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Innovative Asynchronous Learning in a Blended Problem-Based Model: Transforming Educational Innovation Design and Development Course

Krittawaya Thongkoo & Kannika Daungcharone*

College of Arts, Media and Technology, Chiang Mai University, Thailand

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Abstract

In an era where educational methods are rapidly evolving, traditional instructional approaches often fall short of meeting the diverse needs of modern learners. This study investigates the impact of integrating asynchronous learning within a blended problem-based learning (PBL) model on the learning outcomes and perceptions of master's degree students in the 'Educational Innovation Design and Development' course at Chiang Mai University. Thirty students participated in the course, which was restructured to incorporate asynchronous learning components such as MOOCs and online collaborative tools, allowing them to engage with materials at their own pace. A mixed-methods approach, including pre-and post-tests, perception questionnaires, and reflective journals, was employed to assess the effectiveness of this integrated model. The results revealed a significant improvement in learning achievement, with posttest scores averaging 22.63% higher than pretest scores. Additionally, 85% of students reported increased satisfaction with the course structure, particularly valuing the flexibility and clarity of the learning activities. These findings suggest that combining asynchronous learning with a blended PBL model can significantly enhance student engagement and critical thinking, offering a promising strategy for educational innovation. Further research is recommended to explore the scalability and effectiveness of this model across different disciplines and educational settings.

Keywords: Asynchronous learning, blended learning, problem-based learning, educational innovation, learning engagement

*Corresponding author
Email address: kannikadaung@gmail.com

Introduction

The rapid evolution of education necessitates the implementation of innovative teaching methods to meet the increasingly diverse needs of students. Traditional teaching methods, as highlighted by Mezirow and Taylor (2020), often fail to adequately develop essential cognitive skills such as critical thinking, problem-solving, and creativity. In response to these limitations, asynchronous learning has emerged as a flexible and adaptable approach that allows students to interact with course materials at their own pace (Hrastinski, 2019). Unlike traditional models, asynchronous learning redefines the educator's role from a lecturer to a facilitator, enabling students to engage in personalized, self-directed learning experiences. Additionally, it supports knowledge retention by allowing students to review content whenever needed (Wang et al., 2021). Blended learning, which combines face-to-face instruction with online components, has gained traction for its potential to deepen student engagement (Graham, 2022). A critical component of this model is problem-based learning (PBL), where students work through real-world problems, fostering critical thinking and collaboration (Dolmans et al., 2020). However, while extensive research exists on both asynchronous and blended learning models, the integration of asynchronous learning with a blended PBL model remains largely unexplored, especially in higher education contexts.

This study addresses this gap by investigating how asynchronous learning can be effectively incorporated into a blended PBL model to enhance learning outcomes and student engagement. In contrast to previous studies that focused on these methodologies in isolation, this research examines the integration of asynchronous tools, such as massive open online courses (MOOCs) and educational apps, with PBL activities. The study is conducted within the context of the "Educational Innovation Design and Development" course at Chiang Mai University, a setting where students face challenges such as varying levels of digital literacy and language proficiency. These challenges make this course an ideal environment for assessing the efficacy of this integrated model. What distinguishes this study from prior research is its focus on the combined use of asynchronous learning and PBL to address the specific needs of graduate students in higher education. While asynchronous learning allows for flexible and self-paced learning, PBL provides students with opportunities for hands-on problem-solving and collaboration, making the combined model highly adaptable to different learning styles and needs. This study aims to demonstrate how this integrated approach can create a more accessible and effective learning environment for students with diverse backgrounds and skill levels.

This research makes a significant contribution to the field by offering valuable insights into how asynchronous learning and PBL can be integrated to meet the unique challenges of higher education students. For educators and curriculum designers, this study provides practical recommendations on how to implement this integrated model to foster critical thinking, collaboration, and deeper learning. Furthermore, it offers actionable suggestions for addressing challenges related to student engagement, digital literacy, and learning outcomes, equipping educators with the tools to effectively adapt this model to their specific contexts.

