The Development of Online Learning Modules Integrating Artificial Intelligence and Active Learning Models in the Language and Digital Technology for Innovation Development Courses

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Abstract

The objectives of this research were: (1) to develop and evaluate the efficiency of online learning modules integrating Artificial Intelligence (AI) and the Active Learning Model for the course "Language and Digital Technology for Innovation Development" in the Bachelor of Education Program, Faculty of Education, Naresuan University; (2) to compare students' learning achievement before and after using the AI-integrated online modules; and (3) to examine students' satisfaction with learning through the developed modules. The research instruments included the online learning modules, learning achievement tests, and a student satisfaction questionnaire. The study followed the ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation). Key findings revealed that: (1) the developed online learning modules achieved an efficiency level of 87.44/86.25, exceeding the established criteria of 80/80; (2) students' post-test achievement scores were significantly higher than their pre-test scores at the .05 level of significance; and (3) student satisfaction with the learning experience was at a high level ($\bar{x}$ = 4.16).

Keywords: online learning, artificial intelligence, active learning

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Introduction

Educational management in Thailand adheres to the National Education Act B.E. 2542 (1999) as amended in B.E. 2545 (2002), which emphasizes that all learners are capable of learning and self-development, with learners positioned at the center of the educational process. Learning should therefore promote individual development in accordance with natural potential (Office of the National Education Commission, 2002).

Education reform focuses on learner-centered approaches. Teachers must shift from traditional, rote-based instruction to methods that encourage students to think and engage in real-world practice, thereby enabling them to construct knowledge independently. Teachers should create engaging scenarios, spark curiosity, and motivate students to learn. Consequently, the teacher's role transforms from knowledge provider to facilitator and mentor, supporting student success.

Traditional teaching methods often lead to student disengagement. Therefore, educators need to redesign teaching strategies that are engaging and participatory, fostering skills such as inquiry, problem-solving, and critical thinking.

Artificial Intelligence (AI) refers to technology that enables machines to exhibit human-like intelligence, including reasoning, decision-making, and learning. The core of AI lies in Machine Learning (ML), a discipline that allows machines to autonomously analyze relationships between input data and generate appropriate responses without manual programming. ML employs advanced mathematics, statistics, data management, and programming to construct predictive models that adapt to new data inputs.

In education, AI helps reduce teachers' workload in areas such as assessment, registration, and administration. It enhances accuracy and efficiency; for instance, AI-based tools can quickly and precisely grade multiple-choice exams. Additionally, AI supports tasks like scheduling, grade calculation, and record management.

AI can also assist in developing educational content and instructional media, facilitating learning anywhere, beyond traditional classrooms. It evaluates learners' progress and recommends suitable learning materials. AI supports teachers in lesson creation, student data analysis, resource searching, and producing e-books. In the future, AI could serve as a virtual instructor, with teachers acting as AI supervisors who input data and oversee learning delivery. This could enhance teaching scalability and variety (True Plookpanya, 2024).

The integration of AI in education supports autonomous learning, particularly in subjects requiring specialized instruction. AI contributes to personalized curriculum design, accurate assessment, and creative learning experiences that make lessons more engaging (Siamphone, 2024).

Active Learning

Active Learning refers to a teaching approach where students engage in hands-on learning and reflective thinking (Bonwell & Eison, 1991. It fosters cognitive development, including critical thinking, problem-solving, and knowledge application.

This approach encourages learner participation in curriculum design, knowledge construction, collaboration, and mutual responsibility. Activities focus on high-order thinking skills such as analysis, synthesis, and evaluation. Teachers act as facilitators and mentors, guiding learners to engage through experiences and practical application.

