

THE LCA-IT MODEL: INTEGRATING AI AND LMS FOR COLLABORATIVE KNOWLEDGE BUILDING IN INFORMATION TECHNOLOGY EDUCATION

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Abstract

This study examines the LCA-IT (Learning Collaboration with Artificial Intelligence for Information Technology) model in an introductory university course. The model combines Moodle for course organization, Zoom for group discussion, ChatGPT for explanations and learning support. It was developed through the ADDIE framework and implemented over eight weeks at the University of Education, Hue University. A quasi-experimental comparison involved 100 first-year students in two intact classes: 50 used LCA-IT and 50 followed conventional online instruction through Moodle. Mean pre-test scores were 44.22 and 43.80, respectively. Post-test means were 90.83 and 72.20, a difference of 18.63 points. The reported student-level comparison was $t(98) = 11.36$, $p < 0.001$, with Cohen's $d = 2.27$. Mean gains were 46.61 points for the experimental class and 28.40 points for the control class. Survey responses were generally favorable and descriptive observations documented discussion and peer feedback. These findings support further evaluation of the combined instructional approach. They do not establish a separate effect of ChatGPT: class allocation was not randomized and several instructional components changed together. Longer studies with multiple classes and direct measures of collaborative learning are needed.

Keywords: Artificial intelligence in education, ChatGPT, collaborative learning, computer-supported collaborative learning, information technology education.

1. Introduction

First-year students in information technology courses need to explain technical ideas, evaluate possible solutions and work with peers. These demands can be difficult to address in online group work, where access to course materials does not by itself ensure that students discuss or understand them. Research on collaborative learning identifies the design of group activities as an important part of supporting participation and learning.

Computer-Supported Collaborative Learning (CSCL) uses digital tools to support shared tasks, discussion and knowledge construction. A review of programming education describes how these tools have been used and identifies continuing questions about engagement and the use of learning analytics [2]. From this perspective, the instructional problem is how to organize productive work around the tools available to students.

Unequal participation is one difficulty. A few students may complete a group's work while others have little opportunity to explain their reasoning. Another difficulty concerns the depth of discussion: exchanging information is not the same as comparing explanations or resolving disagreement. CSCL research provides a framework for designing support for these processes [3]. Work on video-based

collaboration also draws attention to the relationship between knowledge construction and socioemotional interaction [4].

ChatGPT adds a source of explanations and feedback to this setting. Students can ask it to clarify a concept or suggest how to approach a problem as discussed in research on digital learning management [5]. Its educational role nevertheless depends on how students use its responses. An answer that ends discussion may undermine the collaborative activity it was intended to support. We therefore position ChatGPT as a resource within group work with instructors retaining responsibility for task design and assessment.

We developed the LCA-IT (Learning Collaboration with Artificial Intelligence for Information Technology) model to coordinate Moodle, synchronous discussion and ChatGPT within the course Introduction to Digital Technology, Artificial Intelligence and Applications. The study asks how academic scores compare between an LCA-IT class and a conventional online class over eight weeks and how students describe their experience of the learning environment. The contribution is a course-level implementation and evaluation of this combination. The study does not isolate the effect of any one platform.

2. Literature Review

2.1. Collaborative learning in information technology education

Collaborative learning gives students opportunities to explain their thinking and examine alternatives with peers. Reviews in this area describe a range of instructional arrangements, rather than a single method that works equally well in every setting [1], [2]. For IT courses, the design challenge is to connect group interaction with the technical task: students need opportunities to discuss why a solution works and where it fails.

Jeong and Hmelo-Silver [3] identify seven affordances for CSCL: engaging in a joint task, communicating, sharing resources, participating in productive collaborative processes, constructing knowledge together, monitoring learning and forming groups or communities. These affordances guide the functions assigned to the three LCA-IT layers. Moodle organizes tasks and resources; synchronous communication supports discussion and ChatGPT offers explanations that groups can examine. Research by Lehtinen et al. [4] also considers socioemotional interaction during video-based collaborative learning. This work is relevant to the design of online discussion, although it does not establish how students will respond in the present IT course.

