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HYFLEX BLENDED LEARNING: A GRADUATE-LEVEL CASE STUDY IN STRATEGIC EDUCATIONAL MANAGEMENT

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Abstract

This research and development study focuses on designing, developing, implementing, and evaluating a HyFlex blended learning management system (HLMS) specifically tailored for a graduate-level seminar in strategic educational management. The study involved 17 graduate students and 10 ICT and educational innovation experts. A four-step methodology was employed: 1) analysis of user requirements; 2) system design and development using a database lifecycle approach; 3) usability testing and evaluation; and 4) system performance improvement based on feedback. Quantitative data analysis involved statistical packages, while qualitative data was analyzed using content analysis. The resulting HLMS prototype incorporated a database system, student and lecturer records, knowledge management tools, and online interaction features, providing a flexible learning environment. The study found high satisfaction and efficiency levels among students and experts. The HLMS effectively addressed the need for a dynamic learning experience catering to diverse learning styles and preferences. The findings underscore the potential of HyFlex blended learning for enriching graduate-level education in strategic educational management while highlighting the importance of systematic development and comprehensive evaluation in creating and implementing such systems. The research contributes to a growing body of literature on the effective use of technology in higher education.

Keywords: HyFlex Blended Learning, Learning Management System, Strategic Educational Management, Graduate Education, Technology-Enhanced Learning

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Introduction

Information and Communication Technology (ICT) is a critical and valuable system for the nation's development and progress. It is also very relevant to people's way of life in modern society. All societies have completely adapted to the electronic society (e-Society). Hence, ICT has become a system that is necessary for every operation in various places. Organizations developing and implementing appropriate ICT systems will help their executives and operators receive accurate and timely information. As a result, the decision-making in planning for the organization's operations is more efficient, and solving problems is possible on time. Organizations can compete for advantages and efficiently develop customer services (Laudon & Laudon, 2019). Therefore, studying how to apply the appropriate ICT system to each organization is essential. The practical application of ICT to make timely decisions requires concrete management planning. Including various strategies in systematic management so that the organization achieves its objectives, develops continuously, and has sustainable growth (Sinlarat, 2020; Phakamach, 2023). One of the roles Thai universities should play is understanding the changes and learning new ways to keep up with modern Thai and international technology in education management by introducing modern management and management techniques. They should be applied to educational administration in institutions for maximum academic efficiency and effectiveness (Phangphol & Phakamach, 2021; Demir et al., 2021; Garbin et al., 2022).

Ministry of Higher Education, Science, Research and Innovation realized the importance of ICT and encouraged the use of ICT to develop and apply with students' study and development of knowledge. This aligns with the government's policy according to the 20-year national strategy 2017-2036 and under the ICT Master Plan 3 (ICT Master Plan 3) Higher Education Act and more educational platforms due to the global information connection. In other words, it is a new avenue for education. People use this main road as a path to intellectual treasures and to develop new learning styles (Phakamach et al., 2022). Therefore, the Ministry has established policies and standards to encourage educational institutions and agencies to implement the policy to promote the development of ICT for education by providing ICT educators. Educational personnel and students have developed the ability to use educational platforms to benefit teaching and learning. Educational institutions at all levels need an ICT management system for educational innovation development as a standard system for improving their quality of education (Panjarattanakorn & Phakamach, 2020).

Teaching and learning in the era of transformational change (Education Disruption) are formed by a variety of blended teaching and learning management models that are used to promote and solve educational management problems in various fields, especially in the situation of the epidemic Coronavirus (Ismaili, 2021). Blended teaching and learning management must align with the new learning paradigm, enabling students to seek knowledge independently. Especially the ability to fully use innovation and educational technology in pursuing knowledge (Wang et al., 2021). The principles under the Higher Education Act 2019 show that thinking process skills are still essential and must be encouraged for students because thinking is an intrinsic factor influencing a person's actions and expressions. People with high thinking abilities will be able to solve problems. They accomplished their tasks and developed their own lives. Therefore, developing thinking ability is an integral part of students' development so they can live happily in a changing society (Gioiosa & Kinkela, 2022). Hybrid Flexible (HyFlex) blended learning is a learning management system (LMS) model and method that combines face-to-face and online or digital learning. By leveraging the benefits of face-to-face and online learning, we create more flexible and dynamic learning experiences. In addition, creating defined learning situations or activities through quick perception and action to develop skills or competencies (Hapke et al., 2021; Chen, 2022; Raksakul et al., 2023).

Seminar in Strategic Educational Management is a core course in the Master of Education Program in Educational Administration and Strategies at Rajamangala University of Technology Rattanakosin. Many institutes provide teaching and learning at the graduate level and are compulsory courses for modern educational administrators. This is because it focuses on developing strategic educational management and its use to prepare research projects to develop educational management processes and enhance the student's educational quality (Phakamach et al., 2021). Most of the learning takes place in a regular classroom, creating severe obstacles to student learning if there is no good support for using modern management techniques and operating systems to build up an educational platform. Considering using learning materials on web applications, a teaching and learning process management system that connects students with teachers and students with students, it provides digital learning materials and teaching materials for the instructors acting as trainers (Gioiosa & Kinkela, 2022) and as inspirers by designing experiential proactivity activities that correspond to the course content (Huang & Lai, 2020). This self-paced learning model supports knowledge management in a given course, helping solve problems and obstacles that arise in students' learning. In particular, graduate teaching and learning focuses on posing a learning challenge to construct new knowledge with quality (Calonge et al., 2023).