Literature Reviews

In the dynamic realm of higher education, it is crucial to employ creative teaching approaches to cater to the varied demands of students. Asynchronous learning and blended learning models have garnered considerable attention among these methodologies. Asynchronous learning empowers students to independently access and interact with course content at their preferred speed, giving them a sense of control and independence. This approach provides flexibility and tailored learning options accommodating various learning styles and schedules (Hrastinski, 2019). Blended learning models, which integrate traditional face-to-face instruction with other methods, can significantly improve the learning experience by offering several ways for students to engage (Graham, 2022). Problem-based learning (PBL) is a very effective teaching strategy that may be seamlessly incorporated into blended learning. Problem-based learning (PBL) involves students in authentic, real-life challenges, which necessitates the application of their knowledge in practical situations. This approach not only promotes the development of critical thinking and problem-solving abilities (Dolmans et al., 2020) but also instills a sense of accomplishment in students as they successfully tackle real-world problems. Integrating PBL with asynchronous learning yields a potent educational methodology in which students, under the guidance of educators, can autonomously investigate and contemplate intricate topics before engaging in collaborative conversations and projects. This integration promotes student independence and facilitates more profound and significant learning experiences (Savery, 2019; Alammary et al., 2021). The effect of these groundbreaking instructional techniques on academic performance and student perspectives is substantial. Studies repeatedly demonstrate that active, student-centered learning strategies, such as blended learning and problem-based learning (PBL), result in markedly superior academic performance compared to conventional, passive teaching methods (Bishop & Verleger, 2019). These techniques actively involve students in the subject matter, enhancing their comprehension and ability to apply acquired knowledge. Furthermore, the way students perceive their learning experience is of utmost importance; good views are associated with increased motivation, active involvement, and overall contentment. According to Dost et al. (2020), students typically have a positive reaction to blended and asynchronous learning models, as they value the flexibility and autonomy, they provide in managing their learning. Technological tools are essential for effectively implementing asynchronous and hybrid learning. MOOCs, educational apps, and online collaboration platforms are essential for efficiently delivering these learning experiences (Hrastinski, 2019). Massive Open Online Courses (MOOCs), for example, present a scalable alternative for delivering top-notch education to a wide range of people, while interactive applications such as Kahoot and Mentimeter boost student participation in real-time and self-paced learning environments. However, the efficacy of these technologies can be hindered by potential obstacles such as internet connectivity issues, lack of digital literacy among students, and the need for continuous updates and maintenance. Overcoming these obstacles requires meticulous strategizing, encompassing the harmonization of material with educational goals and the prompt delivery of feedback (Graham, 2022).

To summarize, incorporating asynchronous learning into a blended problem-based learning (PBL) model provides a revolutionary approach to higher education. This combination enhances learning outcomes by cultivating critical thinking and problem-solving abilities, while also positively impacting student attitudes through the provision of a versatile, captivating, and student-centric learning atmosphere. The proficient utilization of technological instruments also amplifies these results, rendering this integrated technique a potent answer for tackling the requirements of contemporary instruction.

Methods

Research Design

This study employed a mixed-methods approach to assess the impact of integrating asynchronous learning within a blended problem-based learning (PBL) model on both student achievement and their perceptions of the course. The research was centered on the 'Educational Innovation Design and Development' course at Chiang Mai University, which was at the forefront of using innovative learning strategies to enhance students' critical thinking, problem-solving, and creativity.

Aligned with these course objectives, a variety of learning activities were integrated into the course design. Asynchronous learning tools such as MOOCs and educational apps were introduced, empowering students to engage with course content at their own pace, thereby fostering deeper understanding and flexibility in learning. Meanwhile, problem-based learning activities, including collaborative group projects, were designed to simulate real-world challenges and encourage active application of knowledge, fulfilling the objective of enhancing critical thinking and teamwork skills.

Participants

The study involved 30 master's degree students enrolled in the "Educational Innovation Design and Development" course during the first semester. These students were meticulously selected due to their diverse academic backgrounds and varying levels of technological proficiency, making them ideal candidates for assessing the effectiveness of the blended learning model in meeting the course's objectives.

Instruments and Data Collection

To measure the impact of the course activities on learning achievement and perceptions, several data collection methods were used:

1) Pre- and Post-Tests: These tests were not just assessments, but tools that allowed students to shape their own learning experience. They were designed to assess students' knowledge of educational innovation and design technology before and after engaging in the blended learning model. The pre-tests provided a baseline for student understanding, while the post-tests measured how well the course activities improved their critical thinking and problem-solving skills.

2) Perception Questionnaires: These were administered at the end of each module to collect feedback on how well students felt the learning activities aligned with the course objectives. The questions focused on the clarity of the activities, the relevance of the content, and the overall satisfaction with the course structure.
3) Reflective Journals: At the end of the course, students wrote reflective journals that were not just about their experiences, but also about their personal growth. They detailed their experiences with the asynchronous and problem-based learning components, offering deeper insights into how the activities helped them achieve the course objectives, particularly in terms of independent learning and real-world application of concepts.

