International Journal of Higher Education; Vol. 15, No. 5; 2026
ISSN 1927-6044 E-ISSN 1927-6052
Published by Sciedu Press

Development and Management of an E-Learning Program in a Research and Learning Innovation Course: Achievement, Creativity, and a Comparison of Mathematics and English Preservice Teachers

Chalard Chantarasombat[1], Pravech Rattanapian[1] & Narin Sungrugsa[2]

[1] Educational Administration Program, Faculty of Education, Rattana Bundit University, Thailand

[2] Faculty of Education, Rattana Bundit University, Thailand

Correspondence: Chalard Chantarasombat, Educational Administration Program, Faculty of Education, Rattana Bundit University, Thailand. ORCID: 0000-0002-8233-3671. E-mail: chalard10@gmail.com

Received: August 25, 2026 Accepted: September 14, 2026 Online Published: September 16, 2026

doi:10.5430/ijhe.v15n5p1 URL: https://doi.org/10.5430/ijhe.v15n5p1

Abstract

This research and development study developed and evaluated a managed e-learning program for a Research and Learning Innovation course and examined whether its core design was workable across two preservice-teacher majors. The study proceeded in three phases: synthesis of the knowledge base, program development and expert validation, and field implementation. The resulting 10-module program integrated e-learning and Google Classroom with individual practice, collaborative learning, product monitoring, and feedback over 15 weeks. Cluster sampling from six intact classes yielded 59 participants: 30 mathematics majors and 29 English majors. Instruments comprised the program and manual, an 80-item achievement test, a 40-item creativity scale, and a 45-item satisfaction questionnaire. Four experts returned the program evaluation; item-objective congruence indices ranged from .75 to 1.00. The efficiency/effectiveness results were 96.67/90.58 and an effectiveness index of .711 for mathematics, and 96.90/91.47 and .750 for English. Posttest achievement exceeded pretest achievement with very large within-group effects for mathematics, $t(29) = 16.32$, $p < .001$, $dz = 2.98$, and English, $t(28) = 15.57$, $p < .001$, $dz = 2.89$. At the two-week follow-up, mathematics scores were maintained, whereas English scores declined slightly; the latter met the .05 but not the prespecified .01 criterion. Overall creativity was excellent ($M = 6.09$, $SD = 1.00$), although 0.06 below the 6.15 target, and satisfaction was at the highest level ($M = 4.64$, $SD = 0.51$). No between-major differences were detected for posttest score, gain, creativity, or satisfaction ($p > .05$), with trivial-to-small effects. The findings support the feasibility of a common management core across the two studied contexts and yield a Research-to-Innovation Learning Cycle that links practice-based learning, four-stage rubric monitoring, and continuous quality improvement. Longer-term creativity and product use require follow-up.

Keywords: research and development, learning innovation, e-learning management, blended learning, academic achievement, creativity, preservice teachers

1. Introduction

Teacher education must prepare preservice teachers not only to recall research concepts but also to frame educational problems, judge evidence, design innovations, collect and analyze data, and use findings to improve classroom learning. These capabilities underpin responsible professional decisions and lifelong learning. They are especially important when future teachers will work with learners whose linguistic, quantitative, cultural, and technological resources differ.

Educational equity in this setting does not mean providing an identical experience to every learner. It means ensuring that learners in different disciplinary contexts can access the tools, processes, feedback, and support needed to develop their potential. Language literacy enables learners to interpret, justify, and communicate evidence, whereas mathematical literacy supports reasoning, modeling, and data-informed decisions. The Programme for International Student Assessment (PISA) similarly emphasizes the application of reading, mathematics, and science to authentic situations rather than the reproduction of content (OECD, n.d.). Placing English and mathematics preservice teachers within a common research-learning architecture therefore provides a meaningful test of whether a shared management core can support two distinct disciplinary contexts.

Creativity is equally important. The OECD (2024) defines creative thinking in terms of generating, evaluating, and improving diverse and original ideas across expressive, scientific, and social problem-solving domains. Research education should consequently engage students in producing questions, designs, evidence, and innovations that address authentic problems. Creativity in this study is treated as an assessable learning outcome, while critical and reflective thinking are treated as learning mechanisms expressed through justification, feedback, and revision; the latter two were not measured by separate standardized instruments.

This orientation is consistent with the Thailand Professional Standards Framework (Thailand-PSF), which foregrounds effective learning management, evidence-informed improvement, achievement of learning outcomes, and continuing professional development (Professional and Organizational Development Network of Thailand Higher Education, n.d.). For preservice-teacher programs, teaching research methodology should therefore be managed as a supported performance system: students inquire, practice, collaborate, present evidence, receive critique, and improve observable products.