Based on this idea, the researcher is interested in developing the HyFlex blended learning management system in a Seminar on Strategic Educational Management for graduate students. This system will change the learning process from using the blended learning management system platform to one that supports teaching and learning activities. To be a complete learning organization, this design and development present educational innovations with dimensions: 1) electronic learning media; 2) a knowledge management support system, i.e., a knowledge repository, knowledge records, a chat board, and a knowledge assessment form; 3) a database of instructors and students as well as academic services; 4) online electronic bulletin boards to exchange learning; and 5) a linkage with universities (e-MIS). The prototype will be a model of a blended learning management system using software and services, and it will assess the efficiency and satisfaction of the students. Performance improvements are based on expert and student feedback. The model system is suitable for serving students at the graduate level. It helps respond to students' needs and contributes to learning about the effective strategic educational management of Entrepreneurship and Ventures in Education.

Literature Review

Phakamach and Panjarattanakorn (2024) argued that Blended Learning (BL) is a learning management model and method combining normal classrooms or Face-to-Face (F2F) and online or digital learning. By leveraging the benefits of F2F learning and online learning, we create more flexible and dynamic learning experiences. Creating defined learning situations or activities through quick perception and action to develop skills or competencies (Viebig, 2022). Universities with BL programs may also choose to reallocate resources to boost learner achievement outcomes. Learners can choose their favorable study settings and learning resources in a BL model. This allows for increased flexibility in scheduling, location, and learning styles. Learners can attend classes on campus, join remotely from a different location, or even switch between in-person and online participation as needed. Hybrid learning refers to learning that integrates complementary F2F (Synchronous) and online learning (Asynchronous) experiences in service of intended learning objectives. All students in a hybrid course are expected to undergo the same combination of online and in-person activities. In contrast, the "Flexible" aspect of HyFlex is that students are given a choice in how they participate in the course and engage with the material in the mode that works best for them over the course and from session to session. Howell (2022) describes that HyFlex learning refers to a flexible approach to education carried out in F2F, online learning settings, and

asynchronous settings using the LMS model. The term “HyFlex” stands for Hybrid-Flexible, indicating that it allows students to choose between different learning modes according to their preferences, needs, and situations (Sumandiyar et al., 2021). In the HyFlex learning model, students can choose their positive educational environment and learning resources. This increases flexibility in arranging schedules, locations, and learning styles. Students can choose to attend on-campus classes, participate remotely from another location, or even switch between in-person and online engagement as they like (Liu & Rodriguez, 2019; Hapke et al., 2021; Wong et al., 2023). However, to maximize the effectiveness of the learning management strategy for the students, the role of teachers is an integral part of engaging and learning options to encourage students to achieve the desired learning outcomes by systematically integrating educational technology into teaching and learning methods. Detyna et al. (2023) and Khumyoo et al. (2024) noted that implementing HyFlex blended learning methods for teaching and learning not only increases students’ motivation but also deploys an adaptive learning platform where students can learn at their own pace from anywhere and at any time (Raksakul et al., 2023).

Previous research by Kohnke and Moorhouse (2021), Raes (2022), Cuadra and Bernal (2023), and Phakamach and Panjarattanakorn (2024) has also established that students online often felt distanced, forgotten, disengaged, and socially isolated. Additionally, Calonge et al. (2023) indicated that even though “many instructors offered synchronous lectures or sessions … it never provides the feeling of being socially present in the same space as other students and the instructor”. Khumyoo et al. (2024) argued that “most colleges and universities that adopted HyFlex teaching during the pandemic did not have the infrastructure to enable the equitable learning experiences and outcomes that characterize the HyFlex teaching model.”

Introducing HyFlex brings challenges and opportunities regarding technical infrastructure and the design of learning environments (Gatlin et al., 2021). On the one hand, the flexibility inherent in HyFlex necessitates that universities and higher education institutions invest in often expensive technological infrastructure, including high-quality video conferencing tools and LMS digital platforms, to ensure effective communication and content dissemination. Furthermore, the design of classrooms must account for essential elements such as acoustics (Detyna et al., 2023), lighting, and camera positioning to guarantee fair involvement from both in-person and remote participants. Conversely, the HyFlex blended learning model provides chances to rethink conventional learning environments (along with the teaching and facilitation that occur in these settings). Institutions can implement adaptable, flexible, and inclusive classroom designs that serve on-site and virtual learners. In addition, the HyFlex blended learning model motivates educators to participate in ongoing faculty development programs and workshops or to investigate innovative teaching strategies, including active learning methods, collaborative activities in both in-person and online formats, and flipped classrooms, all aimed at enhancing engagement and interaction across all formats. The goals of this research are twofold: 1) To design, develop, test, implement, and assess a prototype of the HyFlex blended learning management system and examine its application in the Seminar in Strategic Educational Management course at the graduate level. 2) To recommend the HyFlex blended learning management system and its implementation in the Seminar in Strategic Educational Management course at the graduate level.

Research Conceptual Framework

Relevant literature review and research design formed the research concepts. The HyFlex blended learning management system and its application in the Seminar on Strategic Educational Management at the graduate level follow the flowchart in Figure 1.

