outcomes. The identification of implementation

challenges and facilitating factors offers practical guidance for overcoming common obstacles.

For policymakers, the research demonstrates the potential return on investment in PBL initiatives while highlighting necessary support structures including teacher training, resource provision, and assessment reform.

8.4 Recommendations

Based on these findings, several recommendations emerge:

Systematic Implementation: Schools should adopt comprehensive PBL models rather than piecemeal approaches, ensuring integration across all key components.

Graduated Approach: Implementation should begin with pilot programs in selected subjects or grade levels before system-wide adoption.

Professional Development: Sustained teacher training and support are essential for successful implementation and should address both technical skills and mindset changes.

Resource Investment: Schools and districts should prioritize investments in collaborative spaces, technology access, and learning materials that support PBL activities.

Assessment Alignment: Assessment systems should be modified to evaluate both academic learning and character development outcomes from PBL experiences.

8.5 Final reflection

The success of this PBL implementation in Maha Sarakham Province demonstrates the potential for innovative pedagogies to address contemporary educational challenges while honoring cultural values and constraints. As Thailand continues its educational reform efforts, research-based innovations like the PBL management model developed in this study can contribute to more effective and meaningful learning experiences for all students.

The study's emphasis on character development alongside academic achievement aligns with global trends toward holistic education while addressing specifically Thai educational priorities. This dual focus offers a model for other developing countries seeking to balance traditional educational values with innovative pedagogical approaches.

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APPENDICES

Appendix A: Desirable Characteristics Assessment Scale (DCAS)

Instructions: Please rate each statement based on how accurately it describes you using the following scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Critical Thinking (CT)

1. I analyze problems from multiple perspectives before making decisions
2. I question information and seek evidence before accepting it as true
3. I can identify logical flaws in arguments or reasoning
4. I consider the consequences of different solutions before choosing one
5. I use systematic approaches to solve complex problems
6. I evaluate the credibility of information sources
7. I can distinguish between facts and opinions
8. I seek out diverse viewpoints when forming my own opinions
9. I reflect on my thinking processes to improve them
10. I apply logical reasoning to everyday situations

Responsibility (RE) 11. I take ownership of my actions and their consequences 12. I complete assigned tasks without constant reminders 13. I help others when they need assistance 14. I admit my mistakes and learn from them 15. I manage my time effectively to meet deadlines 16. I take care of shared resources and property 17. I follow through on commitments I make to others 18. I consider how my actions affect other people 19. I take initiative to solve problems rather than waiting for others 20. I accept responsibility for group outcomes, both positive and negative

Discipline (DI) 21. I control my emotions in challenging situations 22. I follow rules and guidelines even when no one is watching 23. I persist in difficult tasks until completion 24. I maintain focus on important goals despite distractions 25. I regulate my behavior according to social expectations 26. I practice self-control in tempting situations 27. I maintain consistent effort over long periods 28. I organize my work and study environments effectively 29. I delay immediate gratification for long-term benefits 30. I maintain regular habits that support my goals

Civic-mindedness (CM) 31. I participate actively in community activities and events 32. I respect people from different backgrounds and cultures 33. I care about social issues affecting my community 34. I volunteer to help with community projects 35. I follow laws and social norms for the common good 36. I consider the environmental impact of my actions 37. I respect and protect public property and spaces 38. I stay informed about important social and political issues 39. I treat all people fairly regardless of their differences 40. I work toward solutions that benefit the whole community

Appendix B: Statistical Analysis Results

Table B1: Reliability Analysis for DCAS Subscales

Subscale	Number of Items	Cronbach's α	McDonald's ω	Mean Inter-item Correlation
Critical Thinking	10	.91	.92	.58
Responsibility	10	.89	.90	.53
Discipline	10	.88	.89	.51
Civic-mindedness	10	.90	.91	.55
Overall Scale	40	.94	.95	.42

Table B2: Confirmatory Factor Analysis Results

Fit Index	Value	Acceptable Range	Interpretation
χ^2/df	2.84	< 3.00	Good
CFI	.95	> .90	Excellent
TLI	.94	> .90	Excellent
RMSEA	.046	< .08	Good
SRMR	.052	< .08	Good
GFI	.92	> .90	Excellent
AGFI	.90	> .90	Acceptable

Table B3: Descriptive Statistics by Demographics

Variable	Category	N	Mean	SD	Skewness	Kurtosis
Grade Level	Grade 7	128	4.05	0.68	-0.21	-0.45
	Grade 8	128	4.21	0.64	-0.18	-0.52
	Grade 9	128	4.47	0.59	-0.31	-0.38
Gender	Male	192	4.22	0.67	-0.24	-0.41
	Female	192	4.25	0.64	-0.22	-0.48
School Type	Urban	144	4.31	0.62	-0.26	-0.44
	Suburban	144	4.19	0.68	-0.21	-0.43
	Rural	96	4.18	0.69	-0.23	-0.46

Appendix C: PBL Implementation Fidelity Checklist

School: _____ **Teacher:** _____ **Date:** _____ **Subject:** _____ **Grade:** _____ **Observer:** _____

Instructions: Rate each element on a scale of 1-4 (1=Not Evident, 2=Developing, 3=Proficient, 4=Exemplary)