Digital technology can broaden access to resources, self-paced review, feedback, and records of progress, but technology alone does not improve learning. UNESCO (2023) cautions that educational technology must be judged by relevance, equity, scalability, and sustainability. Accordingly, blended learning should use technology to strengthen inquiry, interaction, practice, reflection, and feedback rather than merely distribute files. Meta-analytic evidence indicates that online, blended, and flipped approaches can support preservice and in-service teacher learning, although outcomes depend on instructional design and active participation (Schmid et al., 2023). Clear structure, support, learning community, and responsiveness to learners' needs are particularly important (Shand & Farrelly, 2017). Blended cross-disciplinary activities can also strengthen student teachers' capacity to learn and teach interdisciplinary content (Lee et al., 2016).

In course EDU66-314, Research and Development of Learning Innovation, students in six classes were required to develop a research-and-innovation proposal. The e-learning environment retained observable evidence of self-study, discussion, submissions, instructor feedback, and successive revisions. It functioned as both a learning space and a management information system through which the instructor could monitor progress and students could inspect their learning trajectories and approved peer products.

Deep practice occurred when students translated authentic problems into researchable questions, compared alternatives, justified choices, selected evidence, responded to critique, and redesigned an innovation. These actions connected critical judgment, reflection, and creative production. The course was organized according to a quality-management logic comparable to Deming's Plan-Do-Check-Act (PDCA) cycle: learning and products were designed and planned, developed through guided practice, checked against evidence and rubric criteria, and revised through feedback. The intent was to develop not only research knowledge but also emerging leadership in research and learning innovation.

Four gaps nevertheless remain in the literature. First, relatively few course-based studies develop and test a complete system encompassing knowledge synthesis, expert review, implementation, efficiency, effectiveness, and multiple outcomes. Second, research-methods courses commonly prioritize achievement while providing less explicit evidence about creativity and innovation products. Third, studies that implement a common instructional-management core across different preservice-teacher majors and directly examine their outcome patterns remain limited. Fourth, e-learning traces and products are seldom integrated with structured rubric monitoring as a continuous quality-improvement system. This study addressed these gaps through a 10-module program, a three-phase research and development process, a comparison of mathematics and English majors, and a four-stage performance rubric embedded in the e-learning workflow.

2. Research Questions

(1) What knowledge base and management principles are appropriate for an e-learning program in a Research and Learning Innovation course?

(2) What components and quality indicators characterize the developed 10-module program?

(3) What is the program's efficiency, effectiveness, achievement, two-week retention, creativity, and satisfaction outcomes?

(4) How do the posttest, gain, creativity, and satisfaction results of mathematics and English preservice teachers compare within the studied context?

(5) What integrated knowledge can be derived for managing learning from research toward innovation?

3. Research Objectives

(1) To synthesize the theoretical, empirical, and contextual foundations of the program.

(2) To develop and validate a 10-module e-learning program and its management system.

(3) To evaluate program efficiency, effectiveness, achievement, two-week retention, creativity, and satisfaction.

(4) To compare learning outcomes between mathematics and English majors.

(5) To formulate an integrated Research-to-Innovation Learning Cycle for future application and investigation.

4. Hypotheses

(1) The program would satisfy expert content-validity criteria.

(2) The program would meet its specified efficiency criterion, and posttest achievement would exceed pretest achievement at the .01 significance level.

(3) Posttest achievement would be maintained at the two-week follow-up at the prespecified .01 criterion.

(4) Creativity would reach the excellent range and the target mean of 6.15, while satisfaction would reach the highest range.

(5) The two majors would show similar outcome patterns within the observed data, without substantively large between-major effects.

5. Conceptual Framework

The framework integrates five bodies of knowledge. First, research and development provides the three-phase architecture of synthesis, construction and validation, and field implementation (Creswell & Guetterman, 2019). Second, learning-objective taxonomies support alignment among objectives, activities, and assessment (Bloom et al., 1956; Anderson & Krathwohl, 2001). Third, blended learning, self-regulated learning, and technological pedagogical knowledge inform the combination of e-learning, interaction, scaffolding, feedback, and learner agency (Garrison & Kanuka, 2004; Mishra & Koehler, 2006; Zimmerman, 2002). Fourth, creativity theory emphasizes ideas or products that are both original and appropriate (Amabile, 1996; Runco & Jaeger, 2012; Torrance, 1974). Fifth, quality management links intended outcomes, modular implementation, monitoring, evaluation, and improvement through a PDCA logic.

The inputs were the knowledge base, course context, learner characteristics, learning outcomes, digital platform, and expert criteria. The management process comprised design and planning, 10-module implementation, practice and collaboration, monitoring of evidence, feedback, and product revision. The immediate outputs were program quality, efficiency, effectiveness, achievement, short-term retention, creativity, satisfaction, and comparative evidence. The feedback loop returned outcome and product evidence to program improvement. Figure 1 summarizes this system.

