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**Activity-Based Learning Management Integrated with Technology to Promote Students'
Innovativeness and Creative Products for High School Students**

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Abstract

This research and development R&D study addressed a critical educational need: the lack of systematic learning models that integrate activity-based learning with technology to foster innovation and creativity among high school students. The objective was to develop, evaluate, and scale a technology-integrated activity-based learning management model to enhance students' 21st-century skills. A mixed-methods R&D design was employed across five structured phases: research and analysis, model development, implementation, evaluation, and scaling. The participants included 40 Grade 10 students from a Thai demonstration school, selected via purposive sampling. Research instruments comprised validated lesson plans, achievement tests (KR-20 = 0.82), innovation capability rubrics (IOC = 0.78), creative output assessments (inter-rater reliability = 0.85), and satisfaction questionnaires (Cronbach's alpha = 0.94). Quantitative data were analyzed using descriptive statistics and one-sample t-tests. Findings indicated that the model achieved high expert evaluation scores ($M = 4.16$, $S.D. = 0.36$), with student learning outcomes significantly exceeding the 80% benchmark ($p < .001$). During the scaling phase, 90.56% of students demonstrated excellent innovation capabilities, and creative outputs were rated high in quality ($M = 2.59$, $S.D. = 0.25$). Student satisfaction also remained consistently high ($M = 4.36$, $S.D. = 0.12$). The six-step learning model—Stimulation, New Knowledge, Activity Organization, Presentation, Sharing, and Implementation—offers a practical, transferable framework that

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systematically promotes innovation and creative production in upper-secondary education through technology-enhanced active learning.

Keywords : Activity-Based Learning/ Technology Integration/ Innovation/ Creative Output

Introduction

In the context of an increasingly technology-driven, innovation-based global society, traditional educational systems are being challenged to transform. However, Thai secondary education still relies heavily on teacher-centered instruction, rote learning, and passive knowledge transmission. This has led to persistent issues: students lack innovation capacity, struggle with applying knowledge to real-world contexts, and show limited ability to think critically or creatively. If unaddressed, these limitations will widen the gap between learners' potential and the demands of the 21st century. Globally, the Partnership for 21st Century Skills emphasizes "Learning and Innovation Skills"—particularly creativity, innovation, critical thinking, and collaboration—as key competencies for future success (Trilling, Fadel and Partnership, 2009). Nationally, Thailand's Educational Reform Agenda promotes the 3R and 8C Framework, positioning creativity and innovation as central to curriculum transformation (Independent Committee for Education Reform, 2019). The Thailand Education Plan (2017–2036) further calls for educational systems that foster innovation potential among learners in a digital society (Office of the Education Council, 2017).

While activity-based learning (ABL) has been proposed as a potential solution, existing applications often lack a systematic design, integration with technology, and explicit focus on innovation outcomes. As noted by Stößlein (2009), activity-based learning must involve learners in constructing their own understanding through meaningful, hands-on experiences. Yet, there is a gap in frameworks that operationalize ABL in ways that effectively promote innovation and creative outputs—particularly in Thai upper-secondary schools.

Moreover, the integration of ABL with Information and Communication Technology (ICT) remains underutilized. When used effectively, technology can transform classrooms into interactive, learner-centered environments that support experimentation, collaboration, and self-directed inquiry (Sonseeda and Chanla, 2017; McGrath and MacEwan, 2011). However, many educators lack clear models for implementing such approaches in everyday practice.

Research in Thailand suggests that innovative behaviors among learners are shaped by internal dispositions and external support systems—including pedagogical design, collaboration,



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and organizational culture (Sutthawart and Pasunon, 2015) Effective innovation-focused learning environments must therefore be intentionally structured. Educational innovations must also account for context, policy, and theoretical coherence (Sutthawart and Siriwong, 2015)

This study addresses these challenges by developing, evaluating, and scaling a technology-integrated activity-based learning model designed to systematically promote innovation capabilities and creative outputs among upper-secondary school students in Thailand. The model aims to bridge the gap between theory and classroom practice while aligning with both national policy and global education trends.