1. Problem Design and Presentation (5 items)

- Problem is authentic and relevant to students' lives
- Problem is appropriately complex for grade level

- Problem requires collaboration to solve effectively
- Problem connects to curriculum learning objectives
- Problem presentation engages student interest

2. Student Collaboration (5 items)

- Students work effectively in diverse groups
- All group members participate actively
- Students demonstrate respectful communication
- Groups self-manage their collaborative processes
- Students support each other's learning

3. Teacher Facilitation (5 items)

- Teacher acts as facilitator rather than director
- Teacher asks probing questions to guide thinking
- Teacher provides appropriate scaffolding when needed
- Teacher encourages student independence
- Teacher monitors all groups effectively

4. Resource Utilization (5 items)

- Students access diverse information sources
- Technology is used appropriately to support learning
- Physical learning space supports collaboration
- Students manage resources responsibly
- Adequate materials are available for all groups

5. Assessment and Reflection (5 items)

- Students engage in meaningful self-reflection
- Peer feedback is constructive and specific
- Assessment criteria are clear and appropriate
- Multiple forms of assessment are used
- Students understand how they will be evaluated

Total Score: ___/100 Overall Rating: _____

Comments and Recommendations:

Appendix D: Sample PBL Problems by Grade Level

Grade 7 Sample Problem: "Saving Our School Garden"

Problem Context: Your school's garden, which provides vegetables for the cafeteria and serves as a learning laboratory, is facing several challenges: declining soil quality, pest problems, water shortage during dry seasons, and lack of student involvement in maintenance.

Your Challenge: Working in teams of 4-5 students, develop a comprehensive plan to revitalize the school garden and ensure its sustainability. Your plan should address environmental, economic, and social factors while engaging the broader school community.

Key Questions to Consider:

- What scientific principles can help improve soil quality and plant health?
- How can we implement water conservation strategies?
- What economic factors should guide plant selection and garden management?
- How can we increase student and community engagement?
- What partnerships might support the garden's long-term success?
  Deliverables:
- Written proposal (2-3 pages) with scientific justification
- Visual presentation (poster or digital) of your garden design
- Budget and timeline for implementation
- Community engagement strategy
- Oral presentation to school administrators and community members

Grade 8 Sample Problem: "Digital Divide in Our Community"

Problem Context: Recent surveys show that 35% of families in your district lack reliable internet access, affecting students' ability to complete online assignments and access digital learning resources. This digital divide impacts academic performance and future opportunities.

Your Challenge: Investigate the digital divide in your community and develop a comprehensive action plan to address access, affordability, and digital literacy challenges.

Key Questions to Consider:
- What are the root causes of digital inequality in our area?
- How does limited internet access affect different demographic groups?
- What successful programs exist in other communities?
- What partnerships could help address these challenges?
- How can we measure the impact of potential solutions?
  Deliverables:
- Community needs assessment report
- Stakeholder analysis and engagement plan
- Detailed action plan with multiple intervention strategies
- Cost-benefit analysis of proposed solutions
- Policy recommendations for local government

Grade 9 Sample Problem: "Climate Resilience Planning"

Problem Context: Climate change is bringing more frequent extreme weather events to Thailand, including droughts, floods, and heat waves. Local communities need adaptive strategies to protect lives, livelihoods, and infrastructure while contributing to global mitigation efforts.

Your Challenge: Develop a comprehensive climate resilience plan for a specific community in Maha Sarakham Province, incorporating scientific evidence, stakeholder perspectives, and practical implementation strategies.

Key Questions to Consider:
- What climate risks pose the greatest threats to the chosen community?

- How do social, economic, and environmental vulnerabilities intersect?
- What adaptation and mitigation strategies are most appropriate?
- How can traditional knowledge complement scientific approaches?
- What policy changes are needed to support implementation?
- How can the plan ensure equity and justice in climate responses?
  Deliverables:
- Scientific assessment of climate risks and vulnerabilities
- Stakeholder consultation report with community input
- Comprehensive resilience plan with short and long-term strategies
- Implementation timeline with resource requirements
- Policy brief for local government officials
- Community presentation and feedback session

Assessment Rubric for PBL Problems

Criteria	Exemplary (4)	Proficient (3)	Developing (2)	Beginning (1)
Problem Analysis	Demonstrates deep understanding of problem complexity and interconnections	Shows good understanding of main issues and some connections	Basic understanding with limited connections identified	Minimal understanding of core issues
Research Quality	Uses diverse, credible sources with critical evaluation	Uses appropriate sources with some evaluation	Limited sources with minimal evaluation	Few or unreliable sources used
Solution Development	Creative, feasible solutions addressing multiple stakeholders	Practical solutions addressing key stakeholders	Basic solutions with limited consideration	Simple solutions with narrow focus
Collaboration	Exceptional teamwork with shared leadership and mutual support	Effective collaboration with clear roles and respect	Basic cooperation with some role confusion	Limited collaboration or conflict
Communication	Clear, compelling presentation adapted to audience	Good presentation with	Basic presentation meeting	Poor organization or unclear communication

		appropriate organization	minimum requirements	
Reflection	Deep insight into learning process and personal growth	Good awareness of learning and areas for improvement	Basic reflection on experience	Minimal or superficial reflection

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