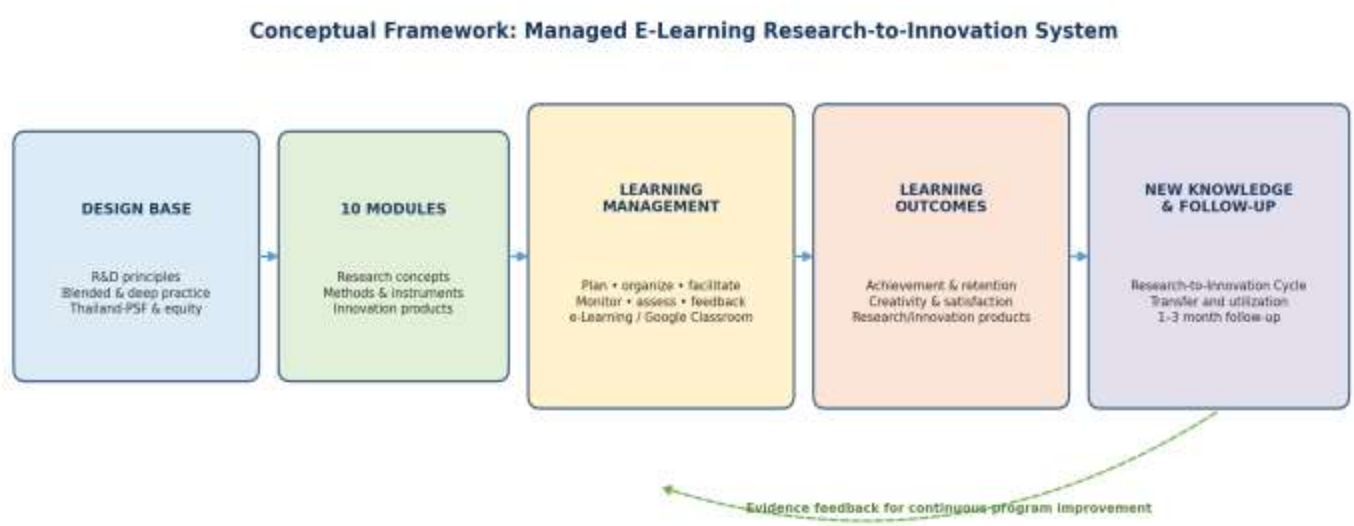

Figure 1.

The learning-performance pathway was operationalized through four rubric stages. Rubrics 1 and 2 primarily supported planning; Rubric 3 guided methodological design and proposal production; Rubric 4 checked the proposal through presentation and peer/instructor feedback; and revision represented action for improvement. This mapping was developmental rather than mechanical; evidence could prompt a return to an earlier stage.

6. Method

6.1 Design

The program was developed through a three-phase research and development process. Phase 3 employed a pre-experimental one-group pretest-posttest design with a two-week follow-up in two intact disciplinary classes. The phases were (1) synthesis of the knowledge base and contextual requirements; (2) program development and expert validation; and (3) field implementation and evaluation. Because no control group was included, the observed changes cannot be attributed solely to the program. The design permits examination of change and exploratory cross-major patterns but does not provide the causal control of a randomized comparative trial.

6.2 Phase 1: Knowledge-Base and Context Synthesis

The researchers reviewed theories and studies on research education, learning innovation, modular design, blended and self-regulated learning, creativity, e-learning management, assessment, and teacher professional standards. Course requirements, intended learning outcomes, platform affordances, expected innovation products, and learner needs were mapped into a provisional program architecture. Particular attention was given to equitable access for English and mathematics majors and to the use of digital traces as evidence for feedback and improvement.

6.3 Phase 2: Development and Quality Validation

The provisional program comprised principles, objectives, learning outcomes, 10 modules, activities, learning media, online workflow, individual and collaborative assignments, four rubric checkpoints, monitoring procedures, and assessment. Five experts were invited to assess content congruence and program appropriateness; four completed and returned the evaluation. Their responses were used to calculate item-objective congruence (IOC), and their qualitative recommendations informed revision. The evaluation contained 30 items across nine program domains. IOC values of .50 or higher were treated as acceptable.

6.4 Participants and Sampling

The accessible population comprised approximately 180 preservice teachers in six classes enrolled in the course during Semester 2 of academic year 2025/2568. Cluster sampling at the intact-class level selected one mathematics class ($n = 30$) and one English class ($n = 29$), yielding 59 participants. Instruction took place from 8 November 2025 to 14 February 2026, followed by the two-week achievement assessment and completion of follow-up outcome records through early March 2026. The unit of instruction was the class, while individual scores were used for descriptive and inferential analyses. Because only two intact classes were sampled, class and major were confounded, cluster-level variability could not be estimated adequately, and the between-major analyses should be interpreted as exploratory comparisons within the two observed classes.

6.5 The 10-Module Program and Learning Management

The 15-week program combined approximately two hours of guided or self-directed online learning and three hours of collaborative or practice-based learning per week. Its 10 modules progressed from foundations of educational research and innovation through problem analysis, literature synthesis, conceptual framing, research design, development and validation of innovations, measurement, data analysis, evaluation, and proposal or product communication. The course was delivered through Walailak University’s established e-learning system and Google Classroom in alignment with the approved course specification (TQF 3). Its design was informed by professional standards for effective teaching, learner engagement, assessment, feedback, and continuing enhancement, including the UK Professional Standards Framework. The institutional systems retained modules, announcements, assigned activities, submissions, assessment records, feedback, online interactions, and revision histories, providing an auditable record of implementation.