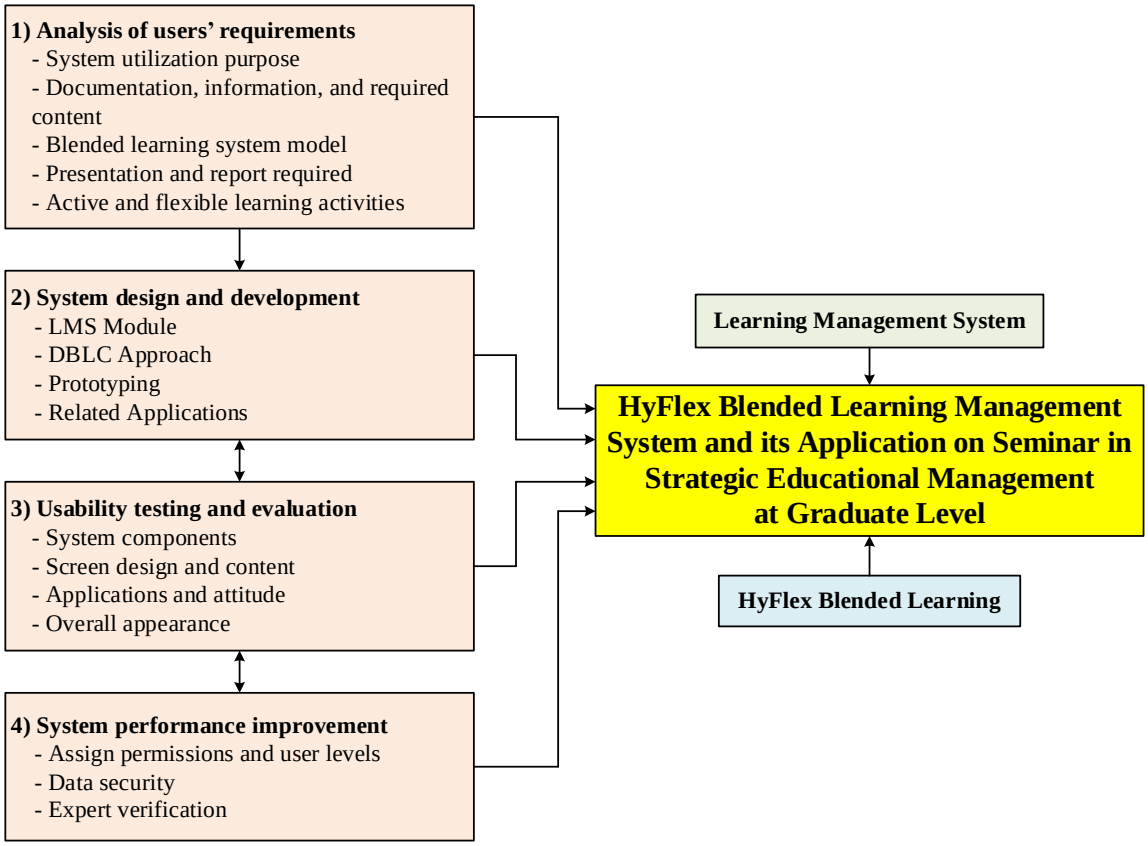

Figure 1 Research conceptual framework.

Research Methodology

Procedures for Conducting Research

The method of this research and development study consisted of four steps as follows:

1) Analysis of users' requirements, which is the study and analysis of the needs of both faculty and students using a survey tool to study the necessary requirements for developing the HyFlex blended learning management system. This study took the learning management approach that promoted the solution of the current problems through a five-step learning process, as follows: (1) Learning Outcome, (2) Assessment, (3) Learning Plan, (4) Considerations; and (5) Reflection and Revision (Chen, 2022; Howell, 2022).

2) System design and development, using the LMS system and programs for developing on-site and online teaching materials. A case study related to the course, including a preliminary test, was designed for study.

3) Ten ICT and educational innovation experts checked Usability testing and evaluation, system quality, and suitability. The trial phase lasted three months, and students enrolled in the EAS 6106 course tested the systems' satisfaction.

4) System performance improvement: Using the test and evaluation results obtained from Step 3 to confirm and improve the performance of the HyFlex blended learning management system at the Seminar in Strategic Educational Management at the graduate level.

The process of creating tools used in blended teaching and learning management includes: 1) studying the educational administration and strategies curriculum/course and analyzing the content of the Seminar in Strategic Educational Management (EAS 6106) course at graduate level; 2) defining the learning objectives to determine the scope of content in each unit including challenging and collaborating learning activities accordingly; 3) determining the format for presenting content by collaborating academic seminars in accordance with the learning management approach that promotes the solution of Hyflex blended learning system

in 5 steps: (1) Learning Outcome, (2) Assessment, (3) Learning Plan, (4) Consideration, and (5) Reflection and Revision; 4) writing the flowchart of the Hyflex blended learning management system to define internal classroom communication channels for appropriate and convenience (Malczyk, 2019; Hapke et al., 2021); 5) designing the storyboard according to a hierarchical structure based on proactive knowledge management techniques (Phakamach et al., 2021); 6) developing the digital platform layout using LMS Tool Box and related computer programs; 7) trailing and revising the system; and 8) evaluating the quality and satisfaction of the system performances.

Population and Sample

The population in this research was graduate students in the Master of Education Program, Department of Education Administration and Strategies, Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, enrolled in the Seminar in Strategic Educational Management (EAS 6106) in the second semester of the academic year 2024. Because this class has 17 students, the number is small and requires data based on the opinions of all students. Therefore, the panel decided to select the entire population as the sample.