2.2. Learning management systems and generative AI

Learning management systems organize course resources, assignments and assessment. Studies of collaborative groups in an LMS examine how instructional design and monitoring relate to learning [6], [7]. ChatGPT serves a different function: it can respond to questions while students work through course content [5]. Bringing these functions together requires decisions about when students consult AI, how they discuss its suggestions and what evidence instructors use to judge understanding. Collaborative learning analytics adds another consideration. Guitert Catusís et al. [8] argue that teachers and students should be able to use and interpret analytics and that their involvement is an ethical issue as well as an instructional one.

These strands of research inform the present design, but they do not by themselves establish the effectiveness of this particular combination of Moodle, Zoom and ChatGPT. LCA-IT assigns a defined role to each tool within the same course. Our evaluation concerns the combined teaching arrangement and its use in one introductory IT setting; it does not claim that combining these technologies is inherently novel or sufficient to improve learning.

3. Methodology

3.1. Architecture of the LCA-IT Model

LCA-IT comprises three functional layers. The lecturer prepares the activities, coordinates group work and reviews students' progress. Figure 1 shows the relationship between these layers and the intended learning processes.

Layer 1: Learning management through Moodle

Moodle holds the course plan, learning materials, assessment criteria and project assignments. Tasks are organized into instructional stages so that students can identify what to study and what to submit. This layer provides the shared course structure for individual preparation and group work.

Layer 2: Synchronous communication through Zoom

Zoom is the primary platform for synchronous group discussion. Video, audio and text communication allow students to explain ideas, compare solutions and coordinate project work. The purpose of this layer is to provide time and space for discussion around a shared task.

Layer 3: Learning support through ChatGPT

ChatGPT is used for explanations of technical concepts, source-code interpretation, debugging support and hints when a group encounters a problem. These are intended support functions within the instructional design. Their presence does not establish that students became better independent problem solvers, an outcome that requires separate measurement.

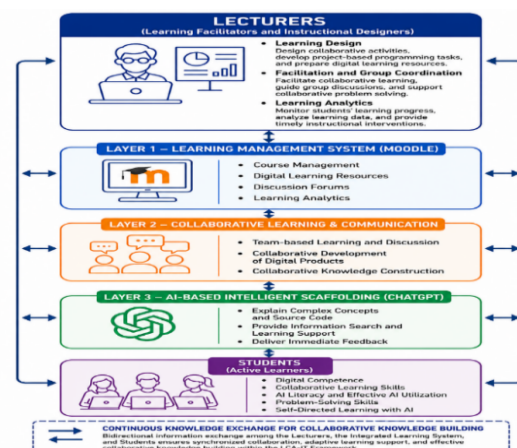


Fig. 1. LCA-IT architecture and intended learning processes

3.2. Implementation through ADDIE

The course was delivered over eight weeks at the University of Education, Hue University. Development followed the five phases of ADDIE:

analysis, design, development, implementation and evaluation.

- Analysis: Student and instructor needs were examined to identify difficulties with interaction, course content and access to technology.
- Design: Open-ended programming tasks were arranged in increasing order of complexity. The design used the zone of proximal development as a rationale for providing support during group problem solving.
- Development: The teaching environment brought together Moodle resources, AI support, collaborative learning scripts, discussion scenarios and learning visualizations.
- Implementation: Online project-based learning was combined with a flipped classroom approach. Students studied theoretical material through Moodle and consulted AI before working on projects in synchronous group sessions, primarily through Zoom.
- Evaluation: Pre-test and post-test scores were compared. Survey responses, LMS activity records and observations of group work provided additional information about the implementation.

3.3. Research Design and Participants

We used a quasi-experimental design with pre-test and post-test measurements. The eight-week intervention took place during the spring semester in the course Introduction to Digital Technology, Artificial Intelligence and Applications. The academic comparison involved 100 first-year students who participated voluntarily. Two existing classes formed the study groups; students were not randomly assigned to conditions.

Experimental group (n = 50): Students used Moodle, took part in structured collaborative activities through Zoom and used ChatGPT for learning support.

Control group (n = 50): Students followed conventional online instruction through Moodle, without the intervention's integrated generative AI support or structured CSCL scripts.