Learning was managed through a repeating sequence: prepare, inquire, practice, collaborate, receive feedback, revise, and demonstrate. Individual accountability was maintained through personal submissions, while paired and group activity supported explanation, critique, and shared problem solving. The instructor and research assistants monitored completion, common misconceptions, and product quality and provided targeted feedback.

Four rubric stages made the practice pathway visible:

Rubric 1—Problem and Need: Students investigated current and desired conditions and assessed the priority need related to an issue of interest, producing the foundation of Proposal Chapter 1.

Rubric 2—Evidence and Framework: Students reviewed and synthesized relevant literature to construct the conceptual framework and Chapter 2. The course criterion required at least 10 Thai and 10 international research studies.

Rubric 3—Research Design: Students specified the population, sample or target group, and procedures appropriate for classroom research or classroom action research, producing Chapter 3.

Rubric 4—Proposal Communication and Revision: Students presented their classroom research proposals in pairs, received peer and instructor feedback, and revised the products.

The revised proposals were intended for possible use during the teaching practicum in Semester 1 of academic year 2026/2569. Such use was a prospective follow-up outcome, not an outcome established in the present study.

6.6 Instruments and Quality Evidence

The instruments were (a) the 10-module program and instructor or learner guidance, (b) the 30-item expert program-evaluation form, (c) an 80-item achievement test, (d) a 40-item creativity self-report scale using a seven-point response format, and (e) a 45-item satisfaction questionnaire using a five-point response format. The instruments were aligned with course objectives, content, activities, and products. The achievement test had a reliability coefficient of .85, discrimination indices of .32–.83, and difficulty indices of .20–.80. Internal-consistency reliability was high in both groups. For mathematics, Cronbach’s alpha was .988 for creativity and .990 for satisfaction; for English, the corresponding coefficients were .989 and .988. The creativity scale measured participants’ perceptions of creativity-related behaviors; it did not independently establish the originality or appropriateness of completed proposals. No independent product-rating outcome is claimed in this article.

Creativity scores were interpreted on the course’s seven-point scale. The value of 6.15 was used as a prespecified aspirational course benchmark rather than as a validated diagnostic cut score; its documentary basis remains for PI verification before submission. Satisfaction scores were interpreted using the five-point scale, for which the observed overall mean fell in the highest range. Because critical and reflective thinking were not measured by separate standardized scales, the study does not report them as confirmed quantitative outcomes.

6.7 Data Collection and Ethical Practice

After orientation and pretesting, participants completed the 10 modules and four rubric stages during the 15-week instructional period from 8 November 2025 to 14 February 2026. Process scores were collected during implementation. Achievement and self-reported creativity were assessed at the end of the program; satisfaction was surveyed after participation; and achievement was assessed again two weeks later, with follow-up outcome records completed through early March 2026. Participants were informed about course procedures and research use of data. Identifiers were coded, analysis was conducted on score records, and results are reported in aggregate. No student names or student identification numbers appear in this manuscript.

6.8 Data Analysis

Descriptive statistics included frequencies, percentages, means, and standard deviations. Program quality was summarized using IOC. Instructional efficiency was expressed as E1/E2, where E1 represented average process performance and E2 represented average posttest performance as percentages of their respective maximum scores (Brahmawong, 2013). The effectiveness index (E.I.) represented the proportion of possible improvement achieved.

Paired-samples t tests assessed pretest-posttest change and posttest-follow-up change, with standardized paired effect size dz. Independent-samples analyses compared majors on posttest, gain, creativity, and satisfaction, accompanied by 95% confidence intervals and Hedges’ g. The study’s prespecified criterion for primary within-group hypothesis testing was $\alpha = .01$; exact p values are also reported so that readers can distinguish this criterion from the conventional .05 level.

7. Results

7.1 Program Development and Expert Review

The development process produced a 10-module program with aligned objectives, activities, digital resources, individual and collaborative products, rubrics, monitoring, feedback, and assessment. Its management architecture connected course planning, online implementation, performance evidence, feedback, and revision. Across the 30 expert-review items in nine domains, IOC values ranged from .75 to 1.00, exceeding the acceptance criterion. These results supported content congruence and progression to field implementation, while expert comments were incorporated before use.

7.2 Efficiency and Effectiveness

Table 1 reports high process and outcome efficiency for both majors. Mathematics achieved E1/E2 of 96.67/90.58 and E.I. of .711; English achieved 96.90/91.47 and E.I. of .750. Combined values were 96.78/91.02 and .731.

