The Development of HyFlex Learning Management System in Seminar on Strategic Educational Management for Graduate Students

*Phongsak Phakamach (iD)
Rattanakosin International College of Creative Entrepreneurship,
Rajamangala University of Technology Rattanakosin, Thailand, *phongsak.pha@rmutr.ac.th*

Darunee Panjarattanakorn (iD)
Rattanakosin International College of Creative Entrepreneurship,
Rajamangala University of Technology Rattanakosin, Thailand, *darunee.pan@rmutr.ac.th*

Prapatpong Senarith
Rattanakosin International College of Creative Entrepreneurship,
Rajamangala University of Technology Rattanakosin, Thailand, *prapatpong.sen@rmutr.ac.th*

Sakda Supap
Rattanakosin International College of Creative Entrepreneurship,
Rajamangala University of Technology Rattanakosin, Thailand, *sakda.sup@rmutr.ac.th*

Ritthidech Phomdee
Educational Innovation Institute,
Promote Alternative Education Association, Thailand, *ritthi-dech@hotmail.com*

Natchaya Sommartdejsakul
Educational Innovation Institute,
Promote Alternative Education Association, Thailand, *natchayasommart@gmail.com*

*Corresponding author E-mail: phongsak**.**pha**@**rmutr**.**ac**.**th

Abstract: *The objectives of this research were to 1) design, create, test, use and evaluate the prototype of the HyFlex learning management system in the seminar on Strategic Educational Management for graduate students; and 2) recommend the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students. This study is designed as research and development. The sample group consisted of 17 graduate students in the Master of Education Program in Educational Administration and Strategies at Rajamangala University of Technology Rattanakosin, who were studying in Semester 2 Academic Year 2023. The target group comprised ten experts in ICT systems and educational innovations particularly selected regarding certain qualifications. The research method consisted of four steps: 1) analysis of users' requirement; 2) system design and development; 3) usability testing and evaluation; and 4) system performance improvement. The analysis of quantitative data was done by using statistical packages to show mean and standard deviation. The qualitative data analysis was done with the content analysis. The research results were listed, as follows. First, the prototype of the HyFlex Learning Management System in the seminar on Strategic Educational Management for graduate students used a database life cycle or DBLC development process. The experiment with the operational system for the graduate study involved the learning alongside technology with a simple implementation. Students had the highest level of satisfaction with the system prototype that developed gradually. Secondly, the structure of this system consisted of the website, the lecturer and student database, the knowledge records, the knowledge assessment, the discussion board, the downloaded documents, the related case studies, and the pictures and videos of various activities. In addition, the prototype system equipped the graduate students with practical skills to learn about how the strategic education management, could improve the quality of education management. This included the development of skills to use educational technology in a more effective way.*

Keywords: HyFlex Learning, Learning Management System, Strategic Educational Management, Graduate Students

1. Introduction

Information and Communication Technology (ICT) is a critical and valuable system for the nation's development to progress. It is also very relevant to people's way of life in the modern society. All societies have changed and adapted to the electronic society (e-Society) completely. 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 organizations' operations is more efficient. Solving problems is possible on time. The organizations are able to compete for advantages and efficiently develop services to customers (Laudon & Laudon, 2018). Therefore, it is essential to study how to apply the appropriated ICT system with each organization. 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 and has continuous development and sustainable growth (Sinlarat, 2020; Phakamach, 2023). One of the roles Thai universities should play is to understand the changes and learn new ways to keep up with modern Thai and international technology in education management (Demir et al., 2021) with the introduction of modern management and management techniques. They should be applied to educational administration in institutions for maximum academic efficiency and effectiveness (Phangphol & Phakamach, 2021; Garbin, Ten Caten, & Jesus Pacheco, 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 is in line 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 B.E. ??? and more educational platforms due to the global connection of information, 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 (Lyapina et al., 2019; Phakamach, Senarith, & Wachirawongpaisarn, 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 with ???. 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 in the era of transformational change (Education Disruption) is formed by a variety of 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 of Coronavirus (Ismaili, 2021). Teaching and learning management must align with the new learning paradigm, to enable students to seek knowledge on their own. Especially the ability to fully use innovation and educational technology in pursuing knowledge (Wang et al., 2021). The principles under the Higher Education Act B.E. 2562 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 develop their own lives. Therefore, the development of thinking ability is an integral part of students' development, to live happily in a changing society (Gioiosa & Kinkela, 2022). Hybrid Flexible Learning (HyFlex) is a learning management model and method that combines face-to-face learning and online or digital learning. By leveraging the benefits of face-to-face learning and online learning, the more flexible and dynamic learning experiences have been shared. In addition, creating defined learning situations or activities through quick perception and action to achieve the actual development of skills or competencies (Chen, 2022; Hapke, Lee-Post, & Dean, 2021; Detyna et al., 2022; Raksakul, Yamrung, & Suthasinobon, 2023; Khumyoo et al., 2024).