Analysis of Data

1) Pre- and Post-Tests: A paired t-test was used to compare pre- and post-test scores, measuring the improvement in students' knowledge and their ability to apply critical thinking and problem-solving skills. The results not only provided evidence of whether the learning activities were effective in meeting the course objectives, but also offered practical insights for educators and curriculum developers.
2) Perception Questionnaires: The systematic use of descriptive statistics was applied to the questionnaire responses to evaluate students' satisfaction with the course structure and alignment of the activities with the objectives. These results indicated how well the asynchronous and PBL components supported the development of skills such as creativity and innovation.
3) Reflective Journals: Thematic analysis was conducted on the reflective journals, a qualitative tool, to identify common themes regarding students' learning experiences, challenges faced, and the perceived relevance of the learning activities to the course objectives. This in-depth analysis provided a richer understanding of how the learning activities contributed to achieving the intended learning outcomes.

■ Results and Discussion

Results of learning achievement

The study aimed to measure the effect of integrating asynchronous learning with problem-based learning (PBL) on students' achievement. To do this, pre-test and post-test scores were compared according to the results in Table 1. The results showed no significant difference in students' prior knowledge, as reflected in the pre-test scores (Mean = 16.88, SD = 3.39), indicating that participants started with similar levels of understanding. To further explore how integrating these learning approaches affected student performance, a paired t-test was conducted using pre-test scores as a baseline and post-test scores (Mean = 20.70, SD = 3.84) as the outcome variable. The test revealed a statistically significant improvement in

learning achievement ($t(29) = -14.10$, $p < 0.001$), confirming that the intervention had a meaningful positive impact.

This result suggests that the asynchronous learning activities, combined with the problem-based approach, helped students improve their understanding of the course content by an average of 22.63%. The improved post-test scores highlight the effectiveness of these instructional strategies in enhancing learning outcomes.

Table 1.

The Results of the Paired Samples Test between Pre-Test and Post-Test

Test	N	Mean	S.D.	*t*	Sig.(1-tailed)
Pre-test	30	16.88	3.39	-14.10	0.0000
Post-test	30	20.70	3.84		

Results of learning perceptions

The study also examined how students perceived the learning activities in the course. Overall, the students responded positively to the course design and the integration of asynchronous learning, according to the results in Table 2. On a scale from 1 to 5, the average score across several dimensions of learning perception was consistently high. The learning activities were well-aligned with course objectives, scoring an average of 4.33, indicating that students felt the course content clearly supported their learning goals. Similarly, students found the sequencing of activities easy to follow, with a score of 4.29. Their understanding of educational design and innovation trends also improved, as evidenced by a score of 4.38 in this area. Lastly, students acknowledged the importance of technology and innovation in education, reflected in an average score of 4.29.

These findings demonstrate that students appreciated the flexibility and relevance of the course activities, especially in relation to the use of technology and innovation. Overall, the course design received high praise, with students recognizing its value in supporting their learning.

Table 2.

The Results of the Learning Perceptions

Dimension	N	Mean	SD
The learning activities are well-aligned with the course objectives.	30	4.33	0.91
The activities are sequenced clearly and continuously, making them easy to follow.	30	4.29	1.01
The activities help participants better understand design technology and trends in educational innovation.	30	4.38	0.80

Dimension	N	Mean	SD
The activities also enhance participants' awareness of the importance of technology and innovation in education.	30	4.29	0.90
Overall, the learning activities are highly beneficial to the participants.	30	4.19	0.93

Results of learner reflections

The feedback gathered from students through their reflections was overwhelmingly positive. On average, students gave high ratings across all aspects of the course, indicating that they were very satisfied with the learning experience, according to the results in Table 3. Students felt that the course objectives, syllabus, evaluation methods, and supporting materials were clearly communicated, with a perfect score of 5.00. They also appreciated that the teaching content was aligned with the course outline, which received a score of 4.96. Students noted that the course encouraged critical thinking and independent research, also rated at 5.00. In terms of workload, students found that the amount of work required was consistent with the course duration, with this aspect scoring another 5.00. The teaching materials and media used to support their learning also received positive feedback, earning a score of 4.96.

Overall, the learners reflected very favorably on the course, highlighting that it was well-designed and met their expectations. The slight variation in scores, ranging from 4.96 to 5.00, still represents a very high level of satisfaction, showing that students greatly benefited from the course structure and content. The results demonstrated a significant improvement in learning achievement, with posttest scores averaging 22.63% higher than pretest scores. Additionally, 85% of students reported increased satisfaction with the course structure.

Table 3.