Students should participate in varied activities beyond passive listening—such as reading, writing, discussion, and problem-solving—to create deep, meaningful learning. Active Learning is grounded in two key assumptions:

1. Learning is a natural human endeavor, and
2. Individuals learn differently (Prince, 2004).

Students evolve from passive recipients to active co-creators of knowledge (Felder & Brent, 1996). Through interactive learning experiences, they develop deeper understanding, apply knowledge in innovative ways, and enhance essential skills such as communication and collaboration. Research has shown that Active Learning strategies—such as academic presentations, simulations, and real-world applications—can improve learning outcomes by up to 70%, with some methods yielding retention rates as high as 90% (Freeman et al., 2014; National Training Laboratories, 2001).

Research Objectives

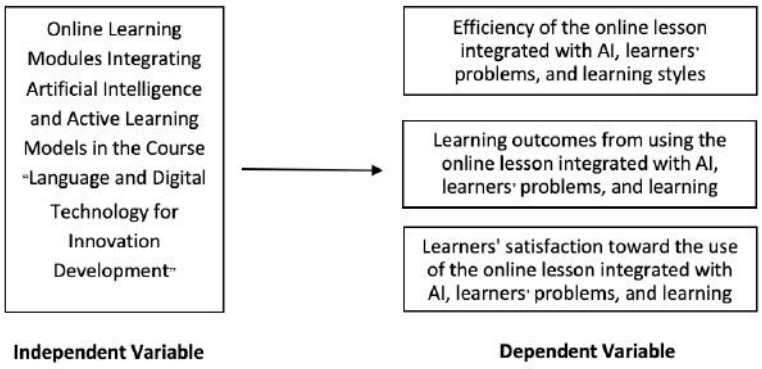
1. To develop and evaluate the efficiency of online learning modules integrating AI and the Active Learning Model for the course "Language and Digital Technology for Innovation Development" in the Bachelor of Education Program, Faculty of Education, Naresuan University.
2. To enhance students' learning achievement before and after using the AI-integrated Active Learning modules.
3. To assess student satisfaction with learning via the developed modules.

Research Hypotheses

1. The developed online learning modules integrating AI and the Active Learning Model will meet the efficiency criteria of E1/E2 at a standard of 80/80.
2. Students' post-learning achievement will be significantly higher than pre-learning achievement at the .05 level of significance.
3. Students will report a high level of satisfaction with the online learning modules.

Conceptual Framework

Figure 1
Research Framework



Population and Sample

The population consisted of 120 undergraduate students enrolled in the Bachelor of Education program, majoring in Computer Education and Educational Technology and Communication, who registered for the course "Language and Digital Technology for Innovation Development" in the academic year 2025.

Research Procedures

The research was conducted in the following three phases:

Phase 1: Development and evaluation of the efficiency of an online lesson integrated with artificial intelligence (AI) tools and an active learning approach in the course Language and Digital Technology for Innovation Development.

Phase 2: Development of students' learning achievement before and after instruction using the online lesson integrated with AI tools and an active learning approach.

Phase 3: Assessment of students' satisfaction toward learning with the online lesson integrated with AI tools and an active learning approach.

Phase 1: Development and Evaluation of the Efficiency of the Online Lesson Integrated With Artificial Intelligence and Active Learning

Data Sources

Population: Third-year undergraduate students in the Bachelor of Education program, Faculty of Education, Naresuan University, who enrolled in the course Language and Digital Technology for Innovation Development.

Sample Group: Third-year students majoring in Educational Technology and Communication, Faculty of Education, Naresuan University, who were selected through purposive sampling

Content Scope: The course Language and Digital Technology for Innovation Development covers the following topics:

- Selection, utilization, and skills in using digital media, technology, and innovations for learning.
- Design and production of digital media and innovations for learning.
- Evaluation of digital media and innovations for learning.