Research Objectives

1. To develop an activity-based learning management model integrated with technology that systematically promotes innovation capabilities and creative product development among upper-secondary school students.
2. To evaluate the effectiveness of the developed model in the following aspects:
 - 2.1 Students' learning achievement outcomes
 - 2.2 Students' innovation capability levels
 - 2.3 The quality of creative products produced
 - 2.4 Students' satisfaction and engagement with the learning process
3. To implement and scale the developed learning model across diverse educational contexts to examine its adaptability and sustainability.

Methodology

Research Design

This study adopted a mixed-methods research and development (R&D) approach grounded in a systematic five-phase framework: (1) Research and Analysis (R1), (2) Development (D1), (3) Implementation (R2), (4) Evaluation (D2), and (5) Transferring and Scaling (T). The design emphasized methodological rigor by integrating both quantitative and qualitative methods to ensure the reliability and validity of the findings. The approach followed experimental and quasi-experimental research principles established by Campbell and Stanley (1963), allowing for empirical evaluation across developmental stages.



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Participants

The primary participants comprised 40 Grade 10 students from Section 4/3 of the Demonstration School of Silpakorn University during the first semester of the 2020 academic year. A purposive sampling technique was employed to select participants who demonstrated foundational digital literacy skills necessary for engaging in technology-enhanced learning. The sample included 22 female students (55%) and 18 male students (45%), aged between 15 and 16 years. All students participated voluntarily and provided informed consent prior to inclusion in the study.

Research Instruments

To support multi-dimensional evaluation, five validated research instruments were employed to collect both quantitative and qualitative data.

First, the **Learning Achievement Test** was a 30-item multiple-choice instrument designed to assess students' knowledge in life guidance content. The test demonstrated acceptable internal consistency ($KR-20 = 0.82$) and strong content validity ($IOC = 0.89$).

Second, the **Innovation Capability Assessment** was developed as a 20-point performance-based rubric evaluating students' practical innovation-related skills such as teamwork, problem-solving, and creative implementation. The instrument showed high inter-rater reliability (0.85) and acceptable content validity ($IOC = 0.78$).

Third, the **Creative Output Evaluation Form** was a rubric employing a 3-point scale to evaluate five key criteria: originality, practicality, execution quality, alignment with objectives, and potential impact. Inter-rater reliability for this rubric was 0.87, ensuring consistency in the assessment of student-generated products.

Fourth, the **Student Satisfaction Questionnaire** comprised 25 Likert-scale items measuring student perceptions across four key domains: engagement, perceived learning value, integration of technology, and overall satisfaction. This instrument yielded a high internal consistency reliability (Cronbach's $\alpha = 0.94$).

Finally, the **Expert Quality Assessment Form** was a structured instrument used by educational experts during model development and refinement stages. This tool focused on theoretical soundness, feasibility, and pedagogical relevance, achieving high content validity ($IOC = 0.92$).



Data Collection and Analysis

Data collection was conducted sequentially across all five phases of the research process. Quantitative data were analyzed using descriptive statistics (means, percentages, standard deviations) and inferential statistics, particularly one-sample t-tests, to assess the effectiveness of the developed model against pre-established benchmarks. Qualitative data—derived from open-ended student feedback and expert evaluations—were analyzed through thematic content analysis to extract recurring patterns, insights, and contextual nuances relevant to model validation and implementation outcomes.

Results

Model Development and Quality Assessment

The activity-based learning model integrated with technology was systematically developed based on constructivist learning theory and refined through expert consultation. The model was evaluated by nine experts using a structured assessment form and received high quality ratings ($M = 4.16$, $S.D. = 0.36$), indicating its strong suitability for implementation in high school settings.