HyFlex learning refers to a flexible approach to education that is carried out in both normal classrooms (Face-to-Face), online learning settings, and asynchronous settings using a Learning Management System or LMS. 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; Howell, 2022). In the HyFlex learning model, students have the option to choose their own positive educational environment and learning resources. This allows for increased 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, Lee-Post, & Dean, 2021; Wong, Li, Chan, & Cheung, 2023; Khumyoo et al., 2024). However, in order to maximize the effectiveness of the learning management strategy for the students, the role of teachers is therefore 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. Implementing HyFlex 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 anytime (Detyna et al., 2022; Phakamach, Senarith, & Wachirawongpaisarn, 2022; Raksakul, Yamrung, & Suthasinobon, 2023; Intasena, 2024).

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 for the preparation of research projects for the development of educational management processes and the enhancement of the students' educational quality (Phakamach, Wachirawongpaisarn, & Panjarattanakorn, 2021). Most of the learning takes place in a regular classroom, creating severe obstacles to student learning if there is no good source of support for the use of 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 is a self-paced learning model that supports knowledge management in a given course, helping to solve problems and obstacles that arise in students' learning. In particular, graduate teaching and learning focuses on posing a learning challenges to construct new knowledge with quality.

Based on this idea, the researcher is interested in developing the HyFlex learning management system on Seminar in Strategic Educational Management for graduate students. This system will change the learning process using the learning management system platform to the one supporting 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 teachers 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 learning management system using software and services. as well as assessing the efficiency and satisfaction of the students. Performance improvements are based on expert feedback. The model system is suitable for serving graduate students. It helps respond to students' needs and contribute to learning about the effective management of Entrepreneurship and Ventures in Education.

2. Research Objectives
2.1 To design, create, test, use and evaluate a prototype of the HyFlex learning management system on Seminar in Strategic Educational Management for graduate students.
2.2 To recommend the HyFlex learning management system on Seminar in Strategic Educational Management for graduate students.