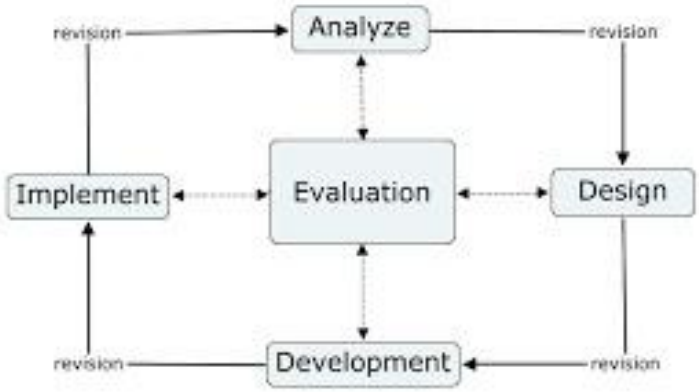
Research Instruments

1. An online lesson for the course Language and Digital Technology for Innovation Development.
2. An evaluation form for the online lesson integrated with AI tools and an active learning model, assessed by experts.
3. An efficiency evaluation form for the online lesson integrated with AI tools and an active learning model, assessed by experts.
4. A lesson plan using the online lesson integrated with AI tools and an active learning approach for the course Language and Digital Technology for Innovation Development.

Instrument Development and Efficiency Evaluation

The online lesson integrated with AI tools and an active learning approach for the course Language and Digital Technology for Innovation Development was developed by the researcher following the ADDIE Model (Indiana State University, 2016; Kemp et al., 1998), which includes the following steps:

Figure 2
Development Process of the Online Lesson Following the ADDIE Model



Analysis

This step includes:

1. **Course Content and Objectives Analysis:**
   The course description and behavioral objectives were analyzed in accordance with the "Digital Era Lifestyle" course under the Bachelor's Degree Curriculum at Naresuan University.
2. **Audience Analysis:**
   The target learners were undergraduate students enrolled in the "Digital Era Lifestyle" course. These students demonstrated foundational computer and network skills at a relatively good level.

3. **Technology Analysis:**
   The researcher selected Adobe Captivate, Canva, and various AI tools to develop the online lesson. These technologies are user-friendly, fast, and innovative. They were applied in the following components:
   1) **Learning Plans, Activity Sheets, and Knowledge Sheets**
   2) **Presentation Media:** Includes texts, images, videos, narration, and animations.
   3) **Interactivity:** The researcher developed interactive quizzes with feedback for learners.
   4) **Course Support:** Social media was utilized for instructional support, enabling learner interaction.
4. **Content Analysis:**
   The scope of content focused on the five ADDIE phases. Behavioral objectives were set, and content validity was reviewed by instructional design experts before lesson development.
5. **Activity and Media Analysis:**
   The researcher applied Active Learning approaches using Generative AI (e.g., ChatGPT, Bard, Copilot) to facilitate information searching, content creation, image generation, and social media interaction (e.g., Facebook for communication and YouTube for on-demand video viewing), aligning with the learning objectives.

Design

1. **Online Lesson Design:**
   The lesson was integrated with AI and Active Learning Model. The instructional sequence was planned using a **flowchart** from beginning to end and detailed through a **storyboard** to guide programming.
2. **Screen Design:**
   Due to screen size limitations, careful design was required to allocate space for content, images, control buttons, and other essential components.

Development

1. **Preparation:**
   Necessary materials such as images, text, and audio were collected or created using software tools and stored for later development.
2. **Lesson Development:**
   The lesson was developed frame by frame using the prepared materials and programming based on the initial flowchart. After completing the online lesson, it was evaluated by experts in terms of media quality, instructional quality, and content.
3. **Documentation:**
   A user manual was prepared, guiding learners on how to use the lesson, including a learning plan.
4. **Suitability Assessment Tool for the Online Lesson:**
   Evaluation forms were developed based on document and research review. The evaluation covered user manuals, learning tools, and AI-integrated components. Expert reviews were used to calculate the Item-Objective Congruence (IOC) index for validation.

Implementation

The fully developed online lesson, integrated with AI and Active Learning strategies, was implemented with the target groups. The lesson's effectiveness was evaluated with students exhibiting similar characteristics to the target group across three stages (Dick et al., 2015).