The finalized model comprises five interrelated components:

1. Foundational Principles – grounded in constructivist pedagogy, emphasizing student-centered knowledge construction and the meaningful use of technology;
2. Learning Objectives – aimed at developing innovation capabilities and generating high-quality creative outputs;
3. Activity Sequence – a six-step cyclical process including: (1) Stimulation and Experience, (2) New Knowledge Provision, (3) Activity Organization, (4) Presentation, (5) Sharing and Reflection, and (6) Improvement and Implementation;
4. Assessment Framework – incorporating both formative and summative assessments across multiple dimensions: learning achievement, innovation skills, and creative product quality;
5. Success Factors – key conditions supporting model effectiveness such as ICT infrastructure, teacher competency, and active learner engagement.



Figure 1: Activity-Based Learning Model Integrated with Technology Framework

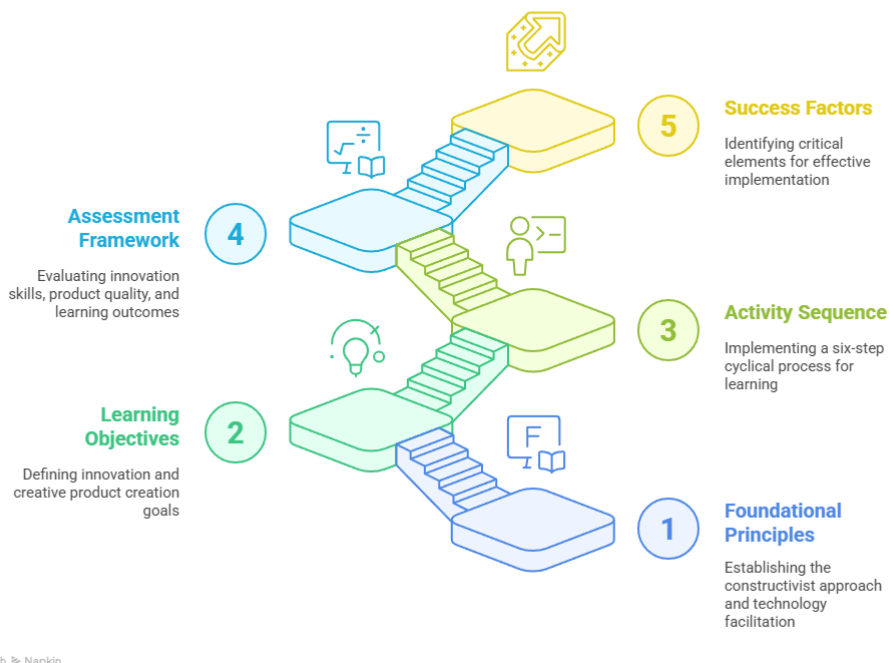


Figure 1 illustrates the structure of the Activity-Based Learning Model Integrated with Technology. Technology integration points (T) are embedded across all phases of the learning cycle to support collaboration, exploration, creation, and presentation.

Learning Achievement Outcomes

Learning achievement results showed a statistically significant improvement after the implementation of the model. The post-test mean score ($M = 87.32$, $S.D. = 6.15$) was significantly higher than the pre-test score ($M = 72.45$, $S.D. = 8.23$), with a large effect size (Cohen's $d = 1.18$). Moreover, the post-test performance significantly exceeded the predetermined benchmark of 80% ($t(39) = 7.31$, $p < .001$, Cohen's $d = 1.19$), indicating substantial enhancement in students' knowledge acquisition after participating in the activity-based learning model integrated with technology.



Table 1: Learning Achievement Results

Assessment Phase	n	Mean Score (%)	S.D.	t-value	p-value	Cohen's d
Pre-test	40	72.45	8.23	-	-	-
Post-test	40	87.32	6.15	7.42*	< .001	1.18
Benchmark Comparison	40	87.32 vs 80.00	6.15	7.31*	< .001	1.19

*p < .05

Innovation Capability Assessment

The assessment of students' innovation capabilities revealed highly promising results. A majority of students (62.5%) achieved scores in the “Excellent” range (18–20 points), and a cumulative 92.5% performed at either “Good” or “Excellent” levels. This indicates the model’s effectiveness in systematically enhancing students' ability to collaborate, solve problems, and generate innovative ideas.

