DEVELOPMENT OF FLIPPED CLASSROOM INSTRUCTIONAL MODEL TO ENHANCE UNDERGRADUATE STUDENTS' PROBLEM-SOLVING SKILLS

CAO YUEWANG

A thesis submitted in partial fulfillment of the requirements for
the Degree of Doctor of Philosophy Program in Curriculum and Instruction
Academic Year 2023

Thesis Title Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem-Solving Skills

Author Mr.Cao Yuewang

Thesis Committee

..... Chairperson
(Associate Professor Dr. Areewan Iamsa-ard)

..... Committee
(Assistant Professor Dr.Saifon Songsiengchai)

..... Committee
(Assistant Professor Dr.Wapee Kong-In)

Accepted by Bansomdejchaopraya Rajabhat Univeristy in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Curriculum and Instruction

..... Dean of Graduate School
(Assistant Professor Dr. Kanakorn Sawangcharoen)

..... President
(Assistant Professor Dr. Linda Gainma)

Defense Committee

..... Chairperson
(Associate Professor Dr. Atipat Boonmoh)

..... Committee
(Associate Professor Dr. Pattawan Narjaikaew)

..... Committee
(Assistant Professor Dr. Pongpatchara Kawinkoonlasate)

Title	**Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem- Solving Skills**
Author	**Cao Yuewang**
Program	**Curriculum and Instruction**
Major Advisor	**Associate Professor Dr. Areewan Iamsa-ard**
Co-advisor	**Assistant Professor Dr. Wapee Kong-in**
Co-advisor	**Assistant Professor Dr. Saipon Songsiengchai**
Academic Year	**2023**

ABSTRACT

The objectives of this research were 1) study the factors to enhance undergraduate students' problem-solving skills 2) develop flipped classroom instructional model to enhance undergraduate students' problem-solving skills and 3) examine the results implementing flipped classroom instructional model to enhance undergraduate students' problem-solving skills. Phases were carried out to answer research objectives 1, 2, 3. The population of Phase 1 are 150 former students and 3 lecturers of the Computer Application Basics Course in the first semester of the 2022 academic year from Qingdao Huanghai University. The target group of phase 2 are 5 experts, and the sample group of phase 3 are 30 students enrolled in the Computer Application Basics Course. The research instruments were 1) a set of questionnaires for student and interviews for lecturers. 2) set of questionnaires for conformity instructional model, 3) lesson plans using blend-based learning model, and 4) scoring rubric. Data analyzed by percentage, mean and standard deviation.

The results found that:

1. The factors enhancing learning achievement in the Computer Application Basics course, as identified by analysis, are categorized into internal and external factors. Internal factors are characterized by students' engagement and perspective on the instructional model, especially the flipped classroom model. Students exhibit a strong interest, respect, and trust in this model, convinced of its efficacy in honing their problem-solving skills. External factors, marked by moderate influence,

comprise teaching methods aligning the flipped classroom model with course objectives and content, course materials blending traditional and online resources, and the indispensability of well-maintained classrooms and multimedia facilities.

2. Flipped Classroom Instructional model to enhance students' problem-solving skills include 5 components: 1) Principle and Rationale, 2) Objectives, 3) Contents, 4) Method of teaching & Materials and 5) Evaluation. The model is 100% conformed to utility, feasibility, propriety, and accuracy as assessed by 5 specialists.

3. It was found that 83.33%% of 30 students who enroll in the computer applications course course students whose problem-solving ability is at good level while another 16.67% of them are assessed to be at Medium and Pass level. The result is consistent with the research hypothesis that 80% upwards of the participants will have problem-solving performance ability at Good level after learning through flipped classroom instructional model.

Keywords: Flipped Classroom Instructional Model, Problem-Solving Skills

Acknowledgement

I am profoundly grateful for the invaluable assistance, wisdom, and support I received from numerous individuals throughout my doctoral research journey. My heartfelt appreciation goes out to all of them. However, I must spotlight two outstanding mentors whose contributions have been remarkably impactful in shaping my academic path.

My first acknowledgment is extended to Associate Professor Dr. Areewan, a symbol of academic excellence and steadfast dedication. Her insightful guidance, constructive critiques, and unwavering encouragement have been instrumental in the crafting of this thesis. Dr. Areewan's commitment to rigorous research and higher learning has set a benchmark that continues to inspire my academic aspirations.

In addition, I express profound gratitude to Assistant Professor Dr. Saifon and Dr. Wapee Kong-In for their intellectual prowess, creativity, and enthusiasm that have left an indelible mark on my academic development. Their imparted wisdom and relentless pursuit of knowledge fostered my growth and resilience. The collaboration with Thai and Chinese experts, students, and lecturers from Qingdao Huanghai University enriched my journey. Though challenging, the mentorship received has not only made the journey manageable but incredibly rewarding, leaving a lasting impression that will echo in my future endeavors.

Cao Yuewang

Contents

Contents (Continued)

List of Figures

List of Tables

List of Tables (Continued)

Chapter 1
Introduction

Rationale

The Computer Application Basics course is a compulsory public course for all students at Qingdao Huanghai University. It serves as a pivotal component in the academic structure of the institution, dedicated to enhancing the quality and efficacy of higher education. The Computer Application Basics course is not merely an academic requirement but a strategic initiative aimed at preparing students for the technological challenges of the contemporary world. In a modern educational environment where technological developments are rapidly changing, this course is designed to improve students' problem-solving abilities based on the development of basic skills and knowledge of computer applications. (Qingdao Huanghai University, 2022)

In the context of a dynamically changing international landscape, characterized by heightened competition, technological advancements, and globalization, the need for adept problem-solving skills has become paramount for individuals to navigate complexities and uncertainties. This global trend underscores the urgency for nations, including China, to fortify their educational frameworks to produce talents capable of addressing multifaceted challenges. In today's rapidly evolving global context, Chinese students need to develop problem-solving skills as the country shifts towards technology-intensive industries (National Bureau of Statistics of China, 2023). The Chinese government, responding to these international and domestic imperatives, has initiated educational reforms such as the National Medium- and Long-term Education Reform and Development Plan (2010-2020). These reforms are designed to cultivate innovative and practical talents equipped to contribute to future socioeconomic development amidst the escalating global complexities.

Problem-solving skills are crucial for students in the Computer Application Basics course. These skills facilitate efficient identification, analysis, and resolution of technological challenges, essential in the realms of coding, debugging, and innovative

solution design (Savage, 2014). However, students often grapple with obstacles such as inadequate prior knowledge and limited exposure to practical applications, rendering the enhancement of these skills a focal concern for educators (Barron, 2010). To bridge this gap, varied teaching strategies including mini-video assignments have been introduced. These assignments encourage students to apply technical knowledge practically, fostering an environment that stimulates creative and critical thinking.

The flipped classroom is characterized by its innovative restructuring of traditional educational approaches, where students access learning materials, such as video lectures or readings, ahead of class sessions. This approach transforms classrooms into hubs for interactive activities and discussions, promoting active participation and collaboration, all aimed at deepening the comprehension of learned concepts. In the sphere of enhancing problem-solving skills, the flipped classroom model has proved instrumental, offering students an environment to delve into complex problems practically and conceptively (Liljedahl, 2016; Talbert, 2017). Studies underscore its effectiveness in not only fostering a collaborative and supportive learning atmosphere but also accentuating student-centeredness, diverse learning resources, and interactive learning experiences, thereby significantly augmenting students' problem-solving acumen (Grigg & Stephan, 2018).

So, the researcher interests to study "Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem-Solving Skills".

Research Questions

1. What are the factors to enhance undergraduate students' problem-solving skills?

2. Is the flipped classroom instructional model developed to enhance students' problem-solving skills appropriate for implementation and how?

3. What are the results of implementing of the flipped classroom instructional model to enhance undergraduate students' problem-solving skills?

Research objectives

1. To examine factors to enhance undergraduate students' problem-solving skills.

2. To develop flipped classroom instructional model to enhance undergraduate students' problem-solving skills.

3. To study the results implementing flipped classroom instructional model to enhance undergraduate students' problem-solving skills..

Research hypothesis

After implementing flipped classroom instructional model, Students' problem-solving skills will be overall improved at 80% (Good Level).

Scope of the Research

Population and the Sample Group

Population

The total of 60 students from 2 classes of students with different levels of proficiency – beginner, intermediate, and advanced, who enrolled in Computer Application Basics Course at Qingdao Huanghai Universityin semester 1st academic year 2023.Those sections involve the following.

30 students in Class A

30 students in Class B

The Sample Group

The 30 students who enroll in the basics of computer applications course from Class A by cluster sampling.

The Variable

Independent Variable

Flipped classroom instructional model

Dependent Variable

Students' problem-solving skills

Contents

The researcher choose Unit 4 Multimedia Software Applications in of Computer Applications Basics Course semester 1 in the academic year 2023.

Time

Semester 1st in Academic year 2023 (May-July 2023)

Advantages

Concerning about the advantages of the flipped classroom Instructional model, there can be assumed to be presented from three perspectives by taking Qingdao Huanghai University for an example.

1. For students: The flipped classroom model improves students' subjective initiative, creativity, personality differences and personality characteristics, stimulates students' diligence in learning, taps students' learning potential, enables students to think independently and creatively, and pays attention to students' learning Ability training enables students to gradually form the habit of wanting to ask, being able to ask, and daring to ask, forming a mentality of blindly worshipping textbooks and teachers, and limiting their divergent thinking and imagination.

2. For lecturers: In the traditional teaching mode in the past, teachers are the pure teachers and the only subjects of educational activities. As the leader of educational activities, teachers have fixed thinking and strict control over teaching objectives, teaching content, teaching methods, teaching process, teaching effect and teaching quality evaluation. Based on the flipped classroom model, it is not only conducive to the growth of students, but also conducive to the cultivation of teachers' creative thinking and ability and the growth of creative talents.

3. For educational institutions: Changed classroom management, in school management, always pay attention to the movement of students in the classroom, because students are usually bored and simply unruly, after the implementation of the model, the performance of the students who disrupted the classroom lost the audience because other students They are all busy with activities or group collaboration, and bored students have no time to be bored. Learning has increased

the concentration of learning, and classroom management has been greatly improved.

In summary, the flipped classroom model stands as a multifaceted educational strategy that garners significant benefits for students, teachers, and educational institutions alike. It fosters an environment where students' creativity and independent thinking are amplified, educators are encouraged to adopt innovative teaching approaches, and classroom management within institutions becomes notably enhanced and efficient. This model marks a pivotal shift from traditional educational paradigms, ushering in an era of enhanced engagement, collaborative learning, and educational innovation.

Definition of Terms

The factors to enhance Problem solving skills of undergraduate students refers to the internal and external factors collected from students using questionnaire and interviews for lecturers designed by the researcher. The internal factors involve the information about students while external factors consist of information about the teacher and circumstances. In addition, the factors will be obtained by structured interviews with the lecturers.

Development of flipped classroom instructional model refers to a new instructional framework which consists of stable teaching activities and procedures. Such a developed instructional model with 5 components: 1) Principle & Rationale, 2) Objectives, 3) Contents, 4) Methods of teaching & Materials and 5) Evaluation, are confirmed by the experts in 4 aspects: 1) Utility Standards, 2) Feasibility Standards, 3) Propriety Standards and 4) Accuracy Standards (Stufflebeam and Social Impact, 2012) as the follows:

Utility Standards: These standards are designed to guarantee that the instructional model being developed will effectively meet the information requirements of its intended users. They ensure that the model serves its primary purpose by delivering valuable content and facilitating learning for the target audience.

Feasibility Standards: Feasibility standards aim to ensure that the instructional model being developed is not only practical but also sensible, adaptable, and cost-effective. These standards assess whether the model can be realistically implemented within the available resources and constraints, making it a viable and sustainable option.

Propriety Standards: Propriety standards are in place to ensure that the instructional model aligns with established teaching principles and ethical guidelines. They focus on the ethical conduct of the instructional process and the achievement of positive outcomes for both educators and learners, promoting fairness, integrity, and effectiveness in the educational context.

Accuracy Standards are intended to ensure that the developed instructional model shows a measure of closeness to a true value .

Flipped classroom instructional model refers to the online and offline teaching activities carried out through the implementation of a complete project. Its purpose is to organically combine theory and practice teaching in classroom teaching, fully explore students' creative potential and improve students' comprehensive ability to solve practical problems. There are 3 steps to teach as follows. (Educational Theory and Practice, 2022)

Step 1 Online module stage: Students' self-study activities in online are independent learning, questioning and questioning.