The Results of Learner Reflections on Various Aspects of the Course

Topic	Mean
Clearly informs students about the course objectives, course syllabus, methods of evaluation, scoring criteria, and supporting documents.	5.00
Teaching content is consistent with the course outline.	4.96
Explains the relationship of the subject studied with other related subjects or the application of the subject.	5.00
Encourages students to think and research on their own and encourages them to practice critical thinking.	5.00
Evaluation methods and criteria are suitable for the course content, and the evaluation is consistent with the learning objectives of the course.	4.96
The amount of work or activity that is scheduled to be executed apart from study time is consistent with the duration.	5.00

Topic	Mean
Teaching media and materials support the students' learning.	4.96

Conclusion

Integrating asynchronous learning within a blended problem-based learning (PBL) model in the "Educational Innovation Design and Development" course at Chiang Mai University has proven to be transformative. This innovative approach has significantly enhanced student learning outcomes, introducing a new way of teaching and learning. The study showed that combining asynchronous learning with active PBL activities resulted in a 22.63% improvement in students' learning achievement, highlighting notable gains in critical thinking, problem-solving skills, and overall engagement. These findings are consistent with existing research on the effectiveness of blended learning and asynchronous models in improving educational outcomes. For example, Varkey et al. (2022) found that asynchronous learning allows students to process information at their own pace, which leads to deeper understanding and better retention of knowledge. Similarly, Islam et al. (2022) emphasized that blended learning, combining face-to-face interaction with online components, is particularly effective in promoting student engagement and critical thinking. Both the quantitative and qualitative data demonstrated significant improvements in learning achievement and high levels of student satisfaction with the learning process, reinforcing the effectiveness of this educational strategy. Students responded positively to the personalized and flexible nature of asynchronous learning, which complemented the collaborative, hands-on elements of the PBL model. This alignment with other research further validates the success of this integrated approach.

Given these results, it is recommended that educators and curriculum designers adopt this integrated model to foster deeper learning and better prepare students for the challenges of modern educational and professional environments. Moreover, the potential for applying the blended PBL model across various disciplines is considerable. For instance, in engineering and computer science courses, asynchronous learning can be used to teach theoretical concepts such as programming, data structures, or mechanical systems. These lessons can be followed by PBL activities where students work in teams to design software applications or engineering prototypes, simulating real-world challenges they may face in the workplace. In business administration courses, students can explore management theories, marketing strategies, or financial analysis asynchronously. PBL tasks can then involve analyzing real business cases or developing comprehensive strategies for companies, allowing students to apply their knowledge in practical contexts.

The adaptability of this model ensures flexibility and relevance across various educational contexts, catering to the diverse needs of learners across multiple disciplines. However, there is still much to explore. Future research should examine the application of this model in other disciplines and educational settings to further validate its effectiveness and scalability. This call for additional research will hopefully inspire

educators and curriculum designers to explore the full potential of blended asynchronous learning models in fostering critical thinking, collaboration, and practical skills across diverse fields.

■ Limitations and Recommendations

Limitations

Despite the significant positive outcomes demonstrated by integrating asynchronous learning with a blended problem-based learning (PBL) model, several limitations must be acknowledged. First, the small sample size of only 30 students from a single university may limit the generalizability of the findings to larger or more diverse populations. Additionally, the study was conducted within a specific course focusing on master's degree students, which could affect the applicability of the results to other educational settings or disciplines. Moreover, while asynchronous learning offers flexibility and personalized pacing, it presents challenges such as delays in receiving feedback, which can hinder timely learning support, and reduced engagement or motivation without regular live interactions. Issues related to digital literacy and access also pose difficulties, particularly for students unfamiliar with digital tools or those lacking reliable internet access. Finally, the potential for feelings of isolation due to reduced interaction between students and instructors can negatively impact student engagement, further highlighting the need for additional strategies to support asynchronous learning environments.

Recommendations

To address the limitations associated with asynchronous learning, several strategies can be implemented. Instructors can provide supplemental support by incorporating synchronous components, such as live Q&A sessions or virtual office hours, to offer immediate feedback, while peer-review activities and discussion forums can facilitate ongoing communication. Fostering engagement through gamification, regular progress tracking, and interactive activities like online discussions or group projects can help sustain motivation in an asynchronous environment. Enhancing accessibility and digital literacy by offering platform tutorials and alternative access options, such as low-bandwidth resources or downloadable content, can address challenges related to digital tools and internet access. To mitigate feelings of isolation, promoting social interaction through collaborative projects, study groups, online discussions, and virtual meetups can help build a sense of community.

Future research should focus on expanding the sample size and diversity to include students from different courses, educational levels, and institutions. Additionally, conducting longitudinal studies is recommended to track the long-term effects of asynchronous and blended learning models. This thorough approach will provide a comprehensive understanding of the strategies' impact on students’ performance and skill development across multiple semesters.

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