3. Research Conceptual Framework
Research concepts was formed with the relevant literature review and research design, as follows. The HyFlex learning management system on Seminar in Strategic Educational Management for graduate students follows the flowchart in Figure 1.
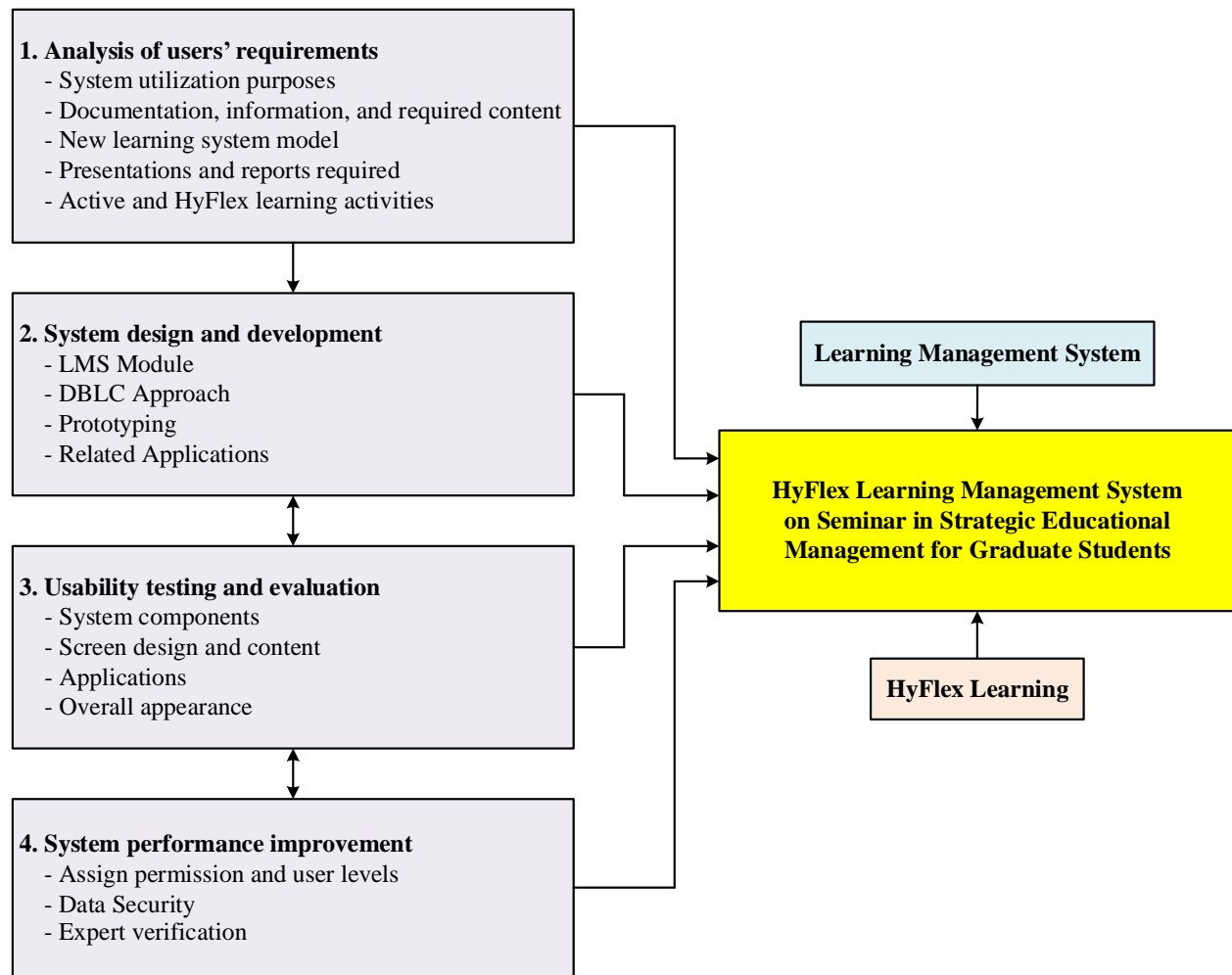
Figure 1. Research conceptual framework

4. Research Methodology

This research is a research and development study with related details as follows:

Procedures for Conducting Research

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

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 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, by using the learning management system and programs related to the development of online teaching materials. A case study related to the course was designed for study, including a preliminary test.

3. Usability testing and evaluation, system quality and suitability were checked by 10 ICT and educational innovation experts. It was a 3-month trial phase, and the satisfaction with the system was evaluated by students enrolled in the EAS 6106 course.

4. System performance improvement, by taking the test and evaluation results obtained from Step 3 for confirmation and improving the performance of the HyFlex learning management system on Seminar in Strategic Educational Management for graduate students.

The process of creating tools used in teaching and learning management includes: 1) studying the curriculum/course and analyzing the content of the Seminar in Strategic Educational Management (EAS 6106) course at the graduate level; 2) defining the learning objectives to determine the scope of content in each unit including challenging 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 learning 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 learning management system to define internal communication channels for convenience (Hapke, Lee-Post, & Dean, 2021); 5) designing the storyboard according to a hierarchical structure based on proactive knowledge management techniques (Phakamach, Wachirawongpaisarn, & Panjarattanakorn, 2021); 6) developing the platform layout using LMS Tool Box and related computer programs; 7) trialling and revising the system; and 8) evaluating the quality and satisfaction of the system.

Population and Target Group
The population in this research was the 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 into the Seminar in Strategic Educational Management (EAS 6106) in the second semester of the academic year 2023. Since there were only just a small number of 17 students in this class, and the study required the data based on all students' opinions of all students, the researchers decided to select the entire population as the sample group.

The study population at Step 3 were 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 group consisted of 17 students in Seminar in Strategic Educational Management (EAS 6106) course at 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 were divided according to the study population as follows: Group 1 with workshops and interviews, Group 2 with workshop facilitation and participant observation.