Step 2 Offline classroom sharing and discussion stage: The teaching process of this stage is that the group raises unsolved problems in the self-study session.

Step 3 Offline practice and summarization stage: In this stage, Each group is required to create a mini video at the end of the course. The mini video should include the group's learning process, feelings, and gains from the course. Additionally, the video should guide students to pay attention to the phenomena in their lives, identify problems in education, teaching, and learning, and explore potential solutions.

Problem-solving skills refers to the group of students to do mini video for their daily life. The dimensions for assessing problem-solving abilities are presented

in below: 1) knowledge and skills, 2) process and method, and 3) emotional attitude and values (Educational Theory and Practice, 2022). Each of dimensions are rubrics score from the researcher.

Knowledge and skills refers to standard 1-3 (Appendix D)

Process and method refers to standard 4-6 (Appendix D)

Emotional attitude and values refers to standard 7-9 (Appendix D)

Undergraduate students refers to the first-year students majoring computer who enroll basics of computer applications course in the 1 semester academic Year 2023 at Qingdao Huanghai University

Qingdao Huanghai University is an ordinary undergraduate university approved by the Ministry of Education with the qualification of bachelor's degree. The university carries out comprehensive quality education and focuses on cultivating students to "use hands and brains, do and learn together". Through the development and participation in various discipline skills competitions, the university cultivates students' practical ability and enhances students' innovation ability, and the quality of talent cultivation and the level of schooling is continuously improved.

Research Framework

With reference to the Development of flipped classroom model enhance students' Problem solving skills. Selecting the undergraduate students who Computer Application Basics Course in semester 1 of academic year 2023 at Qingdao Huanghai University, the new instructional models will be applied to the pedagogical process so as to check its accuracy, propriety, feasibility and utility. And the following is the just the framework of this study.

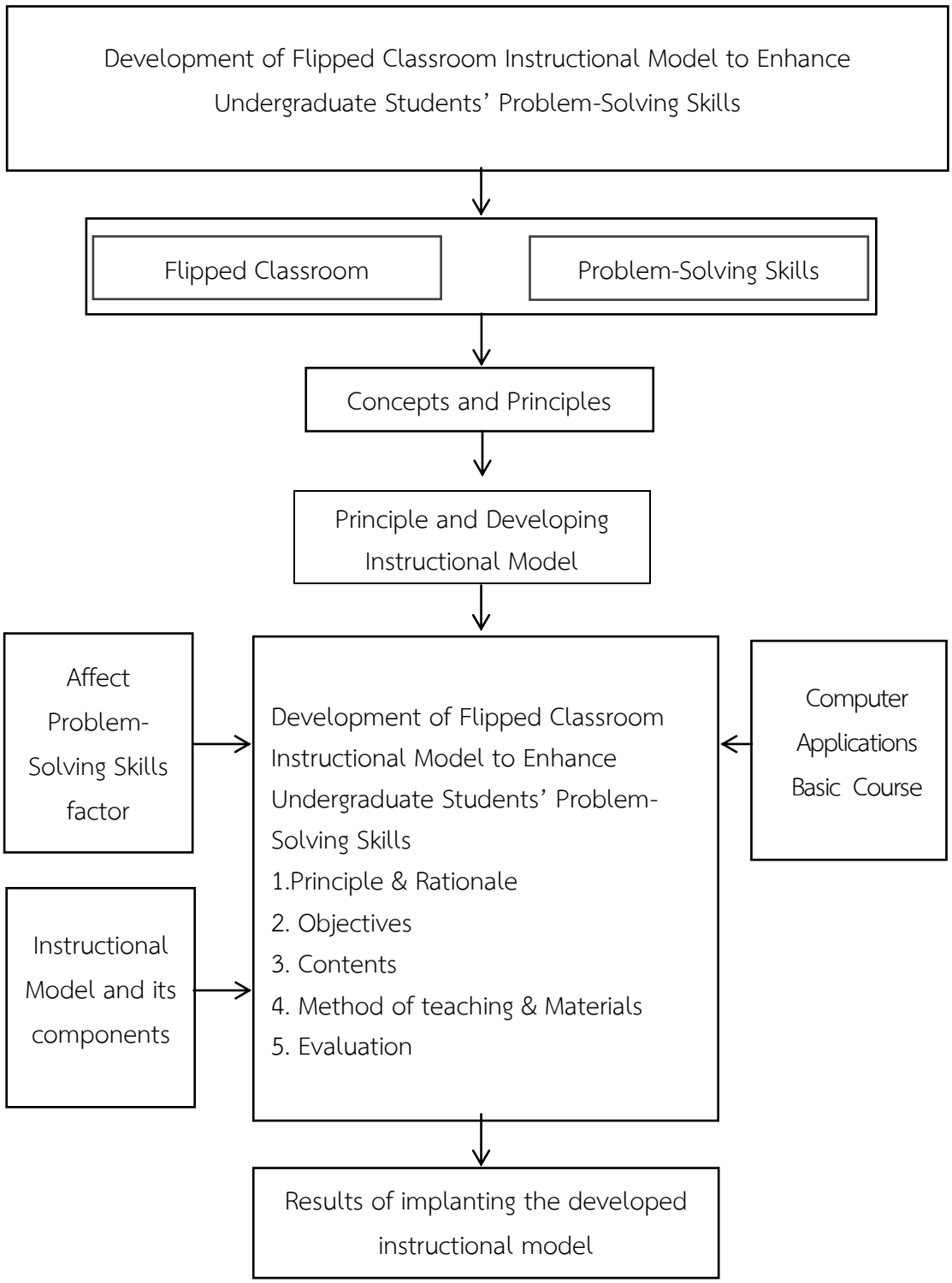

Figure 1.1 Research Framework

Chapter 2
Literature Review

In the study of “Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students’ Problem-Solving Skills”, the researcher studied the documents concerning the following.

1. The condition of teaching and learning about basics of computer applications course for undergraduate students in Qingdao Huanghai university.

2. Specific content of students’ problem-solving skills in Computer Application Basics courses

3. Instructional Model Development

4. Flipped classroom instruction model

5. Problem-solving skills

6. Rubric scores

7. Related Research

The details are as follows.

The Condition of Teaching and Learning about basics of computer applications course for undergraduate students in Qingdao Huanghai University

The Computer Application Basics course at Qingdao Huanghai University is designed as an essential educational component to equip students with fundamental skills and knowledge in computer applications. It incorporates a blend of theoretical insights and practical engagements, aimed at fostering students' capabilities to navigate and utilize various computer applications adeptly. The following analyzes the current situation of the teaching of basic computer application courses.

1. Low teaching resources the teaching resources and supporting software equipment in schools are backward, and the development of information technology is uneven in different regions, for example, the operating system in some schools is still Windows XP, while most of the computer systems circulating in society today are

Windows 7 or Windows 10. Most schools have traditional computer rooms, while some schools in developed areas have flipped classrooms. This backwardness of software and hardware leads to students' learning limited to textbooks and classrooms, which is not conducive to students' comprehensive understanding of computer-related knowledge and their career development.

2. At present, many teachers of Computer Applications courses in universities emphasize theory but not practice for the sake of passing academic level exams. The teaching process is mainly based on the teacher teaching the course content and operating demonstration, and then students follow the teacher's operating steps to imitate the demonstration, under this fixed teaching method, students feel boring, which is not conducive to the innovation of student learning, and is not conducive to students' active exploration and communication and cooperation. In the long run, students will lose their enthusiasm for learning computers, and more seriously, this kind of teaching is contrary to the educational philosophy of vocational education, which is not conducive to the long-term development of vocational education and the cultivation of skilled personnel (Hew & Lo, 2018).

3. As teachers have a single teaching method, the assessment method of the course is relatively fixed, and most schools take the final paper as the only standard for the assessment of the course. This assessment method is not reasonable, as the paper can only evaluate students' theoretical knowledge mastery, but not their practical skills, so it cannot reflect students' comprehensive learning situation scientifically and truly. Under the influence of such a single assessment method, students will be less motivated and active in learning practical operations, which is not conducive to the cultivation of students' comprehensive quality.

Analysis of the current situation of student learning:

1. Students' foundation is weak. This problem is caused by the reform of the national education system and the accumulation of years. However, with the continuous reform of the education system and the expansion of the University entrance examination, more and more people are now going to University, and the quantity is rising while the quality is declining.

2. Students lack interest and initiative in learning. According to the author's research, students' lack of interest in learning is mainly due to the influence of both the school environment and the family environment from childhood learning. The influence of school environment is mainly due to the unbalanced development of regions, which leads to the backward facilities of rural schools, the lack of teaching resources, the chaotic management system, and the backward teaching methods, making students miss the opportunity to develop good learning habits. In addition, some schools are backward in teaching mode and teaching concept, and have been using traditional lecture method to instill knowledge into students, and have assigned a lot of homework in order to improve grades, which leads to students' boredom and reduces students' motivation and initiative in learning (Wang Shu & Kong Lingjun, 2021). The influence of family environment is that some students live in rural areas and their parents are working outside, so they become left-behind children who are neglected by their parents and lack parental love, which makes them inattentive to learning. Another part of the students are spoiled by their parents since they are young, so they do not develop self-discipline and hard-working habits during their formative years.

3. High plasticity of students. Although students' theoretical knowledge is weak, they have strong practical and hands-on skills. They are eager to be praised by their teachers and recognized by their classmates. Therefore, under the correct guidance of teachers, they will slowly improve their theoretical knowledge, strengthen their skills learning and gradually increase their confidence in learning. Single teaching method: Some entrepreneurship courses rely too much on traditional classroom lectures and case studies and lack diverse teaching methods. Entrepreneurship courses can adopt teaching methods such as project-driven, teamwork, and field trips to cultivate students' practical and problem-solving abilities.

In summary, the analysis reveals a dichotomy in the current teaching landscape of the Computer Application Basics course, marked by outdated resources and traditional teaching methods juxtaposed against the students’ innate practical skills and adaptability. It underscores a prevailing need for an evolved teaching

methodology and resource upgrade to cultivate an environment where students' natural propensity for hands-on learning is maximized and complemented with a solid theoretical foundation. The apparent lack of interest and initiative amongst students is not a reflection of incapacity, but rather an indication of the need for an enriched, engaging, and practical learning environment. Addressing these challenges requires a holistic approach, intertwining updated resources, innovative teaching methods, and assessments that evaluate both theoretical and practical competencies of the students.

Specific content of students' problem-solving skills in Computer Application Basics courses

In the computer application basics course, problem-solving ability is a crucial skill that enables students to analyze practical problems quickly and accurately and propose effective solutions. There are three objectives to develop students' problem-solving abilities in this course: knowledge and skills, process and methods, and emotional attitude and values.

1. Knowledge and skills: Students need to understand the development and application areas of computers, recognize the basic components of computer systems, master the management and application methods of operating systems, master the application of the Internet, and master the use of office software and multimedia software. These knowledge and skills form the foundation for students to engage in problem-solving, enabling them to better understand, analyze, and develop effective solutions (Qingdao Huanghai University, 2022).

2. Process and methods: Students should study the teaching materials before class, work in groups during class to solve difficult problems with the teacher's guidance, and test their results and review and consolidate their knowledge through exercises after class. This learning approach helps students develop independent thinking and problem-solving skills. The course also guides students to carry out project design and practical operations to enhance their practical skills and problem-solving abilities (Qingdao Huanghai University, 2022).

3. Emotional attitudes and values: The computer application basics course aims to cultivate students' active exploration, communication and cooperation, independent problem-solving skills, down-to-earth conscientiousness, correct outlook on life and values, and creativity and flexibility of thinking. This fosters computational thinking, which is a crucial component of problem-solving skills. Students with these abilities and values can better analyze problems, find solutions, and translate solutions into practical actions (Qingdao Huanghai University, 2022).

In this paper, the focus is on employing a "mini video" collaborative group discussion in Unit 4 to bolster students' problem-solving skills. This hands-on approach entails the practical application of computer knowledge, enhancing creativity while instilling integral collaborative and independent thinking skills. Students are engaged in using software tools for various tasks, including editing and layout design, while fostering a culture of idea exchange and collective problem-solving. The teacher's role in facilitating explorative learning further amplifies the students' thinking and problem-solving capabilities. Consequently, this methodology not only strengthens grasp over computer fundamentals but enriches students' practical and cooperative skills.