The study population at Step 3 was divided into two groups as follows: Group 1, or the target group, consisted of 10 ICT experts with educational innovations and the following qualifications: 1) knowledge of ICT systems for education; 2) experience in ICT system development and educational innovation for at least 5 years; 3) academic works related to ICT system development and educational innovation with at least 5 works published. Group 2, or the sample, consisted of 17 students in the Seminar in Strategic Educational Management (EAS 6106) course at the Rajamangala University of Technology Rattanakosin.

The tool used to collect the data is an unstructured interview form to test its effectiveness, problems, obstacles, and corrective guidelines. Data collection was divided according to the study population: Group 1: workshops and interviews, Group 2: workshop facilitation and participant observation.

Research Instruments

The research instruments consisted of (1) a HyFlex blended learning management system and its application in a Seminar in Strategic Educational Management at the graduate level and (2) the research tools for data collection:

1) Quality assessment form (for experts) for ICT systems and educational innovations, with a 5-level rating scale that assesses the system's design and development regarding system components, screen design and content, and usability.

2) Students' satisfaction assessment form with a 5-level rating scale that assessed the system's suitability regarding system components, screen design, content, usability, and attitude.

(3) Structured interview form for interviewing students' use of the system in the areas of (1) knowledge and implementation, (2) behavior and response, (3) participation, (4) results of use, and (5) problems and suggestions.

The questionnaire consisted of a checklist of questions, the text form, and a 5-level rating scale, with the questionnaire with three parts, and the details are as follows:

Part 1: Information about the respondents.

Part 2: Opinions on using a HyFlex blended learning management system. It was an analysis to determine the efficiency and satisfaction of the system users.

Part 3: Suggestions and guidelines for developing a HyFlex blended learning management system.

The questionnaire was developed and submitted to 10 experts to verify its content validity and review its appropriate language and wording. Then, it was checked for reliability using Cronbach's Alpha Coefficient formula. Reliability was evaluated at .922.

Experiment and Data Collection

The preparation of the experiment included:

1) asking for permission to collect data and test the system by collecting data and testing the system in the second semester between June and September in the Academic Year 2024.

2) preparing the developed prototype and uploading it as part of the course data on the PP-LMS Learning Centre server before testing its use.

3) preparing the place and the computer, scheduling the experiment, and testing the operating system in the content of educational system development.

The system prototype an expert evaluated was tested for performance evaluation in the following format.

One-to-One Testing: an experiment with three graduate students taking this course before selected students with high, medium, and low grades based on their average grades in the past semester, using the simple random sampling method, testing the system to find defects, and then using to improve and revise with the value E_1/E_2 = 61.66/62.78;

Small Group: Conducting the experiment with nine graduate students who have taken this course before by selecting graduate students with high, medium, and low grades based on the average scores of the course in the past semester as the criterion using a simple random sampling method, testing the system to find bugs and using E_1/E_2 = 71.91/72.87;

Field testing, including:

1) Bringing the system to graduate students for a one-month workshop experiment by selecting a sample of 17 graduate students and organizing a pretesting knowledge meeting. These are carried out in the following order: (1) pre-test by having graduate students test from the achievement test of 40 items, (2) let students study by using a HyFlex blended learning management system on Seminar in Strategic Educational Management at the graduate level, (3) students complete exercises from the system of 10 items per learning unit, and (4) post-test by having students test from the achievement test of 40 items and evaluate the overall efficiency of E_1/E_2 with a value of E_1/E_2 = 82.14/ 83.92;

2) Interviewing a sample of graduate students who used regularly about their use.

3) Analyze the interview results summarized in an essay and improve the system to be suitable and complete.

Data Analysis

1) Analysis of users' requirements: summarized in an essay to illustrate the details that consisted of (1) the purpose of the use of the system, (2) the required documents, information, and content, (3) the format of the Hybrid blended learning system, (4) the presentation and the required report (5) the activities of HyFlex blended learning, and (6) the practical activities.

2) System design and development: by ten experts in ICT systems and innovations for education administration, summarized in an essay format to illustrate the details, which consisted of (1) LMS Module, (2) Database Life Cycle or DBLC Approach, (3) Prototyping, and (4) related applications.

3) Usability testing and evaluation: Ten ICT system development and educational innovation experts assessed the prototype system's efficiency, and 17 graduate students evaluated satisfaction using a 5-level rating scale.

The research at this step will apply Steps 1 and 2 processes by assessing the effectiveness of and satisfaction with the students' use. The information in Step 2 can adjust the process as appropriate. There is a practical test and study according to the prescribed format to obtain a system suitable for the HyFlex blended learning management system on Seminar in Strategic Educational Management at the graduate level.

The data were then analyzed using statistical methods using the SPSS computer program. In order to find the efficiency of education and satisfaction with the system developed for graduate students and present statistical data for assessing efficiency and users' satisfaction as follows:

Data analysis of Group 1: The data were analyzed and synthesized to find ways to improve and develop the system. The correct usage was also recommended according to the prescribed format so that its users could use it effectively.
Data analysis of Group 2: Part 1: The information about the respondents' status was analyzed by frequency and percentage.
Part 2: The information about the graduate students' opinions on using the HyFlex blended learning management system in the Seminar on Strategic Educational Management. The data were analyzed using mean and standard deviation.
Part 3: This is qualitative data about the recommendations and guidelines for developing the system. The information was analyzed using content analysis.
The mean was obtained from the rating scale questionnaire data from the data analysis in Group 2 and was compared with the criteria.
4) System performance improvement: At this stage, the results of the third step were applied to improve the HyFlex blended learning management system on the Seminar in Strategic Educational Management at the graduate level. Five experts in ICT systems and educational innovations were interviewed semi-structured using the focus interview method to verify their opinions and suggestions. Then, the examination results were applied to improve the system's performance and accuracy in meeting the learning requirements according to the teacher's councils of Thailand course criteria.