Table 2: Innovation Capability Distribution

Performance Level	Score Range	Frequency	Percentage	Cumulative %
Excellent	18-20	25	62.5%	62.5%
Good	15-17	12	30.0%	92.5%
Satisfactory	12-14	3	7.5%	100.0%
Needs Improvement	0-11	0	0.0%	100.0%

Creative Output Quality

The quality of students’ creative outputs, as evaluated across five dimensions, consistently fell within the “High” level across all criteria. The highest performance was observed in "Objective Alignment" (M = 2.71, S.D. = 0.46), demonstrating the students' ability to connect creative efforts with instructional goals. Overall creative product quality (M = 2.54, S.D. = 0.54) further supports the success of the model in promoting meaningful and relevant student work.



Table 3: Creative Output Assessment Results

Evaluation Criteria	Mean	S.D.	Performance Level
Originality	2.68	0.52	High
Practicality	2.45	0.61	High
Quality of Execution	2.52	0.48	High
Objective Alignment	2.71	0.46	High
Potential Impact	2.35	0.58	High
Overall Creative Output	2.54	0.54	High

Student Satisfaction and Engagement

Students reported very high satisfaction across all domains. The highest satisfaction was in “Learning Engagement” ($M = 4.42$, $SD = 0.08$), followed closely by “Skill Development” ($M = 4.41$, $S.D. = 0.06$). These results indicate that students responded positively to the active and technology-enhanced learning environment created by the model.

Table 4: Student Satisfaction Results

Satisfaction Domain	Mean	S.D.	Interpretation
Learning Engagement	4.42	0.08	Very High
Technology Integration	4.35	0.09	Very High
Collaborative Activities	4.38	0.07	Very High
Skill Development	4.41	0.06	Very High
Overall Satisfaction	4.37	0.07	Very High

Scaling Implementation Results

During the model’s scaling phase, outcomes not only remained consistent but improved in critical areas. Notably, the proportion of students achieving “Excellent” levels in innovation increased markedly from 62.5% to 90.56%, demonstrating the model’s sustainability and adaptability in broader educational contexts. Slight gains were also observed in learning achievement and creative output quality, while student satisfaction remained high.



Table 5: Scaling Phase Outcomes

Outcome Measure	Initial Implementation	Scaling Phase	Change
Learning Achievement (% above 80%)	85.0%	89.2%	+4.2%
Innovation Excellence (18-20 points)	62.5%	90.56%	+28.06%
Creative Output Quality (M)	2.54	2.59	+0.05
Student Satisfaction (M)	4.37	4.36	-0.01

Discussion

Model Effectiveness and Theoretical Alignment

The high expert evaluation scores for the developed activity-based learning model ($M = 4.16$, $S.D. = 0.36$) validate the appropriateness, clarity, and coherence of its conceptual and procedural design. Rooted in constructivist theory (Stöblein, 2009), the model empowers students to engage in self-directed learning through structured yet flexible steps that emphasize experiential learning. Its six-phase sequence—Stimulation and Experience, New Knowledge Provision, Activity Organization, Presentation, Share, and Improvement and Implementation—ensures a cyclical learning process that balances scaffolding with autonomy. This structure not only facilitates innovation but also provides a replicable pedagogical model adaptable to diverse instructional contexts.