Table 1. Program efficiency and effectiveness by major

Major	n	E1	E2	E1/E2	E.I.
Mathematics	30	96.67	90.58	96.67/90.58	.711
English	29	96.90	91.47	96.90/91.47	.750
Combined	59	96.78	91.02	96.78/91.02	.731

7.3 Achievement and Two-Week Follow-Up

Both groups made statistically significant pretest-posttest gains with very large paired effects (Table 2). Mathematics increased from 53.97 to 72.47, $t(29) = 16.32$, $p < .001$, $dz = 2.98$. English increased from 52.66 to 73.17, $t(28) = 15.57$, $p < .001$, $dz = 2.89$.

Table 2. Pretest-posttest achievement within majors

Major	n	Pretest M (SD)	Posttest M (SD)	Mean gain	t(df)	p	dz
Mathematics	30	53.97 (5.54)	72.47 (4.09)	18.50	16.32 (29)	< .001	2.98
English	29	52.66 (6.44)	73.17 (3.44)	20.51	15.57 (28)	< .001	2.89

At two weeks, mathematics showed a negligible decline from 72.47 to 72.30, $t(29) = 1.31$, $p = .202$, $dz = .24$. English declined from 73.17 to 71.93, $t(28) = 2.27$, $p = .031$, $dz = .42$. Thus, English did not show a statistically significant decline at the prespecified .01 level, although the result would be significant under $\alpha = .05$. It is therefore more accurate to describe partial short-term maintenance with a small decline rather than complete stability.

Table 3. Posttest and two-week follow-up achievement

Major	n	Posttest M (SD)	Follow-up M (SD)	Mean change	t(df)	p	dz
Mathematics	30	72.47 (4.09)	72.30 (3.85)	−0.17	1.31 (29)	.202	.24
English	29	73.17 (3.44)	71.93 (3.78)	−1.24	2.27 (28)	.031	.42

7.4 Creativity and Satisfaction

Creativity was excellent in both groups: mathematics $M = 6.08$ ($SD = 1.01$), English $M = 6.11$ ($SD = 1.01$), and combined $M = 6.09$ ($SD = 1.00$). The combined value was 0.06 below the target of 6.15; therefore, the categorical level was achieved but the numerical criterion was not. Satisfaction was at the highest level for mathematics, $M = 4.61$ ($SD = 0.54$), English, $M = 4.66$ ($SD = 0.49$), and combined, $M = 4.64$ ($SD = 0.51$).

Table 4. Creativity and satisfaction by major

Outcome	Mathematics M (SD)	English M (SD)	Combined M (SD)	Interpretation
Creativity (7-point)	6.08 (1.01)	6.11 (1.01)	6.09 (1.00)	Excellent; 0.06 below target
Satisfaction (5-point)	4.61 (0.54)	4.66 (0.49)	4.64 (0.51)	Highest

7.5 Comparison of Mathematics and English Majors

No statistically significant between-major differences were detected for posttest achievement, gain, creativity, or satisfaction (Table 5). Confidence intervals included zero and effect sizes were trivial to small. These analyses support similar observed development patterns within the two sampled classes; they do not establish statistical equivalence or prove that the program would produce identical results in other populations.

Table 5. Between-major comparisons

Outcome	Difference (Mathematics − English)	95% CI	p	Hedges' g
Posttest	−0.71	[−2.68, 1.26]	.476	−.18
Gain	−2.02	[−5.50, 1.46]	.251	−.30
Creativity	−0.04	[−0.56, 0.49]	.891	−.04
Satisfaction	−0.05	[−0.32, 0.22]	.736	−.09

8. Discussion

8.1 A Managed 10-Module System

The program's acceptable IOC values and high implementation results suggest that its components were coherently aligned. Its contribution lies not only in dividing content into 10 modules but also in managing objectives, resources, practice, rubric evidence, feedback, and revision as one system. This interpretation is consistent with prior Thai module-development work showing the value of structured learning sequences and formative monitoring (Chantarasombat, 2020) and with international work on research e-learning modules (Kowitlawakul et al., 2017). Earlier modules developed by Chantarasombat and colleagues likewise emphasize organized learning tasks, learner responsibility, and assessable products (Chantarasombat & Rooyuenyong, 2020; Chantarasombat & Sombatsakulkit, 2021; Sirisuthi & Chantarasombat, 2021).

The program's management dimension is important for an Educational Administration perspective. Planning defined intended outcomes and module progression; implementation coordinated online and collaborative work; monitoring used submissions and rubric evidence; evaluation integrated achievement, creativity, satisfaction, and efficiency; and feedback drove revision. This PDCA-aligned process made quality visible and actionable rather than treating course administration as scheduling alone.

8.2 Efficiency, Achievement, and Blended Learning

The E1/E2 values and effectiveness indices indicate that participants performed strongly during the learning process and on the outcome assessment. The E1/E2 approach is widely used in Thai instructional-innovation research to relate process performance to final performance (Brahmawong, 2013). The very large pretest-posttest effects are compatible with the possibility that a structured blend of resources, active tasks, collaboration, feedback, and revision supported learning.