Research Results

Analysis of User Requirements Results

1) According to the analysis of users' requirements to use the data to design and build up the system, the users commented on their needs in critical areas, as follows. First, a system must be used to support teaching and learning in a given course. Secondly, the system must support the teaching and learning process with complete support functions. Thirdly, the system should provide operating parts consistent with the course content. Fourthly, the system should have relevant practical learning and case studies to enhance knowledge and understanding. Fifthly, the system designed and built must be able to operate the designed classes according to the schedule.
2) The guidelines and recommendations for developing the HyFlex blended learning management system and its application to Seminars in Strategic Educational Management at the graduate level suggested that the teachers study the information related to the academic Seminar before teaching management. Then, the system development method should be chosen according to the standard model. DBLC has the proper research and development process to achieve an operational learning system combined with the case studies. This responds to the complete knowledge management model in the course.

System Design and Development Results

System design and development should use the DBLC standard method to make the system efficient. The key steps were: (1) System Analysis, (2) System Design, (3) System Implementation, (4) System Installation, (5) System Operation and Evaluation, and (6) System Maintenance and Evolution, resulting in the HyFlex blended learning management system for the course.

Usability Testing and Evaluation Results

The results of the test and the trial of the HyFlex blended learning management system on Seminar in Strategic Educational Management for graduate students with the students enrolled in the Seminar in Strategic Educational Management (EAS 6106) course in the second semester of the Academic Year 2024, with the quality assessment by experts and the satisfaction assessment by students showed the following results:

1) The results of evaluating the effectiveness of the HyFlex blended learning management system and its application in the Seminar on Strategic Educational Management at the graduate level were based on the opinions of 10 experts, as shown in Table 1.

Table 1 Results of Efficacy Assessment by Experts

Topics and Assessment Items		$\bar{x}$	S.D.
System components	1) Website	4.24	0.65
	2) Knowledge record	4.24	0.55
	3) Measuring and evaluating knowledge	3.93	0.50
	4) Discussion board	4.40	0.55
	5) Knowledge repository	4.13	0.65
	6) Active learning activities	4.31	0.55
	7) Pictures of various activities	4.04	0.65
Screen design and content	8) Content and consistency	4.41	0.55
	9) Formats and font sizes	4.10	0.65
	10) Font colors and background	4.05	0.65
	11) Visual and sound effects	4.17	0.50
	12) Multimedia system	3.74	0.45
	13) Instructions and Manuals	3.90	0.55
	14) Overall screen	4.30	0.55
	15) Design process	4.43	0.50
Usability	16) Membership system	4.28	0.45
	17) Back-end system	4.30	0.55
	18) Link and search section	4.19	0.45
	19) Interaction and assignment section	4.42	0.65
	20) Educational management applications	4.13	0.65
	21) Purposeful implementation	4.35	0.55
	22) Practice in the course	4.32	0.45
Total		**4.19**	**0.55**

Table 1 shows the system performance evaluation by experts in three areas: system components, screen design and content, and usability. It was found that the system's overall quality was at a high level in all aspects ($\bar{x}$ = 4.19, S.D. = 0.55). Considering each aspect, it was found that as for the components of the system, 7 items, the overall picture was at a high level ($\bar{x}$ = 4.16), arranged in order of averages from the highest to the lowest in 3 sequences: 1) the active learning activities, 2) the discussion board, and 3) the website, respectively, with the website at the highest level. In terms of screen and content design, 8 items were overall at a high level ($\bar{x}$ = 4.13), arranged in order of averages from the highest to the lowest in 3 sequences: 1) the design process, 2) the content and consistency, and 3) the overall screen with the highest level on the design process as a whole. As for the usability aspect of the 7 items, the overall picture was at the highest level ($\bar{x}$ = 4.28). The mean was sorted from the highest to the lowest in 3 orders, namely 1) the interaction and assignment section, 2) the method of use according to the purpose, and 3) the practice in the course, respectively, with the highest level in terms of interaction and assignment section.

2) The results of the satisfaction assessment of the use of the model of the HyFlex blended learning management system and its application in the Seminar in Strategic Educational Management at the graduate level according to the opinions of 17 students shown in Table 2, as follows:

Table 2 Results of the Satisfaction Assessment by Graduate Students

Topics and Assessment Items		$\bar{x}$	S.D.
System components	1) Website	4.32	0.60
	2) Knowledge record	4.25	0.54
	3) Measuring and evaluating knowledge	4.33	0.63
	4) Discussion board	4.34	0.53
	5) Knowledge repository	4.06	0.53
	6) Active learning activities	4.40	0.65
	7) Pictures of various activities	4.31	0.66
Screen design and content	8) Content and consistency	4.39	0.66
	9) Formats and font sizes	4.27	0.57
	10) Font colors and background	4.16	0.58
	11) Visual and sound effects	4.03	0.61
	12) Multimedia system	4.20	0.67
	13) Instructions and Manuals	4.05	0.66
	14) Overall screen	4.42	0.62
	15) Design process and collaboration	4.44	0.58
Usability and attitude	16) Membership system	4.20	0.63
	17) Back-end system	4.04	0.61
	18) Link and search section	4.30	0.71
	19) Interaction section	4.04	0.66
	20) Enhance cognitive skills	4.17	0.72
	21) Purposeful implementation	4.40	0.67
	22) Practice in the course	4.43	0.68
	Total	**4.24**	**0.66**