Research Instruments
The research instruments consisted of (1) a HyFlex learning management system on Seminar in Strategic Educational Management for graduate students and (2) the research tools for data collection:
1. Quality assessment form (for experts) in ICT systems and educational innovations with 5-level rating scale that assessed the design and development of the system in terms of system components, screen design and content, and usability.
2. Students' satisfaction assessment form with 5-level rating scale that assessed the suitability of the system in terms of system components, screen design and 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 the checklist questions, the text form and a 5-level rating scale, with the questionnaire with three parts and the details, as follows:
Part 1: Information about the respondents.
Part 2: Opinions on using a HyFlex learning management system. It was an analysis to determine the efficiency and satisfaction of the system users. The criteria for using the score measurement were:
> Strongly Agree; the weight was scored as 5.
> Agree; the weight was scored as 4.
> Neutral; the weight was scored as 3.
> Disagree; the weight was scored as 2.
> Strongly Disagree; the weight was scored as 1.
Part 3: Suggestions and guidelines for developing a HyFlex learning management system.
The questionnaire was developed and submitted to 10 experts to verify the content validity and review in terms of appropriateness of language and wording. Then the questionnaire was checked in terms of reliability, using Cronbach's Alpha Coefficient formula. The reliability was evaluated at the rate of .922.

Experiment and Data Collection

The experimental model and the data collection were set as follows.

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 2023.

2. preparing the developed prototype and uploading it as part of the course data on Dr. Darunee 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.

Experiment

The system prototype that had been evaluated by an expert was tested for performance evaluation according to the following format.

One to One Testing: An experiment was conducted with three graduate students taking this course as the 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 it to improve and revise … (???) with the value $E_1/E_2 = 61.45/62.56$

Small Group: The experiment was conducted with nine graduate students who have taken this course before being selected as 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 it to improve $E_1/E_2 = 71.84/72.91$

Field testing, including:

1. Conducting a one-month workshop experiment, applying the system with the 17 graduate students as the sample group, and organizing pretesting knowledge meetings which consist of: (1) the pre-test of achievement with 40 items given to the graduate students; (2) the students' use of the HyFlex learning management system in the Seminar on Strategic Educational Management; (3) the exercises about the system with 10 items per learning unit given to the students; and (4) the post-test of achievement with 40 items given to the graduate students, to evaluate the overall efficiency of E_1/E_2 with a value of $E_1/E_2 = 81.95/83.86$

2. Interviewing the sample group of graduate students who regularly used the system, about their use.

(3) Analyzing the interview results summarized in an essay manner, to improve the system to be suitable and complete.

Data Analysis

The data obtained in the research process were analyzed in the following order:

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 new system, (4) the presentation and the required report (5) the activities of HyFlex 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: assessment of the efficiency of the prototype system by 10 ICT system development and educational innovation experts and evaluation of satisfaction by 17 graduate students, using the form with the 5-level rating scale.

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

The data were then analyzed by some statistical methods using a ready-made computer program. In order to find the efficiency of education and satisfaction with the use of the system developed for graduate students and present a 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 would be able to use it effectively.

Data analysis of Group 2:

Part 1: The information about the status of the respondents were analyzed by frequency and percentage.

Part 2: The information about the graduate students' opinions on their use of the HyFlex learning management system in the Seminar on Strategic Educational Management. The data were analyzed using mean and standard deviation.

Part 3: The information about the recommendations and guidelines for developing the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students, as qualitative data. The content analysis was used to analyze the information.

The mean was obtained from the rating scale questionnaire data from the data analysis in Group 2 and was compared with the criteria. The criteria for interpreting the mean were summarized, as follows:

> 4.21 – 5.00 means efficiency and satisfaction were at the highest level.
> 3.41 – 4.20 means efficiency and satisfaction were at a high level.
> 2.61 – 3.40 means efficiency and satisfaction were moderate.
> 1.81 – 2.60 means that efficiency and satisfaction were at a low level.
> 1.00 – 1.80 means that efficiency and satisfaction were at the lowest level.