1. **First Trial:**
   Three non-sample students tested the lesson to identify issues and assess appropriateness. Observations and feedback were used for revision.
2. **Second Trial:**
   The revised lesson was tested with nine students. Effectiveness was measured using the 80/80 standard (E1/E2), where:
   - E1 = effectiveness during the learning process (mid-lesson test)
   - E2 = effectiveness after completing the lesson (post-test)
3. **Third Trial:**
   The final version was implemented with 360 undergraduate students in the "Digital Era Lifestyle" course. Effectiveness (E1/E2) was reassessed to meet the 80/80 criteria.

Evaluation

Learning outcomes were assessed after the students completed the online lesson using AI tools and Active Learning in the course "Language and Digital Technology for Innovation Development." This will be elaborated in Phases 2 and 3.

Data Analysis

Media Quality Evaluation. Likert-scale surveys were employed to assess media quality (Boonchom, 2002). A mean score of 3.50 or higher was established as the criterion for indicating high appropriateness.

Lesson Effectiveness Evaluation (80/80 Criterion). Lesson effectiveness was evaluated using an 80/80 criterion (Promwong, C., 2013), which involved both in-lesson (E1) and post-lesson (E2) assessments.

E1 (Process Effectiveness): This measure was based on in-lesson performance.

E2 (Result Effectiveness): This measure was based on post-lesson assessment.

Phase 2: Learning Outcome Study

This phase investigated students' achievement after using the AI-integrated online lesson in the course "Language and Digital Technology for Innovation Development."

Data Sources

1. **Experts:**
   - **Media and Innovation Experts:** Master's or Doctoral degree in Educational Technology, with ≥ 3 years of teaching experience (or ≥ 5 years with a Master's degree); 3 experts.
   - **Content Experts:** Master's or Doctoral degree in IT, Computer Science, or related fields, or ≥ 5 years university teaching experience; 3 experts.
   - **Instructional Experts:** Master's degree in Curriculum and Instruction or ≥ 5 years of university-level teaching; 3 experts.

2. **Sample Group:**
    - Third-year undergraduate students in the **Educational Technology and Communication** major, enrolled in the 2024 academic year, in the "Language and Digital Technology for Innovation Development" course; students.

Research Instruments

1. **Achievement Test:**
    - **1.1** Analyze course content and create a test aligned with behavioral objectives.
    - **1.2** Analyze Active Learning activities:
        - *Absorb:* Acquire knowledge and ideas
        - *Do:* Experience and explore
        - *Connect:* Integrate knowledge internally and socially
    - **1.3** Create a 4-option multiple-choice test aligned with lesson content and objectives. Experts reviewed the questions for content validity (IOC ≥ 0.5).
    - **1.4** Test items were analyzed for **difficulty (p)** and **discrimination power (r)**:
        - Difficulty: $p = 0.20–0.80$
        - Discrimination: $r \geq 0.20$
          Final test items met these criteria.
    - **1.5** Reliability of the test was calculated using the Kuder-Richardson formula before implementation.
2. **Lesson Plan:**
   Included content summary, objectives, subject matter, Active Learning activities, teaching media, assessments, and evaluations. Content validity was reviewed by three experts using a Likert scale. An IOC score near 1.00 indicated high relevance.

Final Data Analysis

The researcher analyzed the achievement test results by calculating:
- Item difficulty
- Discrimination power
- Reliability of the test

These analyses were conducted using standard computer software.

Research Findings

1. To develop and determine the efficiency of an online lesson integrated with artificial intelligence (AI) tools and the Active Learning Model for the course *Language and Digital Technology for Innovation Development*, the results showed E1/E2 scores of 87.44/86.25. This met the expected standard of not less than 80/80.
2. The comparison of students' academic achievement before and after studying through the developed online lesson integrated with AI and the Active Learning Model for the course *Language and Digital Technology for Innovation Development* is presented below.