Table 2 shows the students' satisfaction with the use of the system in three areas: system components, screen design and content, and usability and attitude. It was found that the overall system satisfaction was at the highest level in all aspects ($\bar{x}$ = 4.24, S.D. = 0.66). Considering three aspects, it was found that for 7 items of the system, the overall picture was at a high level ($\bar{x}$ = 4.28). The averages were sorted from the least to the most significant in 3 orders: 1) the active learning activities, 2) the discussion board, and 3) the measuring and evaluating knowledge, respectively, with the highest level on the website. In terms of screen design and content, 8 items, the overall picture was at the highest level ($\bar{x}$ = 4.24), arranged in 3 descending orders of average values: 1) the design process and collaboration, 2) the overall screen, and 3) the content and consistency, respectively, with the highest level of content and consistency. As for the usage aspect, 7 items, the overall picture was also high ($\bar{x}$ = 4.22). The mean was sorted from highest to lowest in 3 orders, namely 1) the practice in the course, 2) the methods of use according to the purpose, and 3) the link section, respectively, with the course practice at the highest level.

3) The results of the interviews about the student's opinions on the model of the HyFlex blended learning management system and its application to the Seminar in Strategic Educational Management at the graduate level were revealed as follows:

3.1) In terms of knowledge and implementation, it was found that the students had a learning management system suitable for the teaching and learning styles at the graduate level. In addition, the issues related to the Seminar on Strategic Educational Management can help me apply my knowledge to become an educational administrator in the digital era, including future research design.

3.2) In terms of behavior and response, it was found that the students used the interaction section with the instructor and with their classmates; practice in the course (as group discussion,

One-on-one discussion, brainstorming, doing exercises, and presentation of assignments); used a search system and linked the sections related to the course, and recorded knowledge for exchanging and sharing knowledge. The students could develop themselves as well. They also gained experience in designing strategies for developing educational management models in the digital era and developing educational innovations and technologies.

3.3) In terms of participation, it was found that the system could motivate students to use it to create the atmosphere of exchanging and transferring knowledge in social media, participatory operations, and HyFlex learning. It also helped graduate students practice their designing and development skills and strategies for building up a modern educational digital platform.

3.4) The utilization results showed that the graduate students were satisfied with the system. Applying their knowledge and skills to develop the educational management strategies of other members helped them build up the learning skills needed to be effective education executives in the digital era.

3.5) Regarding problems and suggestions, it was found that the graduate students needed a system to customize the screen by themselves for pleasure and attractiveness. When accessing this course, as with other social networks, practice sessions should be appropriately scheduled for both learning theory and practice in the course.

System Performance Improvement Results

The research team synthesized the results of the testing and trialing of the system from the expert's quality assessment and student satisfaction assessment to improve the system's efficiency. Then, five experts in ICT systems and educational innovations were interviewed for a definitive review. Ten experts continued to provide feedback and suggestions for further improvements in system performance by developing interactive digital content and online interactions, including other techniques and methods for further improvement of academic achievement.

After designing, developing, creating, testing, using, and evaluating the prototype of the HyFlex blended learning management system and its application in the Seminar on Strategic Educational Management at the graduate level, it was found that the system developed according to the methods presented here could be assured in teams of sufficient quality for effective implementation in teaching and learning at the graduate level. An example of a prototype system is shown in Figures 2-6, respectively.

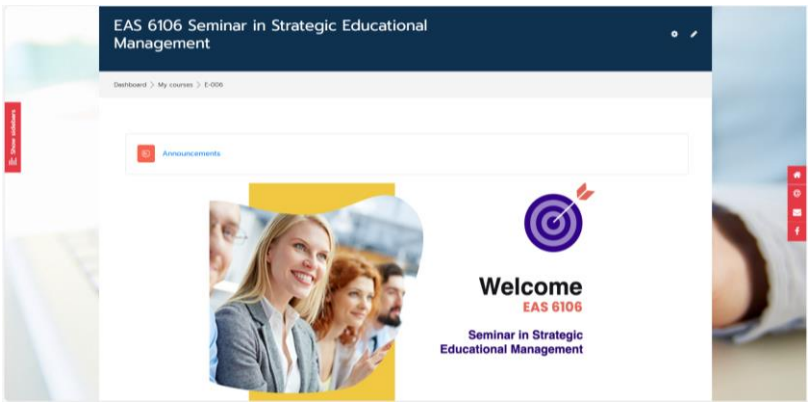

Figure 2 HyFlex blended learning management system on a seminar in strategic educational management at the graduate level.