To sum up, through the cultivation of three aspects: knowledge and skills, process and methods, and emotional attitude and values, the computer application basics course can effectively improve students' problem-solving skills and enable them to deal with various problems and challenges more comfortably in their real life and work. (Qingdao Huanghai University, 2022).

See Table 2.1 for the course content of the "Computer Application Basics Course" in the second semester of the 2022 school year of Qingdao Huanghai University

Table 2.1 Computer Application Basics Course in the second semester of the 2022 school year of Qingdao Huanghai University

Chapter	Chapter Title	Contents
Chapter 1	Computer Basics	1. Exploring Computer Development and Applications 2. Understanding Basic Components of Computer Systems 3. Hands-on with Common Computer Equipment
Chapter 2	Computer Operating Systems	1. Introduction to Operating Systems 2. Mastering Graphical User Interface Operation 3. File Management Skills Development
Chapter 4	Multimedia Software Applications.	1. Introduction to Multimedia Basics 2. Image Processing Techniques 3. Audio and Video Processing Skills
Chapter 5	Word Processing Software Applications	1. Basic Document Operation Techniques 2.Table Operations and Management 3. Mastering Mixed Layout of Graphics and Tables

The researcher chooses the chapter 4 to experiment through the blended teaching mode.

Instructional Model Development

To develop an effective instructional model, I brought together five experts in the field of education, each from a different disciplinary background. Through interdisciplinary collaboration, we discussed and analyzed key elements of an instructional model, such as instructional strategies, assessment methods, and technological tools. After intensive discussion and reflection, the combined efforts of these five experts led to a carefully designed instructional model that is effective in improving student learning outcomes. This model is based on the latest educational research and practice and is designed to provide teachers and scholars with a reliable framework to support students' cognitive development and lifelong learning as follows:

Rutz & Ehrlich (2016) said that instructional model development means creating and refining online learning environments that cater to learners' cognitive processes, maximize engagement, and enhance learning outcomes. This involves understanding and implementing strategies such as reducing cognitive load, utilizing multimedia materials, enabling personalized learning, encouraging social interaction, providing dynamic learning materials, and implementing educational assessment and feedback. By taking these factors into account, instructional models can be designed to optimize learning experiences and improve learner satisfaction.

Obizoba (2015) said that instructional model development means creating effective teaching strategies that address the shortcomings of minimally guided pedagogies, such as constructivist, discovery, problem-based, experiential, and inquiry-based approaches. By focusing on the importance of learners' prior knowledge, guided instruction, structured tasks, and problem-solving strategies, instructional models can provide the necessary support for students to successfully process and acquire new knowledge during cognitive processes. This development also involves promoting evidence-based educational practices, ensuring that the instructional methods implemented in classrooms are backed by empirical research and have demonstrated positive results. In summary, instructional model development, as described by Obizoba (2015), emphasizes the need for a pedagogical framework that reduces cognitive load, enhances learner outcomes, and is grounded in solid evidence.

Lim (2019) said that instructional model development means designing teaching strategies that enhance student cognitive engagement and learning outcomes by incorporating the principles of the ICAP (Interactive, Constructive, Active, Passive) framework. This involves creating various levels of learning tasks and activities that align with the framework's categories, such as facilitating group discussions for interactive learning, assigning writing or problem-solving tasks for constructive learning, and organizing experiments or exercises for active learning. By providing a diverse range of learning experiences, educators can effectively promote students' cognitive engagement, ultimately improving their learning outcomes. The instructional model development also considers evidence from educational research

that supports the relationship between different learning behaviors and their corresponding outcomes within the ICAP framework. While the ICAP framework offers valuable guidance for understanding and fostering students' cognitive engagement, instructional model development should also address the framework's limitations and explore future research directions, such as the impact of affect and motivation on learning or adapting the framework to suit the unique characteristics and context of learners.

Orange et al. (2019) said that instructional model development means creating teaching strategies and practices that prioritize the role and importance of feedback in education. By doing so, educators can significantly impact student learning outcomes. To achieve this goal, instructional model development should focus on understanding and providing various types of feedback that cater to students' needs and goals, ensuring high-quality feedback, and incorporating key elements of effective feedback. Instructional model development should involve designing feedback that is specific, timely, relevant, focused on student needs and goals, and provides clear guidance and suggestions. Furthermore, it should address the three key elements of effective feedback: (1) Feed Up – clarifying learning goals and expectations, (2) Feed Back – providing information about current performance and areas for improvement, and (3) Feed Forward – offering suggestions and strategies to improve and achieve goals. In addition, instructional model development should emphasize the importance of personalized feedback, tailoring it to the unique needs, abilities, and goals of each student. This approach allows students to better understand their strengths and weaknesses, leading to more effective learning plans. Finally, instructional model development should consider the challenges and future research directions related to feedback implementation, such as educators' time and resource constraints or students' receptiveness and attitudes towards feedback. By addressing these challenges, instructional model development can lead to more effective feedback strategies that enhance student learning outcomes.

Van & Kirschner (2018) said that instructional model development means creating a systematic approach to instructional design that effectively addresses

complex tasks and knowledge domains. By adopting models like the Four Component Instructional Design (4C/ID) model and its Ten Steps to Complex Learning, educators can design and implement instructional activities that cater to the unique characteristics of complex learning. Instructional model development, in this context, involves understanding the theoretical foundations and practical applications of such models, following implementation steps, and utilizing examples for reference. Instructional model development should consider key aspects such as task category analysis, task category sequencing, task category refinement, and task category organization. By applying these steps, educators can better identify the complexity and cognitive demands of tasks, design progressive sequences for knowledge and skill acquisition, break down tasks into specific learning activities and objectives, and align tasks with instructional objectives and student needs. Moreover, instructional model development should address challenges in instructional design and implementation, provide support and strategies to overcome these challenges, and incorporate empirical studies and case studies to demonstrate the effectiveness and usefulness of the approach. Lastly, instructional model development should look into future research and directions, exploring the application of these approaches in different educational domains and technological contexts, as well as integrating other instructional design theories and methods to enhance effectiveness and applicability.

Consequently, the development of an instructional model, as consolidated from the insights of five esteemed experts, underscores a multifaceted approach integrating cognitive processes, guided pedagogies, engagement strategies, feedback mechanisms, and systematic instructional design tailored for complex learning environments. These insights offer a holistic perspective, highlighting the need for a balance between technological integration, evidence-based teaching methods, student engagement, and personalized feedback to enhance learning outcomes. Each expert provides a unique yet complementary viewpoint, collectively suggesting a comprehensive instructional model that is adaptive, responsive, and grounded in empirical evidence to support cognitive development and lifelong learning. The convergence of these perspectives affirms the necessity for instructional models that

are both theoretically robust and practically applicable, underscoring the role of continuous refinement and adaptation in response to the evolving educational landscape.

Flipped Classroom Instruction Model

With the advent of the flipped classroom model, there has been a significant shift in traditional teaching methods. This innovative model creates an environment that is not only conducive to learning, but has been carefully designed to enhance critical thinking and problem-solving skills. Scholars in the field of education have also provided different answers. as follows:

According to Talbert (2017), the flipped classroom is a student-centered model that emphasizes active engagement through pre-class and in-class activities. Talbert outlines the following steps for implementing the flipped classroom model:

1. Set clear learning objectives
2. Select appropriate pre-class materials
3. Design engaging in-class activities
4. Integrate technology tools
5. Manage class time effectively
6. Facilitate active learning
7. Assess student learning
8. Provide timely feedback
9. Evaluate and continuously improve

Overall, Talbert emphasizes careful planning and intentional design of the learning experience using technology and active learning strategies to maximize student engagement and mastery of objectives.

Liljedahl (2014) connects the flipped classroom model to the creation of a “Thinking Classroom” environment conducive to developing students’ problem-solving skills. Liljedahl recommends these steps:

1. Establish a safe and supportive learning environment
2. Encourage risk-taking and persistence
3. Promote collaboration and communication

4. Provide timely and meaningful feedback
5. Encourage self-regulation and autonomy

Liljedahl focuses on the classroom conditions and strategies that foster problem-solving, emphasizing the importance of a supportive environment, collaboration, feedback, and student autonomy.

According to TeachThought (2013), the flipped classroom emphasizes diversified learning resources, communication, interaction, and feedback within a student-centered environment. Teach Thought outlines steps focused on effective technology integration:

1. Choose easy-to-use technology
2. Select a video platform with privacy controls
3. Decide on a repeatable video format
4. Set limits on video length and number
5. Verify students are watching videos
6. Be consistent with video creation
7. Reflect and improve over time

Teach Thought provides specific recommendations for creating and implementing pre-class instructional videos, with an emphasis on consistent improvement.

As for the personal steps, they involve:

1: Online module stage questioning and questioning: This involves creating an online module with pre-class materials, such as videos and readings, and encouraging student participation through online discussions and questioning.

2: Offline classroom sharing and discussion stage: This involves using class time for active learning activities that promote student engagement, collaboration, and problem-solving. This can include group discussions, problem-solving activities, and hands-on projects.

3: Offline practice and summarization stage: This involves providing opportunities for students to apply and extend their pre-class learning through practice activities and summarizing their learning through reflection and feedback.

In summary, the fusion of these diverse insights paves the path for a multi-dimensional approach to implementing the flipped classroom. It becomes evident that the model's success is hinged on a delicate balance of meticulous planning, a nurturing environment, and effective technology integration. Every step, strategy, and process is a crucial cog in the intricate machinery of the flipped classroom, where the ultimate goal transcends beyond learning to fostering thinkers, innovators, and problem solvers equipped for the challenges of the contemporary world.

Problem Solving Skills

Improving problem-solving skills is critical in an evolving educational environment. Several scholars have emphasized the flipped classroom model as a key strategy in this effort. These pedagogical approaches, including the integration of Webquests and critical problem-solving activities that emphasize active learning, collaboration, and real-world application, aim to equip students with the analytical and strategic skills necessary to tackle complex challenges in diverse contexts. as follows:

Orange et al. (2019) said that Problem-solving skills means problem-solving skills refer to the ability to navigate, analyze, and synthesize information, and apply critical thinking to solve complex problems effectively. These skills are essential for success in various contexts, including academic, professional, and personal settings. The flipped classroom model using Webquests based on constructivist theory aims to foster these competencies by promoting active learning, collaboration, and reflection, allowing students to construct their knowledge actively, and providing opportunities to develop and apply problem-solving skills in a supportive learning environment. Ultimately, the goal is to prepare students for the challenges they will face in the future by empowering them with the problem-solving skills they need to succeed.

Bishop & Verleger. (2013) said that Problem-solving skills means problem-solving skills involve the use of scientific inquiry, critical thinking, and evidence-based reasoning to construct knowledge and find solutions to complex problems. These skills require active engagement, collaboration, reflection, and the ability to analyze

data, test hypotheses, and make data-driven decisions. Problem-solving skills are crucial in higher education and in the workforce, as they enable individuals to tackle challenges and innovate in various contexts. The UFC-PS Model proposed by the authors aims to cultivate these skills in students by integrating the flipped classroom model, ubiquitous learning, and scientific learning process, creating an effective and engaging learning environment that fosters problem-solving skills.

Chavangklang & Suppasetseree (2018) said that Problem-solving skills means problem-solving skills refer to the ability to analyze complex issues, engage in critical thinking, and apply problem-solving strategies in various contexts. These skills are essential for success in the modern world, where individuals are faced with a wide range of complex challenges in their personal and professional lives. The authors argue that the flipped classroom model with critical problem-solving activities effectively fosters these skills in undergraduate students by promoting active learning, higher-order thinking, and real-world tasks. Through this instructional model, students can develop and apply their problem-solving skills in various contexts, ultimately preparing them for the demands of their future careers and lives.

In summary, problem-solving skills are essential competencies for success in various contexts, including academic, professional, and personal settings. The flipped classroom model, with its focus on active learning, collaboration, and reflection, is an effective approach for fostering problem-solving skills. Overall, the integration of these instructional approaches provides students with the tools they need to succeed in their future careers and lives.