These results align with the transformative potential attributed to well-designed blended learning (Garrison & Kanuka, 2004) and with evidence synthesized across teacher education settings (Schmid et al., 2023). They also reflect self-regulated learning processes in which students plan, monitor, and adjust their work (Zimmerman, 2002). However, the absence of a control group prevents attributing all change to the program. Maturation, assessment familiarity, instructor support, and concurrent learning may also have contributed. Accordingly, the manuscript uses "following participation" and "was associated with" rather than claiming definitive causality.

8.3 Creativity Through Productive Practice

Creativity reached the excellent range in both groups. The program repeatedly required students to generate, assess, explain, and improve ideas while developing a research and innovation proposal. This design reflects the view that creativity involves both originality and appropriateness (Amabile, 1996; Runco & Jaeger, 2012) and the OECD's emphasis on generating, evaluating, and improving ideas (OECD, 2024). Rubric checkpoints and revision history also shifted assessment from a single final judgment toward evidence of development.

Nevertheless, the mean was slightly below the 6.15 target. This small gap is educationally useful: high categorical performance should not be interpreted as completion of the developmental task. More open-ended iteration, exposure to contrasting disciplinary examples, peer critique across majors, and delayed assessment of the transferred product may be needed. Direct analysis of proposal quality would also help explain how fluency, flexibility, originality, and practical appropriateness developed.

8.4 Similar Patterns Across Two Disciplinary Contexts

The mathematics and English groups had similar observed results on all four comparisons, with confidence intervals crossing zero and trivial-to-small effect sizes. This pattern is noteworthy because the two disciplines privilege different representational and reasoning practices. A plausible interpretation is that the common management core—research problem, evidence, design, collaborative critique, feedback, and revision—was sufficiently general to support both contexts, while disciplinary examples and products provided local relevance.

The comparison should not be overstated. Failure to detect a difference is not proof of equality, and two intact classes cannot establish measurement invariance or generalizability. The finding instead supports the feasibility of using a shared core with contextual adaptation in the two studied majors. Replication with more classes, multilevel analysis, and explicit tests of instrument invariance would be required before stronger cross-disciplinary claims.

8.5 Satisfaction and Practical Feasibility

The highest-level satisfaction result suggests that participants accepted the combination of online access, practice, collaboration, monitoring, and feedback. Clear structure and learning community are known to shape preservice teachers' experience of blended learning (Shand & Farrelly, 2017). The platform's preserved learning evidence may have enhanced transparency: students could see expectations, deadlines, feedback, and improvement over time.

Satisfaction is not synonymous with learning, yet its convergence with high achievement and strong process performance supports practical feasibility. The evidence is limited to self-report and the current implementation. Future research should combine satisfaction with behavioral platform data, completion patterns, qualitative interviews, and independent ratings of innovation products.

8.6 Retention, Transfer, and Sustainability

The two-week evidence was encouraging but differentiated. Mathematics achievement was maintained, while English showed a small decline that crossed the .05 but not the prespecified .01 threshold. Reporting the exact p-value avoids an artificially binary interpretation. More importantly, a two-week test captures only short-term achievement retention; it does not demonstrate sustained creativity or application.

This study continues a line of e-learning development in undergraduate education at Walailak University. The proposed next step is to follow creativity, proposal quality, and product use for at least one month or four weeks and, where feasible, at three months and during the teaching practicum. Subsequent work should extend the program to graduate education through a more comprehensive research and development design and incorporate qualitative evidence from interviews, focus groups, learning reflections, platform records, and independent analysis of innovation products. These extensions would help explain how learning develops and whether students can transform a course product into classroom inquiry and learning innovation. They are future research directions, not outcomes established by the present study.

9. Integrated New Knowledge: The Research-to-Innovation Learning Cycle

The study yields a Research-to-Innovation Learning Cycle with five connected processes:

(1) Conceptual Grounding: establish research concepts, professional purposes, disciplinary context, and intended outcomes;

(2) Guided Inquiry: investigate current and desired conditions, identify priority needs, and formulate researchable problems;

(3) Collaborative Practice: synthesize literature, construct frameworks, design methods and innovations, and learn through individual and paired production;

(4) Evidence and Feedback: use e-learning traces, rubrics, presentations, assessment, peer critique, and instructor feedback to judge progress; and

(5) Innovation Transfer: revise, communicate, apply, follow up, and use the research product in authentic professional practice.

The cycle integrates learning and administration. Practice-based learning develops emerging leadership in research and learning innovation, while PDCA provides the quality-management logic: Plan through Rubrics 1–2, Do through methodological design and proposal production in Rubric 3, Check through Rubric 4 presentation and evidence-based feedback, and Act through product revision and prospective transfer to the teaching practicum. Feedback can return learners to any earlier process, making the model iterative rather than linear.