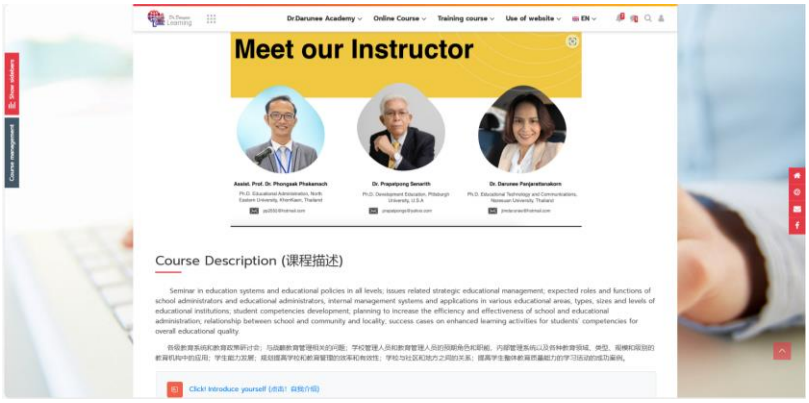

Figure 3 Examples of instructors and course descriptions.

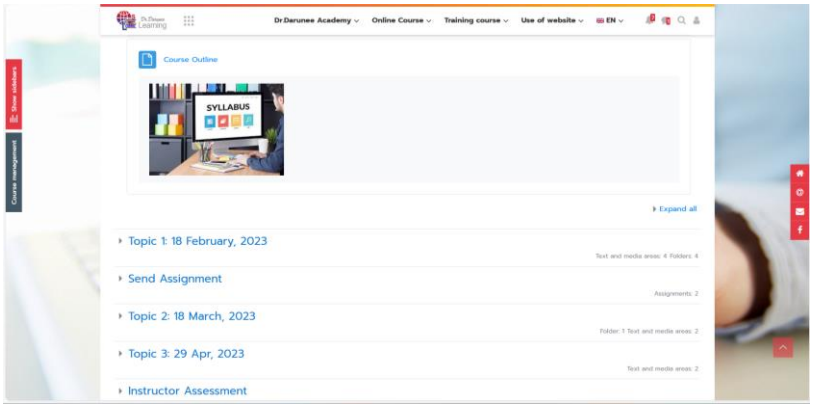

Figure 4 Examples of course Syllabus and topics.

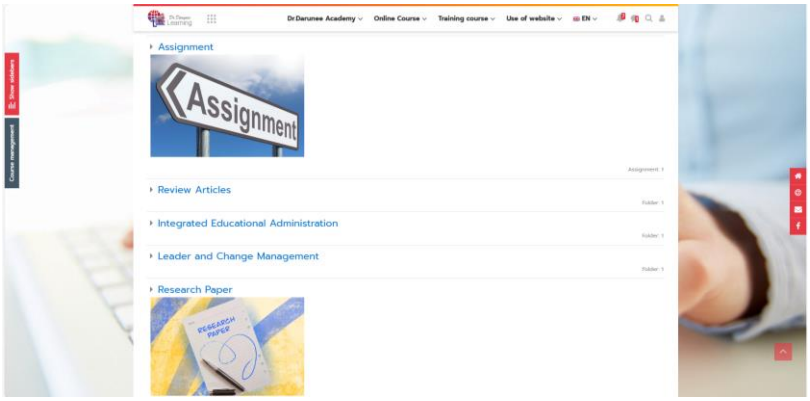

Figure 5 Examples of assignments.

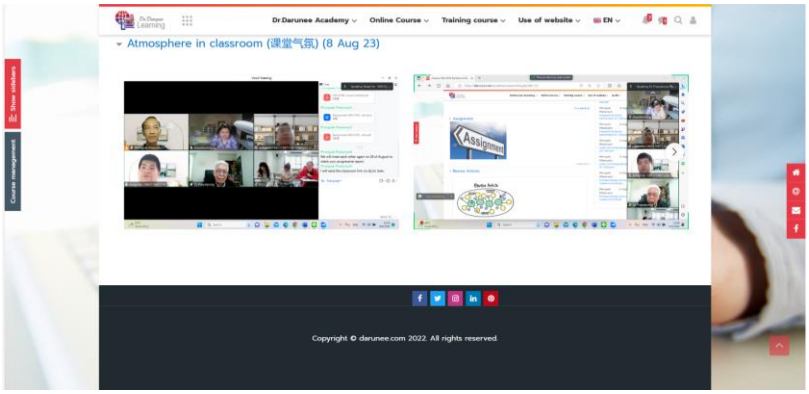

Figure 6 Examples of atmosphere in the classroom.

Conclusion and Discussion

The research and development methodology for the HyFlex blended learning management system on Seminar in Strategic Educational Management at the graduate level consisted of 4 steps: (1) analysis of users' requirements, (2) system design and development, (3) usability testing and evaluation, and (4) system performance improvement. Design and development resulted in a system with important characteristics, like being used for teaching and learning in the course. The system must support the teaching and learning process with complete support functions, provide the operating sections consistent with the course content, and have practical learning and relevant case studies to enhance knowledge and understanding. In addition, the system must be able to operate according to the specified schedule and should use a Content Management System or CMS to make the system perfect.

The standard ICT development process should be used to design and develop the HyFlex blended learning management system and its application in the Seminar on Strategic Educational Management at the graduate level. It should determine clear procedures and practices to obtain a system that can fully respond to learning management in a given course or content.