Rubric Score

In the educational ecosystem, the assessment of student performance and achievement of learning goals is of paramount importance. In this context, grading rubrics have become the cornerstone for evaluating student work, providing a systematic, consistent, and objective approach to assessing student work. By synthesizing insights from diverse scholars, we strive to reveal the subtle layers of

scoring rubrics and their important role in improving the quality and efficiency of educational assessment. as follows:

Li, Ye, Tang, Zhou, & Hu (2018) said that Rubric scores means rubric scores refer to the overall evaluation of a student's work based on specific criteria and scales established within a scoring rubric. Rubric scores are calculated by assessing a student's work against each criterion, assigning a score based on the established scale for each criterion (step 4). The scores for each criterion are then combined (step 5) to calculate an overall score for the student's work. Rubric scores serve as a tool to evaluate the effectiveness of flipped classrooms in medical education, specifically in measuring students' problem-solving and critical thinking skills. Scoring rubrics are essential assessment tools that help ensure consistency and fairness in assessments (step 2), as they are based on predetermined criteria aligned with specific learning objectives and outcomes (step 1). The rubric criteria can be tailored to the specific context and goals of the flipped classroom (step 3). Overall, rubric scores are an important aspect of assessing student performance in flipped classrooms, as they provide educators with a comprehensive evaluation of students' problem-solving and critical thinking skills, allowing them to identify areas for improvement and adapt their teaching strategies accordingly.

Hew & Lo (2018) said that Rubric scores means rubric scores refer to the scores assigned to students' work based on specific criteria outlined in the scoring rubric. Rubric scores are used to evaluate and compare students' performance in flipped learning and traditional lecture-based learning environments, and are calculated by following these steps: Step 1: Identify the specific learning objectives and outcomes for the learning environment being evaluated. Step 2: Develop criteria that align with these learning objectives and outcomes. Step 3: Establish a scale for each criterion, with clear descriptors for each level of performance. Step 4: Assess students' work against each criterion, assigning a score based on the established scale. Step 5: Combine the scores for each criterion to calculate an overall score for the student's work.

Jang & Kim (2020) said that Rubric scores means Rubric scores are used to evaluate students' performance in relation to specific learning objectives and

outcomes, and can help educators assess the relationships among motivation, affect, and strategy use in self-regulated learning within flipped classrooms. Here are the steps involved in calculating rubric scores: Step 1: Identify the specific learning objectives and outcomes for self-regulated learning in flipped classrooms. Step 2: Develop criteria that align with these learning objectives and outcomes. Step 3: Establish a scale for each criterion, with clear descriptors for each level of performance. Step 4: Assess students' work against each criterion, assigning a score based on the established scale. Step 5: Combine the scores for each criterion to calculate an overall score for the student's work. By following these steps, educators can use scoring rubrics to evaluate self-regulated learning in flipped classrooms, and provide students with clear and consistent feedback on their performance.

Wang & Yang (2022) said that Rubric scores means rubric scores refer to the numerical or qualitative ratings assigned to each criterion in a scoring rubric, which are then combined to calculate an overall score for the student's work. Rubric scores are used to evaluate students' performance in relation to specific learning objectives and outcomes, and can help educators assess problem-solving competence, self-efficacy, and learning motivation in higher education. Here are the steps involved in calculating rubric scores: Step 1: Identify the specific learning objectives and outcomes for the assessment. Step 2: Develop criteria that align with the learning objectives and outcomes. Step 3: Establish a scale for each criterion, with clear descriptors for each level of performance. Step 4: Assess students' work against each criterion, assigning a score based on the established scale. Step 5: Combine the scores for each criterion to calculate an overall score for the student's work. By following these steps, educators can use scoring rubrics to evaluate problem-solving competence, self-efficacy, and learning motivation in flipped classrooms or other educational settings, and provide students with clear and consistent feedback on their performance.

Based on the researchers' summaries, here are some general steps involved in calculating rubric scores:

Step1: Identify the specific learning objectives and outcomes for the assessment. Step2: Develop criteria that align with the learning objectives and

outcomes. Step3: Establish a scale for each criterion, with clear descriptors for each level of performance. Step4 : Assess students' work against each criterion, assigning a score based on the established scale. Step5 : Combine the scores for each criterion to calculate an overall score for the student's work. Overall, rubric scores provide educators with a systematic and objective way to assess student performance and provide feedback for improvement. They also help ensure consistency and fairness in assessments, and can inform instructional decisions and improve learning outcomes.

The researcher summaries Rubric scores means Rubric scores refer to the assessment of a student's work based on predetermined criteria and scales within a scoring rubric. These scores are calculated by assessing a student's work against each criterion, assigning a score based on the established scale for each criterion, and combining the scores for each criterion to calculate an overall score for the student's work. Rubric scores are used to evaluate students' performance in relation to specific learning objectives and outcomes, and can help educators assess various skills such as problem-solving, critical thinking, self-regulated learning, self-efficacy, and learning motivation.

Related Research

The educational landscape is witnessing a paradigm shift, anchored by innovative instructional models like the flipped classroom, which has garnered significant attention for its potential to enhance students' problem-solving abilities. Distinguished scholars and extensive studies underline the multifaceted benefits of this approach. It intertwines autonomous and collaborative learning, personalized educational trajectories, and heightened engagement, all converging to a refined pedagogical ecosystem that fosters critical thinking and problem-solving skills. as follows:

Bishop & Verleger (2013) said that the flipped classroom model is instrumental in improving students' academic performance and problem-solving abilities. The authors attribute this enhancement to the model's effectiveness in

facilitating a deeper understanding of course content among students, thereby leading to improved problem-solving skills.

Abeysekera & Dawson (2015) extensively studied the effects of the flipped classroom model on students' problem-solving abilities and highlighted its multifaceted benefits. They underscored the role of personalized learning experiences that this model offers. Unlike traditional classroom settings, flipped classrooms cater to individual learning needs by allowing students to progress at their own pace. This adaptability nurtures self-directed learning abilities, laying a robust foundation for enhanced problem-solving skills. Furthermore, Abeysekera & Dawson pinpointed another strength of the flipped model - its inherent design and methodology that foster increased student engagement and active learning. The interactive and engaging nature of this learning environment not only keeps students involved but also deepens their understanding and mastery of course content, contributing significantly to the enhancement of their problem-solving capacities. In essence, the flipped classroom, with its tailored learning paths and engaging environment, emerges as a potent tool for elevating students' analytical and problem-solving prowess.

Chen et al. (2014) emphasized the role of self-directed learning in the flipped classroom model. They posited that the model’s emphasis on allowing students to take greater responsibility for their learning process is directly linked to improved problem-solving skills. This self-directed learning aspect fosters autonomy and a deeper engagement with the learning material, leading to enhanced problem-solving capabilities.

Bergmann & Sams (2012) asserted that the flipped classroom model enhances students' problem-solving abilities by promoting autonomous learning outside the classroom. This autonomy creates opportunities for in-depth discussions and hands-on problem-solving during class time, enabling students to focus on applying their knowledge practically. This shift in the learning approach, according to the authors, is instrumental in honing students' problem-solving skills.

Strayer (2012) highlighted the role of collaborative learning in the flipped classroom model. He argued that this model encourages students to work together,

share their understanding of the subject matter, and foster a learning community. This communal and interactive approach to learning, Strayer suggests, not only enriches students' understanding but significantly strengthens their problem-solving abilities by promoting a shared learning experience.

Wang & Yang (2019) investigated the effect of flipped classroom instruction on problem-solving ability in undergraduate college computer courses. Their findings revealed that students who participated in the flipped classroom model demonstrated significantly better problem-solving abilities compared to those in traditional classroom settings.

Li (2020) examined China's education emergency management policy during the COVID-19 outbreak. The article highlighted the use of online and flipped classroom models to ensure educational continuity during the pandemic.

Mulyani (2022) studied the impact of a flipped classroom model on enhancing problem-solving and critical thinking skills. They found that students in the flipped classroom environment showed significant improvements in both problem-solving and critical thinking abilities.

In conclusion, the flipped classroom model offers a promising approach to enhancing students' problem-solving skills across various educational contexts. By implementing the strategies outlined above, educators can optimize the potential of flipped classrooms to foster problem-solving abilities, prepare students for success in an increasingly complex world, and contribute to the development of lifelong learning and other essential 21st-century skills.

Chapter 3
Research Methodology

In the study of "Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem-Solving Skills". This research used Mixed Method of Research the researcher follows the following processes.

Phase 1 was conducted to answer research **objective 1:** To examine the factors to enhance undergraduate students' problem-solving skills.

Phase 2 was conducted to answer research **objective 2:** To develop flipped classroom instructional model to enhance undergraduate students' problem-solving skills.

Phase 3 was conducted to answer research **objective 3:** To examine the results of implementing flipped classroom instructional model to enhance undergraduate students' problem-solving skills.

Phase 1 was conducted to answer research objective1: To study the factors to enhance undergraduate students' problem-solving skills.

Population

Group 1: Former 150 undergraduate students year 1 of Computer Application Basics course, semester 2 on academic year 2022 in Qingdao Huanghai University

1) 50 students major in Computer Science and Technology.

2) 50 students major in Software Engineering.

3) 50 students major in Information Security.

Research instrument

The questionnaire for students

Designing instrument 1 (The questionnaires for students)

1. Research on the mixed teaching mode of Computer Application Basics course and the factors affecting undergraduate students' problem-solving skills.

2. Design a questionnaire on factors to improve undergraduate students' problem-solving skills for the students at Qingdao Huanghai University. There are 3

Parts: Part 1 is about Common data of the respondent in overall (N=150) Part 2 Internal factors 15 numbers, external factors 13 numbers and Part 3 suggestion.

3. Present the draft of questionnaires to the advisors for checking correctness and completion.

4. Assess the validity of questionnaire on factors to improve undergraduate students' problem-solving for the undergraduate students at Qingdao Huanghai University by 5 experts (List name from Appendix A) through Index of Item-Objective Congruence (IOC) according to the criteria shown below. (Phongsri, 2010)

+1 = Sure that the contents are related to the topics

0 = Not sure that the contents are related to the topics

-1 = The contents are not related to the topics

The acceptable items must have the IOC values not less than 0.5. The IOC calculated from the validation measures 0.80

5. Design Likert 5-point rating scale questionnaire on the following score rating criteria.

Score rating criteria

5 means strongly agree

4 means agree

3 means neutral

2 means disagree

1 means strongly disagree

The factors affecting students' problem-solving skills obtained from the students are interpreted using MEAN interpretation criteria proposed by Phongsri (2010).

4.51-5.00 means the highest

3.51-4.50 means high

2.51-3.50 means moderate

1.51-2.50 means few

1.00-1.50 means the fewest

Data Collection

1. Ask for permission for data collection.

2. Collect data from the assigned students using the developed questionnaires.

Data Analysis

Descriptive Statistics i.e., Frequency, MEAN (μ), Standard Deviation (σ)

Group 2: The lecturers who are teaching of Computer Application Basics course from 3 colleges in Qingdao Huanghai University.

1) 1 Lecturer from majoring in Computer Science and Technology.

2) 1 Lecturer from majoring in Software Engineering.

3) 1 Lecturer from majoring in Information Security.

Research Instruments

The interview for the lecturers

Designing instrument 2 (The interview for the lecturers)

1. Research on Computer Application Basics course and the factors that affect the students' problem-solving skills.

2. Design 10 questions on the influencing factors of problem-solving skills of undergraduate students at Qingdao Huanghai University. There are 3 Parts: Part 1 is about Common data of the respondent in overall (N=3) Part 2 both Internal factors and external factors and Part 3 suggestion.

3. Submit the first draft of the questionnaire to the consultant for correctness and completeness.

4. To present the draft of questionnaire on factors for problem-solving skills of undergraduate students at Qingdao Huanghai University to 5 experts for checking Index of Item-Objective Congruence (IOC), consider the passage following the content as shown below: (Phongsri, 2010)

+1 = Sure that the contents are related to the topics

0 = Not sure that the contents are related to the topics

-1 = The contents are not Bozhou City related to the topics

The acceptable items must have the IOC values not less than 0.5. The IOC calculated from the validation measures 0.80

5. Do the questionnaire in three lecturers at. The questionnaire type is the Closed-ended questions that can only be answered by selecting from provided number to summated rating scale, 5 scales.