The Research-to-Innovation Learning Cycle is presented as a context-specific synthesis and operational model rather than as a wholly new learning theory. Its contribution lies in integrating e-learning traces, four staged rubric checkpoints, proposal revision, and a PDCA feedback loop within one assessable workflow. The similar observed patterns across the two majors provide initial support for this integrated core within the two studied classes, but they do not demonstrate statistical equivalence or generalizability to other disciplines or institutions.

9.1 Proposed 11-Module Graduate Extension

Future research could replicate and extend the program with master's students in Educational Administration taking a Research Methodology course. The original 10-module core should be retained, with an additional Module 11: Research Article Writing, Dissemination, and Research Utilization. This module would address converting a report into an article, articulating a research gap, reporting and discussing results, selecting an appropriate journal, ethical use of AI, responding to peer review, and returning findings to organizational improvement.

The extension should be evaluated after one and three months at four levels: (1) learning retention; (2) research performance, including thesis or independent-study proposal quality and implementation; (3) scholarly productivity, including manuscript writing, submission, and publication; and (4) research utilization and impact in educational administration. These are proposed outcomes for a future study, not claims arising from the present sample.

10. Conclusion

The study developed and managed a 10-module e-learning program that combined Google Classroom/institutional e-learning with individual practice, collaboration, product monitoring, and feedback over 15 weeks. Practice-based progress was organized through four rubric stages: needs and Chapter 1; literature, conceptual framework, and Chapter 2 with at least 10 Thai and 10 international studies; population, sample/target group, classroom or action-research methods, and Chapter 3; and paired proposal presentation followed by revision.

The program met expert content-validity requirements and showed high efficiency and effectiveness in both majors. Achievement increased with very large within-group effects, creativity was excellent but slightly below its numerical target, and satisfaction was at the highest level. The two majors showed similar observed patterns in posttest achievement, gain, creativity, and satisfaction, supporting the feasibility of a shared management and rubric core for the two contexts studied. The findings connect practice-based learning with emerging leadership in research and learning innovation through a PDCA-aligned sequence of design and planning, implementation, monitoring/evaluation, and product improvement.

The conclusion is limited to 59 preservice teachers in mathematics and English. Whether revised proposals are used successfully in the Semester 1/2026 teaching practicum, and whether creativity and research performance persist, must be established through subsequent follow-up.

11. Recommendations

11.1 Recommendations for Practice

(1) Implement the modules in a coherent sequence that preserves the connection among knowledge, practice, product, evidence, and feedback.

(2) Display assignments, rubric criteria, exemplars, deadlines, and support channels clearly within the e-learning system, with additional assistance for learners who differ in digital readiness.

(3) Use achievement scores together with rubric-rated products and creativity evidence to evaluate research competence comprehensively.

(4) When adapting the program to another major, retain the common research-management core while changing cases, disciplinary language, data, and innovation products.

(5) Preserve revision histories and feedback as evidence for course quality assurance and learner self-regulation.

11.2 Recommendations for Research

(1) Add comparison conditions or randomly sample multiple classes to strengthen causal inference and estimate class-level effects.

(2) Follow creativity, product quality, and research use after one and three months and during teaching practicum.

(3) Analyze proposals independently with validated rubrics and qualitative evidence to explain mechanisms of creativity development.

(4) Test measurement invariance across majors before interpreting small score differences.

(5) Replicate the 11-module extension with Educational Administration graduate students and track thesis/independent-study progress, publication, and research utilization.

12. Limitations

The sample comprised two intact classes from two majors, and all participants received the same program. The study therefore cannot establish causal superiority over another instructional approach. Class and major were confounded; cluster-level variability could not be estimated adequately, and failure to detect between-major differences does not demonstrate statistical equivalence. Satisfaction and creativity were self-reported, and no independent assessment of proposal originality and appropriateness was available. The creativity mean did not attain the prespecified 6.15 aspirational benchmark, and the two-week follow-up provides evidence only of short-term achievement retention, not sustained creativity, transfer, product use, or sustainability. The results should be interpreted only for the 59 mathematics and English preservice teachers in the studied setting.

13. Acknowledgments

The authors thank the experts, teaching and research assistants, preservice teachers, e-learning personnel, and supporting units who contributed to program development, validation, implementation, and follow-up. The authors also acknowledge Walailak University's institutional e-learning environment, which supported the course activities and preserved evidence of implementation. And the class representatives and the teams from the Mathamatrics program (30 members) and th class representatives and the teams from the Eanlish program(29 members) served as co-researchers. They monitored project deliverables according to the program schedule and ensured that instruction adhered to the TQF 3 specifications for course 66-314: Research and Development of Learning Innovation.

14. Author Contributions

Chalard Chantarasombat: conceptualization, methodology, program and instrument development, supervision, data curation, analysis, and original drafting. Pravech Rattanapian: educational-management consultation, conceptual framework and method review, interpretation, and critical manuscript revision. Narin Sungrugsa: methodological review, data interpretation, and critical manuscript revision. The third-author contribution statement and author order are subject to IJHE editorial approval and written consent from all authors before submission. All authors will review and approve the final manuscript.