Pre-test scores were compared to describe the groups' starting points. The absence of a statistically significant difference on this test does not establish that the classes were equivalent on all relevant characteristics. Because the intervention changed several instructional components at once, any observed difference concerns the combined arrangement.

3.4. Measures and data collection

The evaluation used academic tests and a student perception questionnaire, supplemented by

platform records and observations. The latter are treated as descriptive evidence because a reproducible qualitative sampling and coding procedure is not reported.

Academic tests: Course instructors developed pre-test and post-test assessments containing multiple-choice questions and open-ended problem-solving tasks. The tests addressed conceptual understanding, applications of digital technology and AI foundations. Three senior lecturers, experts in IT and instructional design reviewed their alignment with the course learning outcomes.

Student perceptions: A nine-item questionnaire used a five-point response scale from 1 (strongly disagree) to 5 (strongly agree). It addressed usability, support from ChatGPT, learning management through Moodle and teamwork. The reported survey dataset contains 100 responses. Internal consistency was assessed using Cronbach's alpha; this statistic concerns the consistency of the items, not the effectiveness of the intervention or the validity of all interpretations of the survey.

Platform records and observations: The implementation record includes Zoom chat logs, Moodle forum discussions and selected student interactions with ChatGPT. These materials were examined for examples of explanation, discussion of alternatives and peer feedback. They are used here to describe the activities observed rather than to estimate changes in the quality of collaboration.

Before analysis, personal identifiers in grades, survey entries and platform records were replaced with numerical codes.

4. Results

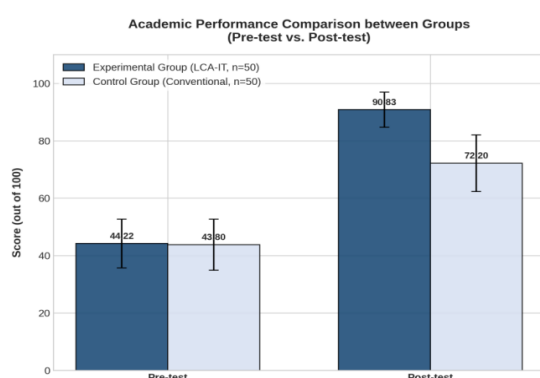
4.1. Students' Academic Performance

Table 1 summarizes the academic scores. At pre-test, the experimental class scored 44.22 (SD = 8.50) and the control class scored 43.80 (SD = 8.90). The reported independent-samples comparison was $t(98) = 0.24$, $p = 0.81$, with a 95% confidence interval of [-3.03, 3.87] for the mean difference. After eight weeks, the respective means were 90.83 (SD = 6.12) and 72.20 (SD = 9.85). The post-test difference was 18.63 points, with $t(98) = 11.36$, $p < 0.001$, a 95% confidence interval of [15.38, 21.88] and Cohen's $d = 2.27$. The tests were conducted in SPSS. Mean gains were 46.61 and 28.40 points, respectively; these gains are descriptive, since no inferential comparison of individual change scores is reported. The post-test difference is large, but the student-level test does not account for the use of one intact class per condition. It therefore cannot separate the intervention from other differences between the classes.

Table 1. Academic scores by study group

Measure	LCA-IT (n = 50)	Control (n = 50)
Pre-test M (SD)	44.22 (8.50)	43.80 (8.90)
Post-test M (SD)	90.83 (6.12)	72.20 (9.85)
Mean gain	46.61	28.40

Post-test difference: 18.63 points; 95% CI [15.38, 21.88]; $t(98) = 11.36$; $p < 0.001$; $d = 2.27$. Gain = post-test mean minus pre-test mean. Inference is based on the reported student-level analysis.


Fig. 2. Pre-test and post-test scores for the two classes

4.2. Student perceptions

The reported overall survey mean was 3.88 out of 5 (SD = 0.95; 100 responses). The item on collaboration enhancing learning capacity had a mean of 4.01 (SD = 1.04) with 82.30% agreement or strong agreement. The item on ChatGPT explaining complex concepts had a mean of 3.93 (SD = 0.99) and 77.68% agreement. Overall satisfaction with the environment was rated 3.87 (SD = 0.92) with 75.45% agreement. These responses describe students' perceptions of usefulness and satisfaction. They do not measure the extent to which ChatGPT improved conceptual understanding.