Data Collection

1. Ask for permission for data collection.

2. Collect data from the assigned lecturers using the developed interview.

Data Analysis

Content analysis

Output Phase 1

The result of the factors to enhance undergraduate students' problem-solving skills. By table 3.1

Table 3.1 Summary how to conduct research from Phase 1

Topics	Details
Research process	Analyzed both internal and external factors
Research objective	To examine y the factors to enhance undergraduate students' problem-solving skills.
Research method	Study the factors affecting undergraduate students' problem-solving skills both internal and external factors.
Resources/ target group	1. Former 150 undergraduate students year 1 of Computer Application Basics course, semester 2 on academic year 2022 in Qingdao Huanghai University. 2. The 3 lecturers who are teaching Course from Qingdao Huanghai University.
Instrument	1. Questionnaires 30 items 2. Interview by 10 questions
Data analysis	1.Descriptive Statistics i.e., Frequency, mean (μ) standard deviation (σ) for questionnaires 2.Content analysis for interview
Output	The result of the factors to enhance undergraduate students' problem-solving skills

Obtain important information that is used as a basis for examine the internal and external factors to enhance undergraduate students' problem-solving skills from the former students and lecturers. And take the result to do flipped classroom model.

Phase 2 To develop flipped classroom instructional model to enhance undergraduate students' problem-solving skills.

1. Designing instrument (the questionnaire for IOC)

1.1 Study related concepts, principles, process about developing instructional model, including results in terms of factors affecting "problem-solving skills" from research objective 1.

1.2 Design the development of Flipped Classroom instructional model to enhance students' problem-solving skills to be the handout which consists of the stable teaching activities and procedures. Such a developed instructional model with 5 components: 1) Principle & Rationale, 2) Objectives, 3) Contents, 4) Methods of teaching & Materials and 5) Evaluation, is in 4 aspects standards: 1) Utility Standards, 2) Feasibility Standards, 3) Propriety Standards and 4) Accuracy Standards.

1.3 Assess the validity of the questionnaire of the appropriateness of the instructional model by 5 experts (List name in Appendix A) through Item-Objective Congruence (IOC) according to the criteria as shown below: (Phongsri, 2010)

+1 = If your are sure the contents measure its objectives

0 = If your are not sure that the measurement contents related its objectives

-1 = If it is certain that the contents is measured and does not related the objectives

The acceptable items must have the IOC values not less than 0.5. The IOC calculated from the validation measures 1.00.

Research instrument

2. Designing instrument about the questionnaire on confirming the model

2.1 Design a questionnaire on confirming the appropriateness of the model in terms of accuracy standard, propriety standard, feasibility standard, and utility standard.

2.2 Present the draft of open-ended interview to the advisors for checking correctness and completion.

2.3 Assess the validity of the questionnaire on confirming the appropriateness of the instructional model by 5 experts through frequency and percentage.

Data Collection

1. Ask for permission of data collection

2. Collect appropriateness of the instructional model in terms of accuracy standard, propriety standard, feasibility standard, and utility standard from the 5 experts including, three Thai experts and two Chinese experts (List name in Appendix A) through Index of Item-Objective Congruence (IOC) according to the criteria shown below. (Phongsri, 2010)

Data Analysis

Descriptive analysis i.e. frequency and percentage.

The acceptable items must not be less than 100%.

Output Phase 2

Flipped Classroom instructional model the appropriateness of which is confirmed by experts for further implementation. The acceptable items 100%. By table 3.2

Table 3.2 Summary how to conduct research from Phase 2

Topics	Details
Research process	Develop flipped classroom instructional model in terms of accuracy standard, propriety standard, feasibility standard, and utility standard
Research objective	To develop flipped classroom instructional model to enhance undergraduate students' problem-solving skills
Research Method	Study the component for development of Flipped Classroom instructional model
Resources/ Target Group	5 experts confirming development Study the component for development of Flipped Classroom instructional model
Instrument	The questionnaire
Data analysis	Frequency and percentage
Output	Flipped Classroom instructional model the appropriateness of which is confirmed by experts for further implementation. The acceptable items 100%.

Obtain important information that develop flipped classroom instructional model to enhance undergraduate students' problem-solving skills from 5 experts. And take flipped classroom instructional model to experiment.

Phase 3 To examine the results of implementing flipped classroom instructional model to enhance undergraduate students' problem-solving skills.

And the details of the research operation are as follows.

Population

The total of 60 students from 2 classes of students with different levels of proficiency – beginner, intermediate, and advanced, who enrolled in Computer Application Basics Course at Qingdao Huanghai Universityin semester 1 academic year 2023.Those sections involve the following.

30 students in class A

30 students in class B

The Sample Group

The 30 students who enroll in the basics of computer applications course from Class A by cluster sampling.

Research Design

Table 3.3 One-Group Post-Test Design

Group	X	T1
Sample group	Flipped classroom instructional model	Problem-Solving Skills

X = Flipped classroom instructional model

T1 = Problem-Solving Skills

Research instruments

1. Lesson plans using Lesson plans using Problem-Solving Skills based Flipped classroom instructional model.

2. Rubric scoring form

Designing instrument 1 (Lesson plans)

1. Study contents, objectives, methods of teaching, materials, evaluation and Blended teaching mode

2. Design lesson plans by format given.

3. Present the lesson plan to the advisors for checking correctness, completion and improvement.

4. Assess the validity of the designed lesson plans by 5 experts including, three Thai experts and two Chinese experts (List name in Appendix A) through Item-Objective Congruence (IOC) according to the criteria as shown below. (Phongsri, 2008)

1 = Sure that the contents are related to the topics

0 = Not sure that the contents are related to the topics

-1 = Sure that the contents are not related to the topics

The acceptable items must have the IOC values not less than 0.5. The IOC calculated from the validation measures 1.00.

5. Conduct a try-out of the developed lessons plans with another group of samples for further improvements and implementation with the sample group.

Designing instrument 2 (Rubric evaluation form)

The process of Rubric evaluation form

1. Study the rubric scoring criteria aligned with the Flipped Classroom Instructional Model.

2. Design rubric scoring criteria.

3. Present the developed rubric scoring criteria to the advisors for checking correctness, completion and improvement.

4. Create the students' Problem-Solving Skills from 3 dimension 1) knowledge and skills 2) process and method and 3), emotional attitude and values by the researcher's scoring rubric.

5. Assess the validity of open-end interview on factors affecting Problem-Solving Skills for the students at Qingdao Huanghai University by 5 experts (List name from Appendix A) through Item-Objective Congruence (IOC) according to the criteria as shown below. (Phongsri, 2010)

+1 = Sure that the contents are related to the topics

0 = Not sure that the contents are related to the topics

-1 = Sure that the contents are not related to the topics

The acceptable items must have the IOC values not less than 0.5. The IOC calculated from the validation measures 1.00. Criteria to evaluate Item1: Self-management ability by table 3.4**,** table 3.5, table 3.6, and table 3.7.

Table 3.4 Criteria to evaluate Item 1: knowledge and skills

Score	Grade
13- 15	Excellent
10 -12	Good
7-9	Medium
4-6	Pass
Less than 4	Poor

Table 3.5 Criteria to evaluate Item 2: process and method

Score	Grade
13- 15	Excellent
10 -12	Good
7-9	Medium
4-6	Pass
Less than 4	Poor

Table 3.6 Criteria to evaluate Item 3: Communication skills

Score	Grade
13- 15	Excellent
10 -12	Good
7-9	Medium
4-6	Pass
Less than 4	Poor

Table 3.7 Criteria to evaluate over all

Score	Grade
37-45	Excellent
27-36	Good
18-26	Medium
9-17	Pass
Less than 9	Poor

Data Collection

1. Ask for permission of data collection

2. Collect students' performance by using rubric scoring before assessment by external raters.

Data Analysis

Categorize students' performance according to rubric scoring criteria into their levels descriptor.

Output Phase 3

Students' Problem-Solving Skills are at good level at least 80% By table 3.8.

Table 3.8 Summary how to conduct research from Phase 3

Topics	Details
Research process	1. Deign lesson plan 2. Design scoring rubric form
Research objective	To examine the results of implementing flipped classroom instructional model to enhance undergraduate students' problem-solving skills.
Research Method	Designing instrument 1 (Lesson plan) Designing instrument 2 (Rubric evaluation form)
Resources/ Target Group	The 30 students who enroll in Computer Application Basics from class 1 by cluster sampling, Qingdao Huanghai University in the 1st Semester of academic year 2023 are obtained by cluster sampling.
Instrument	1. Lesson plan 2. Rubric evaluation form
Data analysis	Categorize students' performance according to rubric scoring criteria into their levels descriptor.
Output	Students' Problem-Solving Skills are at good level at least 80%

Obtain important information that develop lesson plans and scoring rubric form to enhance Problem-Solving Skills from 5 experts. And take lesson plans and scoring rubric form to experiment. And summary development of Flipped classroom instructional model to enhance Problem-Solving Skills by Figure 3.1.

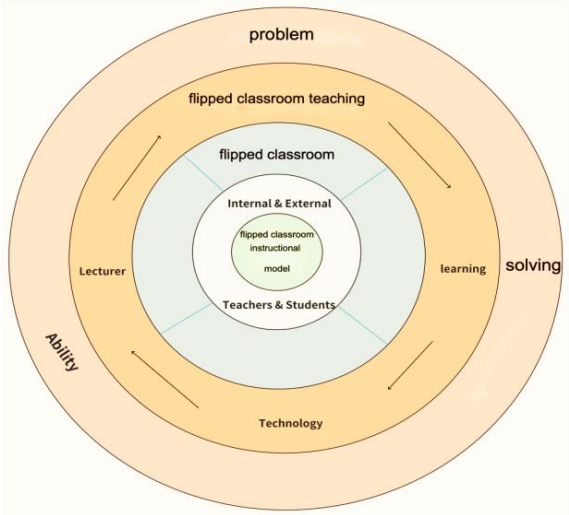

Figure 3.1 Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem-Solving Skills.

Chapter 4
Results of Analysis

In the study of “Development of flipped classroom instructional model to enhance undergraduate students’ problem - solving skills”, the researcher studied the documents concerning the following.

Part 1: To examine the factors to enhance undergraduate students’ problem-solving skills.

Part 2: To develop flipped classroom instructional model to enhance undergraduate students’ problem-solving skills.

Part 3: To study the results of implementing flipped classroom instructional model to enhance undergraduate students’ problem-solving skills.

Data Analysis Results

Part 1: Analysis results serving objective 1–To examine the factors to enhance learning achievement for undergraduate students in Qingdao Huanghai University.

This section presents analysis results serving objective 1 using table and description in terms of MEAN, standard deviation, interpretation (Level of Attitude), and ranking of all factors in overview. After that, items of all factors are presented likewise.

Table 4.1: Common data of the respondent in overall

(N=150)

Data	Frequency	Percentage
Gender		
Male	50	33.30
Female	100	66.70
Total	**150**	**100.00**
Age		
Below 17 yrs.	25	16.70
18-20 yrs.	50	33.30
21-23 yrs.	50	33.30
over 23 yrs.	25	16.70
Total	**150**	**100.00**

From Table 4.1 the common data of the respondent in overall shows that about two-thirds of the respondents are female, representing 66.7% of the total participants. The male respondents make up 33.3% of the total. The age distribution is relatively evenly spread out, with the age range of 19-20 years being the most common, with 33.3% of the respondents falling in this category.