From the results of the study analyzing the efficiency and satisfaction of using the HyFlex blended learning management system and its application in the Seminar in Strategic Educational Management at the graduate level, it was concluded as follows:

1) The efficiency of using the system, in the experts' opinions, appeared to be at a high level ($\bar{x}$ = 4.19, S.D. = 0.55), indicating that the developed system could be used as a teaching tool in the course. This system could also be used as an effective learning and implementation tool in the EAS 6106 course, supporting the learning about the Seminar in Strategic Educational Management.

2) The overall satisfaction, in the students' opinions, with the use of the system was at the highest level ($\bar{x}$ = 4.24, S.D. = 0.66), indicating that the students who used this system had a high level of satisfaction because this system could respond well to the management of learning about Seminar in Strategic Educational Management.

Discussion

Developed system prototype: The researcher has applied the conceptual framework for research and development from the ideas of Adnan & Anwar (2020), Phakamach et al. (2021), Kant et al. (2021); Howell (2022) and Khumyoo et al. (2024) to design the following steps: (1) course content analysis; (2) system design by ordering content, classifying subject subjects according to learning principles, assigning learning activities, determining the relevant research resources, creating a virtual learning room, and processing knowledge; (3) development of the system based on the principles of 4Is: Information, Interactive, Individual and Immediate Feedback; (4) use of the system for teaching and learning based on the communication channels provided; and (5) testing for the efficiency of the system mainly based on the students' opinions.

The evaluation results by experts revealed that the developed system was suitable at a high level. It showed that the developed prototype system had the quality and could be used in practice because the researcher developed the lessons systematically from the study and analyzed the data using the ADDIE process, with the experts' review. After that, they were tested with the sample to evaluate the efficiency and were improved according to the reviewed results. It is a method of conducting media production according to research and development (R&D) and relying on trials and modifications to be as complete as possible. That is consistent with the research studies by Phakamach et al. (2021), Demir et al. (2021), Trivedi et al. (2022), Detyna et al. (2023), and Khumyoo et al. (2024). However, to get a good model and make graduate students understand the subject matter, some aspects of multimedia and graphic

system design should be improved in operation. This is to improve the system and provide more educational options.

3) The satisfaction assessment results by students disclosed that the developed system showed the highest satisfaction. It showed that students could learn about the Seminar in Strategic Educational Management. The system could support learning management very well. This was consistent with the research by Wang et al. (2021); Singh et al. (2021); Kohnke & Moorhouse (2021); Hamdan et al. (2021); Calonge et al. (2023); Detyna et al. (2023); Panjarattanakorn et al. (2023); Intasena (2024); Phakamach & Panjarattanakorn (2024); and Khumyoo et al. (2024) that revealed that developing a sound model system required at least four elements: data source and content; support resources; discussion boards; online learning activities. Besides, case studies help students understand, which could be used to create a virtual learning model. (Parramore, 2019). Therefore, the prototype system had all the elements that could be used to support learning management in this course.

4) The results of the system approval by the experts from group interviews showed that the Hyflex learning management system could support teaching and learning at the graduate level. It could enable graduate students to gain theoretical knowledge and practice learning experiences in the study. Therefore, it could confirm that the system's efficiency was developed from the international elements and procedures for developing a quality learning management system (Liu & Rodriguez, 2019; Chapman & Bell, 2020; Kant et al., 2021; Tam, 2022; Howell, 2022; Raes, 2022; Detyna et al., 2023; Intasena, 2024; Khumyoo et al., 2024; Phakamach & Panjarattanakorn, 2024).

In conclusion, the HyFlex blended learning system represents a dynamic and student-centric approach to learning design, bridging the gap between in-person and online education. It promotes inclusivity, engagement, adaptability, and the seamless integration of relevant technology while also challenging educators and institutions to strategically rethink the design of learning spaces and teaching methods. While it presents challenges in terms of initial setup and resource allocation, the potential benefits for students and the advancement of pedagogy make hybrid flexible a compelling model for contemporary education.

Overall, this study also strengthens the idea that a) HyFlex classroom design is a complex, lengthy, concise, costly, cross-departmental/collaborative (multi-stakeholder), assumptions-challenging and iterative process, as described in Figure 2-6, and b) strategically incorporating learning and teaching strategies and tested pedagogical practices into the design of on-campus/virtual learning spaces is critical to ensure stakeholder engagement.

According to the design and development methodology, sufficient quality can be assured for implementing this model for teaching and learning at the graduate level. Therefore, it can be concluded that research and development could produce desirable performance for graduate students.

Suggestions for Applying Research Results

Implementing and developing this HyFlex blended learning management system to be more effective resulted from the following causes.

1) A learning support system requires a qualified and efficient development team, such as lecturers, educators, educational psychologists, programmers, and educational innovation and technology designers.

2) For the learning management process to be fast and cost-effective, literacy training using browser programs or applications should be provided before learning to help students understand the correct method and solve problems that arise during self-study.

3) The course should include Appropriate details, such as the website, related case studies, and the interaction section, to provide in-depth practical training for students and promote broader learning.

4) Online learning systems should be developed appropriately, using consistent fonts, graphics, sounds, and multimedia to facilitate situational learning and processing effectively and efficiently.

Suggestions for Further Research

1) This HyFlex blended learning management system should be developed using more elements as standard learning materials. It will provide insights to improve learning styles and make them more effective.

2) There should be research and development of digital platforms based on HyFlex blended learning models that can make online students feel more positive and more imaginative by developing that attract online students' attention.

3) More research and development of HyFlex blended learning management systems or models in other subjects should increase modern learning resources to further develop higher education in Thailand.

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