4) System performance improvement:

At this stage, the results of the 3rd step were applied, to improve the practical learning management system combined with the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students. Semi-structured interviews with the focus interview method were conducted with five experts in ICT systems and educational innovations, to verify their opinions and suggestions. Then the examination results were applied, to improve the system's performance and accuracy to the learning requirements according to the Teacher's Council of Thailand's compulsory course criteria. An example of the prototype system is shown in Figures 2-6, respectively.
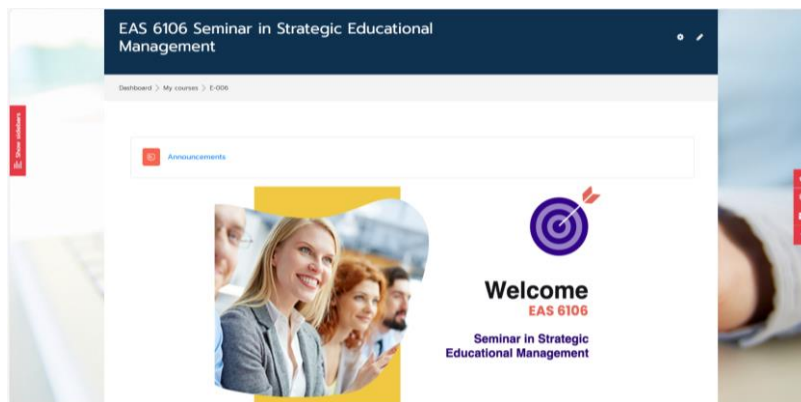

Figure 2. HyFlex Learning Management System on Seminar in Strategic Educational Management for Graduate Students
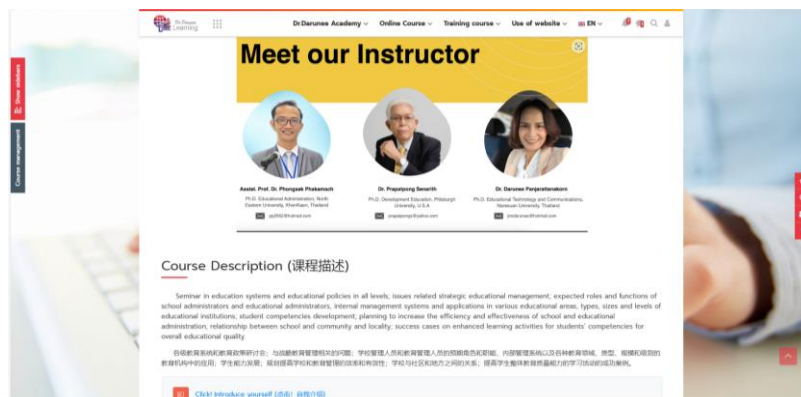

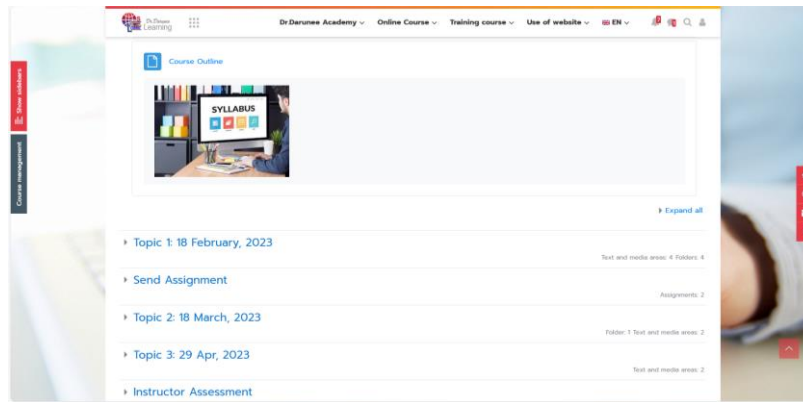*Figure 3.* Examples of Instructors and Course Description
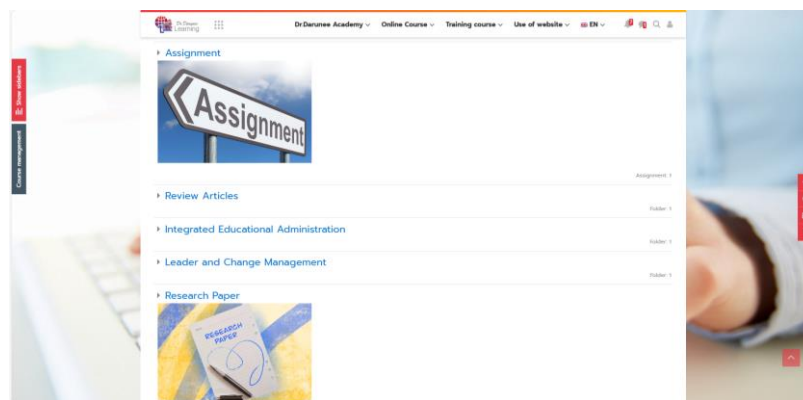
Figure 4. Examples of Course Syllabus and Topics