Two further items concerned participation and course management. Active participation in group discussions was rated 3.93 (SD = 0.90) with 77.88% agreement. The item on Moodle helping students manage learning was rated 3.81 (SD = 0.90) with 72.72% agreement. These self-reports complement the academic comparison but are not direct measures of collaborative competence or self-regulation.

4.3. Observations of collaborative activity

The descriptive account of Moodle activity, discussion forums and project work records students exchanging ideas, comparing possible solutions and coordinating tasks. Classroom observations also

noted explanations and peer feedback. Some groups consulted ChatGPT when they encountered conceptual difficulties. These observations identify activities that occurred during the intervention; they do not establish how often each activity occurred or whether participation was more evenly distributed than in the control class.

Without coded interaction data, contribution counts, or comparable observations from the control class, the evidence does not establish an improvement in collaborative knowledge construction. It instead identifies processes that a later study could examine systematically.

5. Discussion

5.1. Interpretation and ethical use of learning analytics

The academic comparison favors the LCA-IT class, while the survey describes a generally positive learning experience. The two results answer different questions. Test scores concern performance on the course assessments; survey ratings concern students' perceptions. Neither the survey nor the descriptive observations can explain which component produced the post-test difference. More structured group work, the flipped format, instructor support and AI access are all plausible contributors.

Learning analytics raises a related question about who can interpret and act on the records. Guitert Catasús et al. [8] place teacher and student empowerment alongside privacy and informed consent in their discussion of ethical analytics. LCA-IT includes simplified dashboards intended to support students' reflection on their activity. However, positive survey ratings do not demonstrate that dashboard feedback increased learner autonomy. Such a claim would require evidence about dashboard use and subsequent decisions or behavior. In practice, instructors should explain what the records show, allow students to question their interpretation and avoid treating activity counts as complete measures of learning.

5.2. Research Limitations

The study has several limitations. First, it compares two intact classes at one institution. With one class per condition and no random assignment, the intervention is confounded with class membership; student-level significance tests cannot resolve this problem. Second, Moodle, structured collaboration, synchronous discussion, the flipped format and ChatGPT were evaluated as a package. The design cannot identify their separate contributions. Third, eight weeks is too short to establish whether any benefit persists or transfers to independent work; novelty may also influence participation and satisfaction. Fourth, the survey relies on self-report and the relationship between its

100 responses and the 100 students in the academic comparison requires clarification before the findings can be combined. Finally, the descriptive activity records do not provide a validated measure of collaboration quality. Further evaluation should include multiple classes per condition, clearly documented sampling, delayed assessments and tasks completed without AI assistance.

6. Conclusion and Practical Recommendations

6.1. Conclusion

LCA-IT organizes Moodle, Zoom and ChatGPT around collaborative work in an introductory IT course. In the eight-week comparison, the class using this arrangement had a higher mean post-test score than the conventional online class. Survey responses also indicated that students generally found the environment useful. These findings justify further evaluation in comparable courses, with attention to the limitations of the two-class design and the unresolved survey sample description.

The present evidence supports a cautious conclusion about the combined instructional approach. It does not demonstrate that ChatGPT alone caused the score difference or that students developed lasting gains in teamwork, critical thinking or independent problem solving. Those outcomes require direct assessment.

6.2. Practical Recommendations

Institutions considering this approach should check whether students have reliable access to the required platforms and establish rules for using learning records. Students need to know what data are collected, who can access them how those records are used in teaching and research.

Lecturers should define the role of each platform in the task, make assessment criteria explicit and distinguish individual understanding from the quality of a group's final product. Future implementations should document the ChatGPT version and access arrangements, retain examples of the guidance given to students and record how instructors respond to inaccurate AI output.

Students should check AI explanations against course materials and explain the reasoning behind any suggestion adopted by their group. Group discussion should make room for disagreement and for testing alternative solutions. These are recommendations for implementing LCA-IT; the present study did not separately test their effects.

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