Table 1
Academic Achievement Before and After Studying With the Online Lesson Integrated With AI and the Active Learning Model for the Course "Language and Digital Technology for Innovation Development"

Evaluation	N	$\bar{x}$	∑ D	∑ D2	T
Pre-test	120	0.67	995	8447	70.92*
Post-test	120	8.96			

* Statistically significant at the .05 level

According to Table 1, the post-test academic achievement after learning with the online lesson was significantly higher than the pre-test at the .05 level.

3. Students' satisfaction toward learning through the online lesson integrated with AI and the Active Learning Model in the course *Language and Digital Technology for Innovation Development* was at a high level ($\bar{x}$ = 4.02). The satisfaction was divided into components as follows:
    - Learning process based on the online lesson with the Active Learning Model: high satisfaction ($\bar{x}$ = 4.28)
    - Use of media and facilities on the online network: high satisfaction ($\bar{x}$ = 4.25)

Discussion

1. The efficiency of the developed online lesson integrated with AI and the Active Learning Model was found to be 87.44/86.25, exceeding the defined standard of 80/80. This result stemmed from implementing the ADDIE Model (Indiana State University, 2016; Kemp et al, 1998; Wikipedia, 2016) in five phases:
    - **Analysis**: Studied related literature and research, analyzed teaching methods, learners' prior knowledge and skills, lesson content, real classroom settings, supportive digital technologies, teaching media, and active learning strategies.
    - **Design**: Designed lesson content beginning with Program Learning Outcomes (PLOs) and Course Learning Outcomes (CLOs), instructional activities, content scope, behavioral objectives, and lesson flow. A storyboard was created for online lesson screen design, ensuring compatibility with PC, tablet, smartphone, and computer, and internal linking within the lesson.
    - **Development**: Built each screen of the lesson according to the storyboard, including assessment components.
    - **Implementation**: Piloted the lesson with small groups and target learners.
    - **Evaluation**: Evaluated the efficiency and learning outcomes of the online lesson integrated with AI and the Active Learning Model.

This finding aligns with the research of Pechmon and Benjakul (2025), whose active learning techniques enhanced first-year teacher students' understanding of celestial relationships at the Faculty of Education, Rajabhat University Nahhon Si Thammarat, demonstrating the approach's high suitability for instruction (Pechmon & Benjakul, 2025).

2. The comparison of students' academic achievement before and after using the online lesson showed a statistically significant improvement at the .05 level. This improvement is attributed to the integration of AI tools and the Active Learning Model, which promoted deeper learning engagement.

The findings align with previous research. Specifically, Khetbanjong and Mawan (2021) employed AI-based data grouping with Grade 5 students at Samsennok School and found that post-test scores were significantly higher than pre-test scores ($p < .05$). Similarly, Sangwanratanee et al. (2022) reported that Grade 10 students who participated in AI-integrated STAD cooperative learning demonstrated significantly greater academic achievement and more positive attitudes than those in the control group. In the present study, students also reported a high level of satisfaction with the online lesson. The lesson could be accessed from any location with internet connectivity and was compatible with mobile devices, tablets, and smartphones—providing portability and flexibility. Learners were able to study at any time and from any place, connect via cellular or Wi-Fi networks, and communicate through social media platforms, which enhanced interaction between teachers and students. These results are consistent with the study by Panitpichetvong et al. (2024), who explored the use of creative AI in higher education. Their research examined AI integration in teaching, student satisfaction, and the advantages and limitations of AI-assisted learning. Among 20 multimedia and animation students at Bangkok Thonburi University, the findings indicated a high level of satisfaction with AI tools such as Microsoft Bing, Google Bard, and ChatGPT (Panitpichetvong et al., 2024).

Conclusion: Suggestions From the Research

1. The developed online lesson integrated with AI and the Active Learning Model should be adapted for use with learners across various educational levels, institutions, and subjects.
2. Other instructional models should be integrated with online lessons to enhance the effectiveness and learning outcomes further.

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