Figure 5. Examples of Assignments
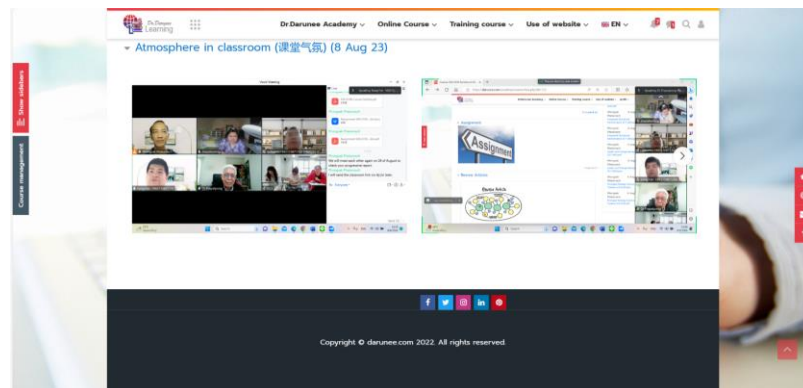
Figure 6. Examples of atmosphere in classroom

5. Research Results

The results of the research on Developing the HyFlex learning management system in the Seminar on Strategic Educational Management for Graduate Students. The results of the research were as follows:

Research results according to Objective 1: To design, create, test, use and evaluate a prototype of a HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students. The following research findings were:

Analysis of the results of the users' requirements

1) According to the analysis of users' requirements in order to use the data to design and build up the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students, the users made the following comments on their needs in critical areas, as follows. First, it must be the system that can be used to support teaching and learning in a given course. Secondly, the system must support the process of teaching and learning with complete support functions. Thirdly, the system should provide the operating parts that are 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 learning management system on Seminar in Strategic Educational Management for graduate students suggested that the teachers should study the information related to the academic Seminar on Strategic Educational Management 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-study learning in the Seminar on Strategic Educational Management. 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 learning management system for the course.

Usability testing and evaluation results

The results of the test and the trial of the HyFlex 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 2023, with the quality assessment by the experts and the satisfaction assessment by the students were:

1) The results of evaluating the effectiveness of the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students were based on the opinions of 10 experts, as shown in Table 1.

Table1. Results of Efficacy Assessment by Experts

Topics and Assessment Items		$\bar{x}$	S.D.
System components	1. Website	4.22	0.55
	2. Knowledge record	4.20	0.65
	3. Measuring and evaluating knowledge	3.91	0.50
	4. Discussion board	4.28	0.55
	5. Knowledge repository	4.11	0.55
	6. Active learning activities	4.29	0.65
	7. Pictures of various activities	4.02	0.65
Screen design and content	8. Content and consistency	4.39	0.45
	9. Formats and font sizes	4.08	0.65
	10. Font colors and background	4.03	0.65
	11. Visual and sound effects	4.15	0.50
	12. Multimedia system	3.72	0.55
	13. Instructions and Manuals	3.88	0.55
	14. Overall screen	4.28	0.50
	15. Design process	4.41	0.55
Usability	16. Membership system	4.26	0.55
	17. Back-end system	4.28	0.45
	18. Link and search section	4.17	0.45
	19. Interaction and assignment section	4.40	0.65
	20. Educational management applications	4.11	0.45
	21. Purposeful implementation	4.33	0.55
	22. Practice in the course	4.30	0.65
Total		**4.17**	**0.55**

Table 1 showed 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 ($\bar{x}=4.17$, 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 ($\bar{x}=4.14$), 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) website, respectively, with the website at the highest level. In terms of screen and content design, 8 items were overall at a high level ($\bar{x}=4.11$), 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 ($\bar{x}=4.26$). 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 learning management system in the Seminar on Strategic Educational Management for graduate students, according to the 17 students' opinions shown in Table 2, as follows.