Learning Achievement and Knowledge Construction

Post-test results ($M = 87.32\%$) significantly surpassed the 80% benchmark ($p < .001$, Cohen's $d = 1.19$), indicating the model's strong impact on content mastery and cognitive development. These results align with Eggen and Kauchak's (1996) assertion that strategic teaching—blending sociocultural, psychological, and anthropological perspectives—enhances learning outcomes. The findings are consistent with previous studies such as Sooksena (2017), who demonstrated similar gains using activity-based learning to cultivate ASEAN citizenship traits. Additionally, the results reflect Lijanpor's (2013) findings on behavioral improvement through structured, experiential learning. The large effect size affirms that integrating active learning with technological tools has practical significance in boosting academic achievement.

Innovation Capability Development

Student performance on the innovation capability rubric revealed that 62.5% initially reached the “excellent” level, later increasing to 90.56% in the scaling phase. This confirms that



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the model systematically nurtures creative and innovative thinking, particularly when experiential learning is supported by structured coaching and iterative practice (Wongyai and Patphol, 2018). The process reflects the logic of the GPAS 5 Steps framework (Sithsungnoen et al, 2018) which encourages metacognitive growth, critical thinking, and transfer of knowledge to real-world contexts. This result reinforces the model's strength in equipping students with future-oriented skills aligned with Thailand 4.0 goals.

Creative Output Quality and Authentic Assessment

High average ratings across five dimensions of creative output (overall $M = 2.54$, $S.D. = 0.54$), with objective alignment scoring the highest ($M = 2.71$), reveal that students successfully internalized learning goals and translated them into meaningful products. These results affirm the effectiveness of authentic assessment strategies that encourage originality, relevance, and the application of knowledge in real-life scenarios. The model's emphasis on integrating creativity with objective-driven learning ensures that students move beyond rote memorization to produce tangible, value-driven outcomes.

Technology Integration and Student Engagement

Student satisfaction scores ($M = 4.37$, $S.D. = 0.07$) and engagement metrics ($M = 4.42$) suggest that technology use within the model did not create cognitive overload but instead enhanced clarity, participation, and collaborative learning. These findings validate the role of ICT in promoting learner motivation, especially when technology is integrated seamlessly with pedagogy (Sonseeda and Chanla, 2017). By aligning technological tools with specific stages of the learning process, the model reinforces active participation and sustained interest.

Scaling Effectiveness and Sustainability

Notably, during the scaling phase, student innovation excellence rose markedly from 62.5% to 90.56%, while creative product quality and satisfaction remained consistently high. These results indicate that the model possesses both scalability and adaptability. Its clearly defined structure, combined with accessible implementation guidelines, facilitates adoption across varied educational settings. The findings suggest that with institutional support and teacher readiness, the model holds promise as a transformative instructional strategy applicable to Thailand's broader educational reform landscape.



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Conclusion

This research successfully developed and validated an activity-based learning model integrated with technology, designed to cultivate innovation and creativity among high school students. The model's six-step structure offers a coherent and adaptable framework that promotes 21st-century competencies through experiential, technology-enhanced learning. The findings revealed significant improvements in learning achievement, high levels of innovation capability, consistent production of quality creative outputs, and strong student engagement. The model's effectiveness was further confirmed through its successful scaling, underscoring its practical applicability across diverse educational contexts. The study contributes to educational innovation by presenting a theoretically grounded and empirically supported model that addresses the pressing need for pedagogical strategies preparing students to thrive in a dynamic, technology-driven world.

Limitations and Future Research

While the findings are promising, several limitations should be acknowledged. The study focused on a single subject area (life guidance) within one institution, limiting broader generalizability. Future research should explore implementation across multiple disciplines and school settings. Moreover, longitudinal studies are recommended to assess the long-term impact on students' sustained innovation and creativity development, as well as institutional capacity for ongoing adoption.

Recommendations for Practice

To ensure successful adoption, educational institutions should invest in sufficient technological infrastructure, provide ongoing professional development for teachers, and institutionalize the six-step model within broader instructional planning. Embracing this model requires commitment to fostering learning environments that support creativity, risk-taking, and innovation as core values.



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