Table 4.2 Factors affecting Internal and External according to all respondents in overview

(N=150)

Factors	**μ**	**σ**	Interpretation	Ranking within All Factors
Internal Factor (respondents)				
1. Students are very interested in the flipped classroom instructional model in the Computer Application Basics course.	4.10	0.710	High	2
2. Students actively participate in problem-solving activities and discussions through online platforms.	3.93	0.706	High	10

Table 4.2 (Continued)

(N=150)

Factors	μ	σ	Interpretation	Ranking within All Factors
3. Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course.	3.88	0.683	High	15
4. Students devise a study plan for the Computer Application Basics course, using IT and collaborative support.	3.73	0.672	High	20
5. Students believe that flipped classroom and online learning can help them improve their problem-solving skills.	4.04	0.685	High	5
6. Students think that the assignments provided by teachers and the feedback received can help them better apply their knowledge to real-world situations.	3.78	0.731	High	18
7. Students provide objective feedback on their teachers and the online learning platform to improve their learning experience.	3.97	0.698	High	7
8. Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model.	3.64	0.716	High	24
9. Students are satisfied with the interaction between themselves and the online learning resources provided in the flipped classroom model.	3.83	0.683	High	16
10. Students can develop new insights based on their experiences with practical problem-solving tasks.	3.84	0.718	High	14
11. Students can effectively prepare for the course by completing pre-class tasks and assignments.	3.84	0.720	High	13

Table 4.2 (Continued)

(N=150)

Factors	μ	σ	Interpretation	Ranking within All Factors
12. Students develop a sense of accomplishment and pride through their engagement in various problem-solving activities.	3.93	0.707	High	11
13. Students can develop new insights and perspectives based on their experiences with the flipped classroom model.	3.87	0.708	High	17
14. Students trust online resources to excel in the Computer Application Basics course.	3.96	0.701	High	8
15. Students respect and trust their teachers' expertise in organizing and managing the flipped classroom model.	4.10	0.696	High	1
Total Average	**3.89**	**0.672**	**High**	
External factors (teacher, material and circumstance)				
16. Lecturers use video lectures and computer simulations to engage students in problem-solving.	3.75	0.714	High	22
17. The lecturers pay close attention to students' engagement and participation in course activities.	3.80	0.699	High	19
18. The lecturers' evaluation methods include formative and summative assessments, incorporating various types of tasks and assignments.	3.83	0.686	High	21
19. The lecturers use a combination of self-assessment, peer assessment, and teacher assessment to evaluate students' performance.	3.93	0.690	High	9

Table 4.2 (Continued)

(N=150)

Factors	μ	σ	Interpretation	Ranking within All Factors
20. The lecturers emphasize the application and function of information technology in the Computer Application Basics course.	3.78	0.704	High	27
21. The lecturers treat each student equally, fostering confidence and reducing anxiety in problem-solving activities.	3.78	0.704	High	26
22. The lecturers combine traditional classroom assessments with modern online assessment systems to evaluate students' learning progress.	3.85	0.704	High	12
23. Lecturers give students feedback through methods like face-to-face talks, written comments, and audio/video messages.	3.78	0.685	High	25
24. The teaching methods employed in the flipped classroom model align with the course objectives and content.	3.94	0.748	High	6
25. The instructional model engages students' interests and meets their contemporary needs, **Such as the use of technology and online resources.**	3.85	0.683	High	23
26. Course materials and presentations are carefully designed, well-organized, and visually appealing.	3.70	0.683	High	29
27. Traditional instructional models that rely solely on teacher-led instruction may negatively impact students' engagement in learning.	3.75	0.678	High	28

Table 4.2 (Continued)

(N=150)

Factors	μ	σ	Interpretation	Ranking within All Factors
28. Course materials include a combination of traditional textbooks and online resources to broaden students' knowledge and exposure to computer applications and problem-solving techniques.	3.90	0.693	High	3
29. Well-maintained classrooms and multimedia facilities, including computers, projectors, and large screens, are essential for creating an effective learning environment.	3.87	0.691	High	4
30. The university provides a stable and high-speed network throughout the campus, Ensuring smooth access to online learning resources and supporting the flipped classroom model.	3.70	0.693	High	30
Total Average	**3.81**	**0.685**	**High**	

From Table 4.2 indicates that internal factors affecting the learning achievement of the Computer Application Basics course are found to be at a high level overall (μ=3.81). Considering each item individually, it was found that No.15 - Students respect and trust their teachers' expertise in organizing and managing the flipped classroom model have the highest mean (μ=4.10), followed by No.1 - Students are very interested in the flipped classroom instructional model in the Computer Application Basics course (μ=4.10), and then No.5 - Students believe that flipped classroom and online learning can help them improve their problem-solving skills (μ=4.04), and the lowest mean is No.8 - Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model (μ= 3.64).

For external factors affecting the learning achievement of the Computer Application Basics course, the overall level is found to be moderate (μ=3.81). Considering each item individually, it was found that No.24 - The teaching methods employed in the flipped classroom model align with the course objectives and content has the highest mean (μ=3.94), followed by No.28 - Course materials include a combination of traditional textbooks and online resources to broaden students' knowledge and exposure to computer applications and problem-solving techniques (μ= 3.90), and the lowest mean is No.26 - Course materials and presentations are carefully designed, well-organized, and visually appealing (μ= 3.70).

Table 4.3 Common data of the respondent in A. major in Computer Science and Technology.

(n=50)

Data	Frequency	Percentage
Gender		
Male	23	46.00
Female	27	54.00
Total	**50**	**100.00**
Age		
below 17 yrs.	3	6.00
18-20 yrs.	34	68.00
21-23 yrs.	13	26.00
over 23 yrs.	0	0.00
Total	**50**	**100.00**

From table 4.3 the common data of the respondent majoring in Computer Science and Technology, the number of male and female participants is similar with 54% female and 46% male. The most age is 19-20 yrs, 68%.

Table 4.4 The result of questionnaire from students in A. major in Computer Science and Technology.

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
Internal Factor (respondents)				
1. Students are very interested in the flipped classroom instructional model in the Computer Application Basics course.	4.08	0.680	High	8
2. Students actively participate in problem-solving activities and discussions through online platforms.	3.78	0.794	High	19
3. Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course.	4.06	0.658	High	4
4. Students plan their study for the Computer Application Basics course using self-study, IT, and teacher/peer support.	3.90	0.703	High	12
5. Students believe that flipped classroom and online learning can help them improve their problem-solving skills.	4.02	0651	High	16
6. Students believe teacher assignments and feedback help them apply knowledge to real-world scenarios.	3.92	0.733	High	11
7. Students provide objective feedback on their teachers and the online learning platform to improve their learning experience.	3.98	0.669	High	3
8. Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model.	3.78	0.684	High	20

Table 4.4 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
9. Students are satisfied with the interaction between themselves and the online learning resources provided in the flipped classroom model.	4.00	0.665	High	5
10. Students can develop new insights based on their experiences with practical problem-solving tasks.	3.90	0.717	High	13
11. Students can effectively prepare for the course by completing pre-class tasks and assignments.	3.98	0.681	High	7
12. Students develop a sense of accomplishment and pride through their engagement in various problem-solving	3.86	0.733	High	16
13. Students can develop new insights and perspectives based on their experiences with the flipped classroom model.	3.84	0.671	High	15
14. Students believe that they can succeed in the Computer Application Basics course with the help of online learning platforms and resources.	3.78	0.746	High	21
15. Students respect and trust their teachers' expertise in organizing and managing the flipped classroom model.	3.90	0.725	High	14
Total Average	**3.98**	**0.668**	**High**	
External factors (teacher, material and circumstance)				
16. The lecturers utilize modern instructional approaches, such as video lectures, computer simulations, to engage students in problem-solving activities.	3.72	0.695	High	22

Table 4.4 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
17. The lecturers pay close attention to students' engagement and participation in course activities.	3.72	0.738	High	23
18. The lecturers' evaluation methods include formative and summative assessments, incorporating various types of tasks and assignments.	3.66	0.731	High	25
19. The lecturers use a combination of self-assessment, peer assessment, and teacher assessment to evaluate students' performance.	3.78	0.715	High	17
20. The lecturers emphasize the application and function of information technology in the Computer Application Basics course.	3.76	0.735	High	18
21. The lecturers treat each student equally, fostering confidence and reducing anxiety in problem-solving activities.	3.82	0.696	High	9
22. The lecturers combine traditional classroom assessments with modern online assessment systems to evaluate students' learning progress.	3.88	0.786	High	10
23. The lecturers provide appropriate feedback to students using various methods, such as face-to-face communication, written comments, and voice or video messages.	3.78	0.748	High	24
24. The teaching methods employed in the flipped classroom model align with the course objectives and content.	3.74	0.727	High	26

Table 4.4 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
25. The instructional model engages students' interests and meets their contemporary needs, such as the use of technology and online resources.	3.68	0.748	High	27
26. Course materials and presentations are carefully designed, well-organized, and visually appealing.	3.80	0.734	High	2
27. Traditional instructional models that rely solely on teacher-led instruction may negatively impact students' engagement in learning.	3.68	0.695	High	28
28. Course materials include a combination of traditional textbooks and online resources to broaden students' knowledge and exposure to computer applications and problem-solving techniques.	3.80	0.740	High	1
29. Well-maintained classrooms and multimedia facilities, including computers, projectors, and large screens, are essential for creating an effective learning environment.	3.84	0.706	High	30
30. The university provides a stable and high-speed network throughout the campus, ensuring smooth access to online learning resources and supporting the flipped classroom model.	3.86	0.703	High	29
Total Average	**3.78**	**0.704**	**High**	

From Table 4.4 indicates that internal factors affecting the Computer Application Basics course enhance learning achievement of undergraduate students overall found at a high level (μ= 3.98). Considering only each item, it was found that No.7 - Students provide objective feedback on their teachers and the online learning platform to improve their learning experience has the highest mean (μ= 4.08), followed by No. 3 - Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course (μ=4.06) and the lowest mean is No. 2 - Students actively participate in problem-solving activities and discussions through online platforms (μ=3.78).

For external factors affecting the Computer Application Basics course enhance learning achievement of undergraduate students overall found at a moderate level (μ=3.78). Considering only each item, it was found that No. 26 - Course materials and presentations are carefully designed, well-organized, and visually appealing has the highest mean (μ=3.80), followed by No. 21 - The lecturers treat each student equally, fostering confidence and reducing anxiety in problem-solving activities (μ=3.82) and the lowest mean is No. 18 - The lecturers' evaluation methods include formative and summative assessments, incorporating various types of tasks and assignments (μ=3.66).

Table 4.5 Common data of the respondent in B.majoring in Software Engineering.

(n=50)

Data	Frequency	Percentage
Gender		
Male	23	46.00
Female	27	54.00
Total	**50**	**100.00**
Age		
below 17 yrs.	0	0.00
18-20 yrs.	34	68.00
21-23 yrs.	16	32.00
over 23 yrs.	0	0.00
Total	**50**	**100.00**

From table 4.5 the common data of the respondent majoring in Software Engineering the most gender is female, 54% .The most age is 18-20 yrs, 68%.

Details: The gender distribution among Software Engineering majors is relatively balanced, with females slightly outnumbering males. Specifically, 54% (27 out of 50) of the respondents are female, while males constitute 46% (23 out of 50). The majority of Software Engineering students fall within the 18-20 years age group, representing 68% (34 out of 50) of the respondents.

Table 4.6 The result of questionnaire from students in B. majoring in Software Engineering.

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
Internal Factor (respondents)				
1. Students are very interested in the flipped classroom instructional model in the Computer Application Basics course.	4.00	0.707	High	6
2. Students actively participate in problem-solving activities and discussions through online platforms.	3.97	0.793	High	10
3. Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course.	4.03	0.706	High	1
4. Students create a study schedule for the Computer Application Basics course, incorporating self-study, information technology, and support from teachers and peers.	3.89	0.807	High	16
5. Students believe that flipped classroom and online learning can help them improve their problem-solving skills.	3.96	0.761	High	15

Table 4.6 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
6. Students think that the assignments provided by teachers and the feedback received can help them better apply their knowledge to real-world situations.	3.81	0.837	High	21
7. Students provide objective feedback on their teachers and the online learning platform to improve their learning experience.	3.93	0.745	High	4
8. Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model.	3.87	0.754	High	29
9. Students are satisfied with the interaction between themselves and the online learning resources provided in the flipped classroom model.	3.91	0.733	High	28
10. Students can develop new insights based on their experiences with practical problem-solving tasks.	3.94	0.738	High	23
11. Students can effectively prepare for the course by completing pre-class tasks and assignments.	3.94	0.755	High	20
12. Students develop a sense of accomplishment and pride through their engagement in various problem-solving activities.	3.92	0.751	High	25
13. Students can develop new insights and perspectives based on their experiences with the flipped classroom model.	3.93	0.762	High	13
14. Students believe that they can succeed in the Computer Application Basics course with the help of online learning platforms and resources.	3.86	0.797	High	30

Table 4.6 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
15. Students respect and trust their teachers' expertise in organizing and managing the flipped classroom model.	3.90	0.760	High	24
Total Average	**3.92**	**0.748**	**High**	
External factors (teacher, material and circumstance)				
16. The lecturers utilize modern instructional approaches, such as video lectures, computer simulations, to engage students in problem-solving activities.	3.91	0.736	High	26
17. The lecturers pay close attention to students' engagement and participation in course activities.	3.97	0.739	High	27
18. The lecturers' evaluation methods include formative and summative assessments, incorporating various types of tasks and assignments.	3.92	0.748	High	7
19. The lecturers use a combination of self-assessment, peer assessment, and teacher assessment to evaluate students' performance.	3.94	0.772	High	8
20. The lecturers emphasize the application and function of information technology in the Computer Application Basics course.	3.93	0.760	High	14
21. The lecturers treat each student equally, fostering confidence and reducing anxiety in problem-solving activities.	3.87	0.743	High	11
22. The lecturers combine traditional classroom assessments with modern online assessment systems to evaluate students' learning progress.	3.92	0.741	High	17