Table2. Results of the Satisfaction Assessment by Graduate Students

Topics and Assessment Items		$\bar{x}$	S.D.
System components	1. Website	4.30	0.61
	2. Knowledge record	4.23	0.55
	3. Measuring and evaluating knowledge	4.31	0.64
	4. Discussion board	4.32	0.54
	5. Knowledge repository	4.04	0.54
	6. Active learning activities	4.38	0.66
	7. Pictures of various activities	4.29	0.67
Screen design and content	8. Content and consistency	4.37	0.67
	9. Formats and font sizes	4.25	0.58
	10. Font colors and background	4.14	0.59
	11. Visual and sound effects	4.01	0.62
	12. Multimedia system	4.18	0.68
	13. Instructions and Manuals	4.03	0.67
	14. Overall screen	4.40	0.63
	15. Design process and collaboration	4.42	0.59
Usability and attitude	16. Membership system	4.18	0.64
	17. Back-end system	4.02	0.62
	18. Link and search section	4.28	0.72
	19. Interaction section	4.02	0.67
	20. Enhance cognitive skills	4.15	0.73
	21. Purposeful implementation	4.38	0.68
	22. Practice in the course	4.41	0.69
Total		**4.22**	**0.67**

Table 2 showed 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 ($\bar{x}=4.22$, S.D.=0.67). Considering three aspects, it was found that for 7 items of the system, the overall picture was at the high level ($\bar{x}=4.26$). 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 in 8 items, the overall picture was at the highest level ($\bar{x}=4.22$), 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 in 7 items, the overall picture was also high ($\bar{x}=4.20$). The mean was sorted from the highest to the 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 students' opinions on the model of the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students were revealed, as follows:

3.1 In terms of knowledge and implementation, it was found that the students had the 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 be used 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, as well as 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 platform.

3.4 The utilization results showed that the graduate students were satisfied with the system by applying the knowledge and skills in developing educational management strategies of other members. It also helped building up the learning skills to be an effective education executive in the digital era.

3.5 In terms of 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 experts 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 include other techniques and methods for further improvement of academic achievement.

Research results according to Objective 2: To design, develop, create, test, use and evaluate the prototype of the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students. I It was found that the system developed according to the methods presented here could be assured in terms of sufficient quality for effective implementation of this system in teaching and learning at the graduate level.

6. Conclusion and Discussion
Conclusion
1) The research and development methodology for the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students 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 the system with important characteristics, like being able to be used for teaching and learning in the course. The system must support the teaching and learning process with complete support functions, must provide the operating sections consistent with the course content and must have practical learning and relevant case studies to enhance knowledge and understanding. In addition, the system could be operated according to the specified schedule and should be used with a Content Management System or CMS to make the system perfect.

2) In terms of the design and development of the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students, the standard ICT development process should be used to develop the HyFlex learning system. It should determine clear procedures and practices to obtain a system that could fully respond to the learning management in a given course or content.

3) From the results of the study analyzing the efficiency of and the satisfaction with the use of the HyFlex learning management system in the Seminar on Strategic Educational Management for graduate students, it was concluded, as follows.

3.1 The efficiency of using the system, in the experts' opinions, appeared to be in a high level ($\bar{x}$=4.17, S.D.=0.55), indicating that the developed system could be used as a tool for teaching in the course. This system could be used as an effective learning and implementation tool in the EAS 6106 course. It could support the learning about Seminar in Strategic Educational Management as well.

3.2 The overall satisfaction, in the students' opinions, with the use of the system was at the highest level ($\bar{x}$=4.22, S.D.=0.67), 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 the Seminar on Strategic Educational Management.

Discussion

As for the discussion of this research, there were related parts that should be discussed in the following key points.

1) Developed system prototype: the researcher has applied the conceptual framework for research and development from the ideas of Adnan and Anwar (2020), Phakamach, Wachirawongpaisarn, and Panjarattanakorn (2021), Kant, Prasad, and Anjali (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.