15. Conflict of Interest

The authors declare no conflict of interest.

References

Advance HE. (2023). *Professional Standards Framework for teaching and supporting learning in higher education 2023*. https://www.advance-he.ac.uk/teaching-and-learning/psf

Amabile, T. M. (1996). *Creativity in context*. Westview Press.

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals.* Handbook I: Cognitive domain. David McKay.

Brahmawong, C. (2013). Efficiency testing of media or instructional packages. *Silpakorn Educational Research Journal, 5*(1), 7-20. https://so05.tci-thaijo.org/index.php/suedureasearchjournal/article/view/28419 [in Thai]

Chantarasombat, C. (2020). Development of a learning module on educational policy, strategy, and strategic planning (EDA6201) for master's students in Educational Administration. *Journal of Education, Mahasarakham University, 14*(1), 19-31. https://doi.org/10.5430/wje.v10n3p19

Chantarasombat, C., & Rooyuenyong, W. (2020). The development of learning module of educational administration and educational institute for students in Master of Education degree in Thailand. *World Journal of Education, 10*(3), 19-32. https://doi.org/10.5430/wje.v10n3p19

Chantarasombat, C., & Sombatsakulkit, E. (2021). Doctoral program learning module on developing leading secondary school teachers in creative thinking for enhancement of students' learning activities in Thailand. *International Journal of Higher Education, 10*(3), 138-149. https://doi.org/10.5430/ijhe.v10n3p138

Creswell, J. W., & Guetterman, T. C. (2019). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (6th ed.). Pearson.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education, 7*(2), 95-105. https://doi.org/10.1016/j.iheduc.2004.02.001

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

OECD. (n.d.). *Programme for International Student Assessment (PISA).* https://www.oecd.org/en/about/programmes/pisa.html

OECD. (2024). *PISA 2022 results (Volume III): Creative minds, creative schools*. OECD Publishing. https://doi.org/10.1787/765ee8c2-en

Professional and Organizational Development Network of Thailand Higher Education. (n.d.). *Thailand Professional Standards Framework (Thailand-PSF).* https://www.thailandpod.org/th_psf/step_th-psf.html [in Thai]

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal, 24*(1), 92-96. https://doi.org/10.1080/10400419.2012.650092

Schmid, R. F., Borokhovski, E., Bernard, R. M., Pickup, D. I., & Abrami, P. C. (2023). A meta-analysis of online learning, blended learning, the flipped classroom and classroom instruction for pre-service and in-service teachers. *Computers and Education Open, 5*, 100142. https://doi.org/10.1016/j.caeo.2023.100142

Shand, K., & Farrelly, S. G. (2017). Using blended teaching to teach blended learning: Lessons learned from pre-service teachers in an instructional methods course. *Journal of Online Learning Research, 3*(1), 5-30. https://doi.org/10.70725/352751rlvyzy

Sirisuthi, C., & Chantarasombat, C. (2021). The development on the learning module of a school-based supervision course for Master degree students majoring in educational administration in Thailand. *International Journal of Higher Education, 10*(4), 21-31. https://doi.org/10.5430/ijhe.v10n4p21

Torrance, E. P. (1974). *Torrance tests of creative thinking: Norms-technical manual*. Personnel Press.

UNESCO. (2023). *Global education monitoring report 2023: Technology in education—A tool on whose terms?* UNESCO.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice, 41*(2), 64-70. https://doi.org/10.1207/s15430421tip4102_2

Author Statements

Author(s) declared the statement below:

Acknowledgments

The authors sincerely thank the preservice teachers who participated in the study and the experts who reviewed the program and research instruments.

Author Contributions

Author contributions follow the CRediT (Contributor Roles Taxonomy):

Conceptualization: Chalard Chantarasombat

Methodology: Chalard Chantarasombat, Pravech Rattanapian, and Narin Sungrugsa

Formal analysis: Chalard Chantarasombat

Investigation: Chalard Chantarasombat

Writing - original draft: Chalard Chantarasombat

Writing - review and editing: Chalard Chantarasombat, Pravech Rattanapian, and Narin Sungrugsa

Validation: Pravech Rattanapian and Narin Sungrugsa

Project administration: Chalard Chantarasombat

Consent for Publication

All authors have read and approved the published version of the manuscript.

Funding

This research received no external funding.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed Consent

Informed consent was obtained from all participants.

Ethics Approval

Ethics approval was not required for this study.

Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Use of Artificial Intelligence

The authors used generative artificial intelligence solely for language editing and grammar improvement. The authors reviewed and verified all AI-assisted revisions and take full responsibility for the final content of the manuscript.

Supplementary Materials

No supplementary materials are available.

Journal Information

The Editorial Board declared the below statement on behalf of the journal and publisher.

Ethics Statement

The journal’s policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Preservation Policy

This journal is archived by Library and Archives Canada (LAC).