Table 4.6 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
23. The lecturers provide appropriate feedback to students using various methods, such as face-to-face communication, written comments, and voice or video messages.	3.86	0.765	High	22
24. The teaching methods employed in the flipped classroom model align with the course objectives and content.	3.93	0.755	High	2
25. The instructional model engages students' interests and meets their contemporary needs, such as the use of technology and online resources.	3.92	0.751	High	3
26. Course materials and presentations are carefully designed, well-organized, and visually appealing.	3.88	0.743	High	5
27. Traditional instructional models that rely solely on teacher-led instruction may negatively impact students' engagement in learning.	3.92	0.741	High	19
28. Course materials include a combination of traditional textbooks and online resources to broaden students' knowledge and exposure to computer applications and problem-solving techniques.	3.94	0.738	High	12
29. Well-maintained classrooms and multimedia facilities, including computers, projectors, and large screens, are essential for creating an effective learning environment.	3.87	0.752	High	18

Table 4.6 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
30. The university provides a stable and high-speed network throughout the campus, ensuring smooth access to online learning resources and supporting the flipped classroom model.	3.90	0.752	High	9
Total Average	**3.92**	**0.746**	**High**	

From Table 4.6 indicates that internal factors affecting the Computer Application Basics course enhance learning achievement of majoring in Software Engineering overall found at a high level (μ= 3.92). Considering each item individually, it was found that NO. 3 - Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course has the highest mean (μ=4.03), followed by NO.1 - Students are very interested in the flipped classroom instructional model in the Computer Application Basics course (μ=4.00), and the lowest mean is NO. 6 - Students think that the assignments provided by teachers and the feedback received can help them better apply their knowledge to real-world situations (μ=3.81).

For external factors affecting the Computer Application Basics course, learning achievement of majoring in Software Engineering overall is found at a high level (μ=3.92). Considering each item individually, it was found that NO. 17 - The lecturers pay close attention to students' engagement and participation in course activities has the highest mean (μ=3.97), followed by NO. 16 - The lecturers utilize modern instructional approaches, such as video lectures, computer simulations, to engage students in problem-solving activities (μ=3.91), and the lowest mean is NO. 23 - The lecturers provide appropriate feedback to students using various methods, such as face-to-face communication, written comments, and voice or video messages (μ=3.86).

Table 4.7 Common data of the respondent in C. majoring in Information Security.

(n=50)

Data	Frequency	Percentage
Gender		
Male	8	16.00
Female	42	84.00
Total	**50**	**100. 00**
Age		
below 17 yrs.	1	2.00
18-20 yrs.	36	72.00
21-23 yrs.	13	26.00
over 23 yrs.	0	0.00
Total	**50**	**100. 00**

From table 4.7 the common data of the respondent majoring in Information Security. the most gender is female, 84%. the most age is 19-20 yrs, 72%.

Based on the provided data, it is evident that there is a significant gender disparity among students majoring in Information Security, with females comprising the majority. Specifically, 84% (42 out of 50) of the respondents are female, while males represent only 16% (8 out of 50). This substantial female majority is noteworthy and prompts further investigation into the factors contributing to this gender distribution in the Information Security major. The majority of students are within the 18-20 years age bracket, accounting for 72% of the respondents.

Table 4.8 The result of questionnaire from students in C. majoring in Information Security.

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
Internal Factor (respondents)				
1. Students are very interested in the flipped classroom instructional model in the Computer Application Basics course.	3.96	0.694	High	9
2. Students actively participate in problem-solving activities and discussions through online platforms.	3.68	0.798	High	16
3. Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course.	3.94	0.686	High	2
4. Students create a study schedule for the Computer Application Basics course, incorporating self-study, information technology, and support from teachers and peers.	3.76	0.754	High	14
5. Students believe that flipped classroom and online learning can help them improve their problem-solving skills.	3.92	0.641	High	12
6. Students think the assignments provided by teachers and the feedback received can help them better apply their knowledge to real-world situations.	3.76	0.724	High	22
7. Students provide objective feedback on their teachers and the online learning platform to improve their learning experience.	3.80	0.686	High	3

Table 4.8 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
8. Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model.	3.64	0.729	High	28
9. Students are satisfied with the interaction between them selves and the online learning resources provided in the flipped classroom model.	3.86	0.688	High	25
10. Students can develop new insights based on their experiences with practical problem-solving tasks.	3.78	0.701	High	17
11. Students can effectively prepare for the course by completing pre-class tasks and assignments.	3.94	0.705	High	23
12. Students develop a sense of accomplishment and pride through their engagement in various problem-solving activities.	3.82	0.660	High	24
13. Students can develop new insights and perspectives based on their experiences with the flipped classroom model.	3.80	0.704	High	27
14. Students believe that they can succeed in the Computer Application Basics course with the help of online learning platforms and resources.	3.82	0.724	High	29
15. Students respect and trust their teachers' expertise in organizing and managing the flipped classroom model.	3.86	0.684	High	26
Total Average	**3.86**	**0.682**	**High**	

Table 4.8 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
External Factor (Teacher, material, and circumstance)				
16. The lecturers utilize modern instructional approaches, such as video lectures, computer simulations, to engage students in problem-solving activities.	3.74	0.699	High	20
17. The lecturers pay close attention to students' engagement and participation in course activities.	3.70	0.733	High	19
18. The lecturers' evaluation methods include formative and summative assessments, incorporating various types of tasks and assignments.	3.68	0.731	High	5
19. The lecturers use a combination of self-assessment, peer assessment, and teacher assessment to evaluate students' performance.	3.76	0.722	High	13
20. The lecturers emphasize the application and function of information technology in the Computer Application Basics course.	3.76	0.727	High	1
21. The lecturers treat each student equally, fostering confidence and reducing anxiety in problem-solving activities.	3.80	0.690	High	8
22. The lecturers combine traditional classroom assessments with modern online assessment systems to evaluate students' learning progress.	3.84	0.756	High	18
23. The lecturers provide appropriate feedback to students using various methods, such as face-to-face communication, written comments, and voice or video messages.	3.74	0.730	High	10
24. The teaching methods employed in the	3.72	0.711	High	6

Table 4.8 (Continued)

(n=50)

Factors	μ	σ	Interpretation	Ranking within All Factors
flipped classroom model align with the course objectives and content.				
25. The instructional model engages students' interests and meets their contemporary needs, such as the use of technology and online resources.	3.68	0.732	High	11
26. Course materials and presentations are carefully designed, well-organized, and visually appealing.	3.78	0.733	High	4
27. Traditional instructional models that rely solely on teacher-led instruction may negatively impact students' engagement in learning.	3.66	0.695	High	30
28. Course materials include a combination of traditional textbooks and online resources to broaden students' knowledge and exposure to computer applications and problem-solving techniques.	3.78	0.718	High	15
29. Well-maintained classrooms and multimedia facilities, including computers, projectors, and large s creens, are essential for creating an effective learning environment.	3.82	0.711	High	21
30. The university provides a stable and high-speed network throughout the campus, ensuring smooth access to online learning resources and supporting the flipped classroom model.	3.84	0.698	High	7
Total Average	**3.74**	**0.701**	**High**	

Table 4.8 indicates that internal factors affecting Computer Application Basics course learning achievement of majoring in Information Security are overall at a high level (μ= 3.86). Considering each item individually, it was found that No. 1 - Students are very interested in the flipped classroom instructional model in the Computer Application Basics course has the highest mean (μ= 3.96), followed by No.11 - Students can effectively prepare for the course by completing pre-class tasks and assignments (μ=3.94), and the lowest mean is No.8 - Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model (μ=3.64).

For external factors affecting Computer Application Basics course learning achievement of majoring in Information Security, the overall level is moderate (μ= 3.74). Considering each item individually, it was found that No.30 - The university provides a stable and high-speed network throughout the campus, ensuring smooth access to online learning resources and supporting the flipped classroom model has the highest mean (μ=3.84), followed by No.22 - The lecturers combine traditional classroom assessments with modern online assessment systems to evaluate students' learning progress (μ=3.84), and the fewest mean is No.18 - The lecturers' evaluation methods include formative and summative assessments, incorporating various types of tasks and assignments (μ=3.68).

Table 4.9 Common data of the respondent in overall

(N=3)

Data	Frequency	Percentage
Gender		
Male	2	66.70
Female	1	33.30
Total	**3**	**100.00**
Experience teaching		
below 3 yrs.	1	33.33
3-6 yrs.	1	33.33
7- 9 yrs.	1	33.33
over 9 yrs.	0	0
Total	**3**	**100.00**

Table 4.9 (Continued)

(N=3)

Data	Frequency	Percentage
Age		
below 30 yrs.	1	33.33
30-40 yrs.	1	33.33
41-50 yrs.	0	0.00
over 50 yrs.	1	33.33
Total	**3**	**100.00**

From table 4.9, the common data of the lecturers shows that the most common gender is male, representing 66.7% of the respondents, while female lecturers make up 33.3% of the sample.

Interview Results

After the results from interview with the 3 lecturers, the factors affecting Students' problem-solving skills can be concluded as follows.

Internal Factors

Physics: All three lecturers employ active teaching methodologies that likely require a certain level of physical engagement from students, including interactive lectures, hands-on lab sessions, and practical projects. This engagement may help students stay focused and retain information better. Furthermore, the requirement of physical presence in lab sessions and class discussions underlines the importance of health and stamina.

Psychology: Each lecturer employs strategies to enhance students' motivation and interest in the subject. For instance, Lecturer A incorporates real-world applications and problems into assignments and coding competitions, while Lecturer B uses a project-based approach and encourages peer collaboration. Lecturer C engages students through real-world security scenarios, simulations, and cybersecurity competitions. These strategies likely promote a positive learning mindset and boost students' confidence and problem-solving abilities.

External Factors

Social environment All three lecturers promote an interactive and collaborative learning environment. They encourage group discussions, peer reviews, and collaborative projects, which can enhance students' social interaction, teamwork skills, and mutual learning.

Materials Each lecturer uses a variety of instructional materials, including lecture notes, online resources, coding platforms, software engineering tools, and simulations. These materials are used to facilitate learning, illustrate complex concepts, and enable students to apply their knowledge in practical tasks.

Teaching methods The lecturers use a range of teaching methods tailored to their specific courses. These include interactive lectures, flipped classroom approach, project-based learning, and blended learning approaches that combine lectures, online resources, and hands-on activities.

Class size While not directly mentioned, class size can potentially impact teaching methods and student engagement. A smaller class size might allow for more personalized attention and interactive learning experiences, while a larger class size might necessitate more lecture-based teaching and independent learning.

Evaluation All lecturers employ a mixture of formative and summative assessments, including exams, assignments, and projects. These evaluations not only measure students' understanding and skill levels but also provide opportunities for feedback and improvement. Peer reviews and presentations are also used as forms of assessment, allowing for student self-reflection and peer learning..

In summary, these internal and external factors highlight the complex interplay between a student's physical and psychological state, the social learning environment, available learning materials, teaching methods, class size, and evaluation methods in shaping their learning outcomes and experiences.

Table 4.10 Problem solving skills below.

Factor	Internal factors	External factors
Students' opinion	1) Students recognize the importance of preparation for the Computer Application Basics course and create effective study schedules. 2) They diligently complete pre-class tasks and value the interactive environment of the flipped classroom model. 3) There's a pronounced interest from students in the flipped classroom approach. 4) They actively participate in problem-solving activities, believing this enhances their skills.	1) Teaching methods: Students appreciate modern instructional approaches and the use of information technology in the flipped classroom model. 2) Students value a blend of self, peer, and teacher assessments with relevant feedback. 3) Equal treatment: Students value fairness and lecturer attention in activities. 4) Course materials: Effective learning stems from quality textbooks and online resources. 5) University infrastructure: Reliable, high-speed campus networks are crucial for online resources and the flipped classroom approach.
Lecturers' opinion	1) Lecturers utilize active teaching methods like interactive lectures, labs, and projects. 2) Such methods demand physical engagement, emphasizing the significance of health and stamina for students. 3) Lecturers imlement strategies highlighting real-world applications to boost motivation.	1) Social environment: Lecturers promote an interactive and collaborative learning environment, enhancing students' social interaction, teamwork skills, and mutual learning. 2) Materials: Diverse instructional tools are used to clarify concepts and apply knowledge practically.