2) The evaluation results by experts revealed that the developed system was suitable in the 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, the system was tested with the sample to evaluate the efficiency and was improved according to the reviewed results. It is a method of conducting media production according to the research and development (R&D) and of relying on trials and modifications to be as complete as possible. That is consistent with the research work of Phakamach, Wachirawongpaisarn, and Panjarattanakorn (2021), Demir, Maroof, Sabbah Khan, and Ali (2021), Trivedi, Patra, and Singh (2022), Detyna et al. (2022), and Khumyoo et al. (2024). However, to get a good model and make graduate students understand the subject matters, some aspects of multimedia and graphic system design should be improved in terms of 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 satisfaction in the highest level. It showed that students could learn about the Seminar on Strategic Educational Management. The system could support the learning management very well. This was consistent with the research by Wang et al. (2021), Singh, Sharma, and Paliwal (2021), Hamdan et al. (2022), Detyna et al. (2022), Panjarattanakorn et al. (2023), Intasena, (2024), and Khumyoo and others (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 as a system 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 be a support system for 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, Prasad, & Anjali, 2021; Tam, 2022; Howell, 2022).

According to the design and development methodology, it can be assured of sufficient quality for implementing this HyFlex learning management system in the Seminar on Strategic Educational Management for teaching and learning at the graduate level. Therefore, it can be concluded that research and development of this HyFlex learning management system in the Seminar on Strategic Educational Management could produce a desirable performance for graduate students.

7. Suggestions

The researchers put forward two kinds of feedback as follows:

7.1 Suggestions fora pplying ther esearchresults

Implementation and development of this HyFlex 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, there should be literacy training using browser programs or applications before learning to make understanding of the correct method and to solve the problems that arise during the self-study.

3. Appropriate details should be added to the course, such as the website, related case studies, and the interaction section. To provide the in-depth practical training for students and to promote broader learning.
4. The development of online learning systems should be used appropriately with the consistent fonts, graphics, sounds and multimedia, to make situational learning and processing possible effectively and efficiently.

7.2 Suggestions for further research
1. This HyFlex learning management system should be developed to use more elements as standard learning materials. It will provide insights to improve learning styles to be more effective.
2. There should be research and development of digital platforms based on HyFlex learning models that can make online students feel more positive and more imaginative by developing the multimedia that attract online students' attention.
3. There should be more research and development of HyFlex learning management systems or models in other subjects to increase modern learning resources for the further development of higher education in Thailand.

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Authors' information

Phongsak Phakamach is an assistant professor and lecturer in the Graduate Department of Educational Administration and Strategies, Rattanakosin International College of Creative Entrepreneurship (RICE), Rajamangala University of Technology Rattanakosin Rattanakosin (RMUTR), Nakhon Pathom, Thailand. His current research interests include educational provision, leadership and educational change, digital transformation in education, educational innovative organization, educational technology and innovation development, and the use of educational technology and innovation.

Darunee Panjaratanakorn is a lecturer in the Graduate Department of Educational Studies, Rattanakosin International College of Creative Entrepreneurship (RICE), Rajamangala University of Technology Rattanakosin Rattanakosin (RMUTR), Nakhon Pathom, Thailand. Her current research interests include educational communications and technology, leadership and educational change, digital transformation in education, educational technology and innovation development, and the use of educational technology and innovation.

Prapatpong Senarith is a lecturer in the Graduate Department of Educational Administration and Strategies, Rattanakosin International College of Creative Entrepreneurship (RICE), Rajamangala University of Technology Rattanakosin Rattanakosin (RMUTR), Nakhon Pathom, Thailand. His current research interests include educational administration and strategies, educational leadership development, digital transformation in education, and current leadership issues in education institutions.

Sakda Supap is a lecturer in the Graduate Department of Educational Administration and Strategies, Rattanakosin International College of Creative Entrepreneurship (RICE), Rajamangala University of Technology Rattanakosin Rattanakosin (RMUTR), Nakhon Pathom, Thailand. His current research interests include educational administration and strategies, learning organization development, educational technology and innovation development, and the use of educational technology and innovation.

Ritthidech Phomdee is a full-time academic staff member in the Educational Innovation Institute (EII), Promote Alternative Education Association, Thailand. His current research interests include digital transformation in education, educational technology and innovation development, and the use of educational technology and innovation.

Natchaya Sommartdejsakul is a specialist in the Educational Innovation Institute (EII), Promote Alternative Education Association, Thailand. Her current research interests include educational administration and strategies, digital transformation in education, educational leadership development, and issues in science education.

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