Table 4.10 (Continued)

Factor	Internal factors	External factors
Lecturers' opinion	4) They use project-based approaches to foster deeper understanding and application.	3) Teaching Methods: Lecturers use methods like interactive lectures, flipped classrooms, and blended project-based learning. 4) Class size: Smaller classes give individual attention, while larger ones lean on independent learning, influencing teaching methods.
Synthesized data	1) Lecturers and students both understand the value of maintaining motivation and interest in the learning process. 2) Students are very interested in Chinese culture. Lecturers be prepared for teaching, and both students and instructors can actively participate in teaching. 3) Lecturers should guide students to have the perseverance to solve difficulties and be willing to actively explore knowledge after class. 4) Before starting a new lesson, lecturers should prepare students emotionally, focus their attention, review basics, and assist in knowledge enhancement. 5) Students are not satisfied with the teacher's teaching methods	1) Physical: Lecturers emphasize active teaching methods tailored for effective student engagement. 2) They carefully design these methods to cater to every student's learning needs. 3) Students, on their part, gear up both physically and mentally to maximize focus during learning. 4) Psychological: Lecturers employ real-world applications and projects to enhance motivation. 5) Students actively engage in problem-solving, cultivating a positive learning mindset and enhancing their skills.

Table 4.10 From the table 4.10, it is evident that internal factors affecting students' learning involve their motivation and interest. Lecturers utilize strategies such as real-world applications and project-based approaches, while students actively participate in problem-solving activities. This results in a positive learning mindset and improved problem-solving abilities.

External factors, such as equal treatment, social environment, course materials, class size, infrastructure, and evaluation, also play a significant role in students' learning experiences. Students prefer equal treatment and an interactive learning environment that enhances social interaction and teamwork skills. Well-designed materials contribute to effective learning, with class size impacting teaching methods and engagement. A stable, high-speed campus network supports various teaching methods and assessments, benefiting both students and lecture.

Part 2: To develop flipped classroom instructional model to enhance undergraduate students' problem-solving skills.

To serve objective 2, the collected data of confirming the appropriateness of 6 components of instructional model are analyzed in 4 areas, i.e., utility, feasibility, propriety, and accuracy and presented by frequency and percentage of the specialists as shown in table and description below.

Table 4.11 Frequency and percentage of confirmability of utility, feasibility, propriety, and accuracy of the instructional model components in 6 areas by specialists

No.	Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem-Solving Skills	Opinion of the specialists							
		Utility		Feasibility		Propriety		Accuracy	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Principle and Rationale	5	100	5	100	5	100	5	100
2	Objectives	5	100	5	100	5	100	5	100
3	Contents	5	100	5	100	5	100	5	100
4	Methods of Teaching & Materials	5	100	5	100	5	100	5	100
5	Evaluation	5	100	5	100	5	100	5	100

From table 4.11 the confirmability of each component of the instructional model by 5 specialists can be elaborated as follows.

Principle and Rationale

The utility of principle and rationale of the instructional model is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Objectives

The objectives of principle and rationale of the instructional model is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Contents

The contents of principle and rationale of the instructional model is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Methods of Teaching & Materials

The methods of teaching & materials of principle and rationale of the instructional model is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Evaluation

The evaluation of teaching & materials of principle and rationale of the instructional model is confirmed to be appropriate by 5 specialists 100% of all specialists; feasibility 5 specialists 100%; propriety 5 specialists 100%; and accuracy 5 specialists 100%.

Summary: Development of Flipped Classroom Instructional Model Implementation Step Framework mainly refers to five aspects of standards by the researcher.

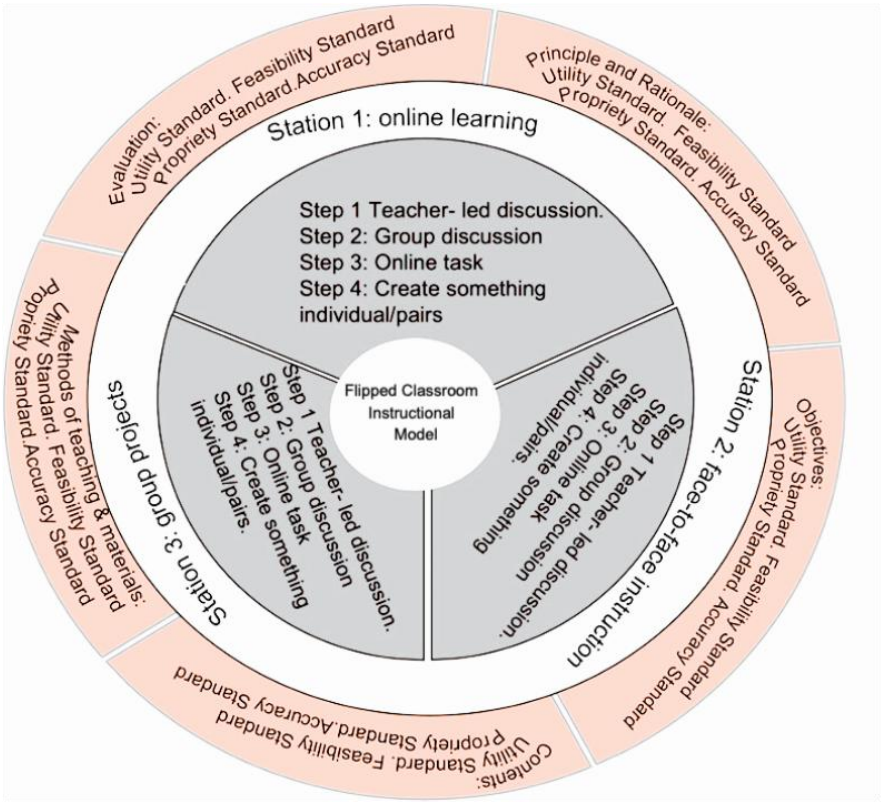

Figure 4.1 Development of Blend-Based Learning Model Implementation Step Framework mainly refers to five aspects of standards

From Figure 4.1 Development of Flipped Classroom Instructional model mainly refers to five aspects of standards: Principle and Rationale, Objectives, Contents, Methods of teaching & materials, Evaluation. Blended-based learning model refers to categories consisting of Station Rotation Model (Staker.H & Horn.M, 2012). Students rotate on a fixed schedule among various modalities, Include 3 learning stations: 1) online learning; 2) face -to-face instruction; 3) group projects. For example, a learner may complete an assignment online, then participate in a group activity, and, finally, engage in teacher-led instruction. Students tend to be grouped by learning styles, skills, or needs. Consists of 4 steps: Teacher-led discussion, Group discussion, Online task, Create something individual/pairs.

Part 3: To examine the results implementing flipped classroom instructional model to enhance undergraduate students' problem-solving skills.

Objective 3 analysis results are presented by reporting students' performance according to rubric score-based assessment criteria and satisfaction of learning students' problem-solving skills Through flipped classroom instructional model as specified in chapter 3 with tables and descriptive analysis.

Table 4.12 Frequency and percentage of students' performance quality on basis of holistic rubric-score assessment

Aspects of assessment	μ	σ	Interpretation of quality level	Rank
Knowledge and skills	11.47	1.72	Good	3
Process and methods	11.80	1.83	Good	2
Attitude and values	12.30	1.58	Good	1
Average (Analytic RSA)	**11.86**	**1.71**	**Good**	
Average Total Scores (Holistic RSA)	**35.57**	**4.30**	**Good**	

Table 4.12 indicates that after implementing flipped classroom instructional model, students' performance assessed by analytic RSA at Excellent level (μ = 11.86) and holistic rubric-scoring at Good level (μ = 35.57) For analytic RSA results, Attitude and values is the aspect the students can develop most obviously followed by Process and methods and Knowledge and skills.

Table 4.13 Relative Developmental Score of Students' Problem-Solving Skills Enhancement Through Flipped Classroom: mini video over all

Development level	Frequency	Percentage
Excellent	0	0.00%
Good	25	83.33%
Medium	1	3.33%
Pass	4	13.33%
Poor	0	0.00%
Total	**30**	**100.00%**

From Table 4.13, the majority of students (83.33%) demonstrated good problem-solving skills. To be more specific, 0 students (0%) achieved an excellent level, 25 students (83.33%) reached a good level, 1 student (3.33%) was at the medium level, and 4 students (13.33%) were at the pass level. There were no students in the poor level for problem-solving skills.

Overall, from Table 4.13, it can be observed that most students (83.33%) improved their problem-solving skills after the implementation of the flipped classroom instructional model. This finding is consistent with the research hypothesis stating that after implementing the flipped classroom instructional model, students' problem-solving skills will be overall improved at 80% (Good Level or higher). Therefore, we can conclude that the flipped classroom instructional model is effective in enhancing students' problem-solving skills.

Table 4.14 Relative Developmental Score of Students' Problem-Solving Skills Enhancement Through Flipped Classroom: Knowledge and Skills Criteria Evaluation

Development level	Frequency	Percentage
Excellent	8	26.67%
Good	18	60.00%
Medium	4	13.33%
Pass	0	0%
Poor	0	0%
Total	**30**	**100.00**

From Table 4.14, most students (86.67%) have achieved a good or excellent level of problem-solving skills, exceeding the expected 80% in the research hypothesis. This indicates that the flipped classroom instructional model has a significant positive impact on students' problem-solving skills.

Table 4.15 Relative Developmental Score of Students' Problem-Solving Skills Enhancement Through Flipped Classroom: process and method

Development level	Frequency	Percentage
Excellent	11	36.67%
Good	15	50.00%
Medium	4	13.33%
Pass	0	0%
Poor	0	0%
Total	**30**	**100.00**

From Table 4.15, most students (86.67%) achieved at least a Good level of problem-solving skills, with 36.67% reaching an Excellent level and 50% reaching a Good level. This supports the research hypothesis that implementing the flipped classroom instructional model can improve students' problem-solving abilities.

Table 4.16 Relative Developmental Score of Students' Problem-Solving Skills Enhancement Through Flipped Classroom: attitude and values

Development level	Frequency	Percentage
Excellent	18	60.00%
Good	10	33.33%
Medium	2	6.67%
Pass	0	0%
Poor	0	0%
Total	**30**	**100.00**

From Table 4.16, most students (93.33%) achieved good (33.33%) or excellent (60.00%) problem-solving skills after implementing the flipped classroom model of instruction. This supports our research hypothesis that the flipped classroom instructional model has a positive impact on students' problem-solving skills.

Only 6.67% of the students achieved a medium level of problem-solving skills after implementing the flipped classroom model of instruction. This indicates

that while the majority of students benefit from the flipped classroom model of instruction, there are still some students who need additional support and resources to improve their problem-solving skills.

There were no students with pass or poor problem-solving skills. This further confirms the positive effect of the flipped classroom model of instruction on students' problem-solving skills.

Chapter 5
Conclusion, Discussion and Recommendations

The result in the study of “Development of flipped classroom instructional model to enhance undergraduate students’ problem - solving skills”, the researcher presented the documents concerning the following.

Conclusion

From the objectives of research

1. The factors which promote learning achievement in the Computer Application Basics course encompass two main categories: Internal factors and external factors.

For internal factors affecting learning achievement, data analysis results reveal several significant elements. These factors are indicative of the students' engagement and perspective on the instructional model, particularly the flipped classroom model. The results highlight that students are very interested in the flipped classroom instructional model and highly respect and trust their teachers' expertise in organizing and managing this method (μ=4.10). Other influential internal factors include the belief that flipped classrooms and online learning can help improve problem-solving skills (μ=4.04), and the lowest mean, representative of students' appreciation for the cooperative and interactive learning environment, is found at 3.64.

On the external front, factors related to the learning achievement of the Computer Application Basics course are found to be moderate (μ=3.81). These include Teaching Methods (such as the alignment of the flipped classroom model with course objectives and content, μ=3.94), Course Materials (a combination of traditional textbooks and online resources, μ=3.90), and Learning Environment (including the necessity of well-maintained classrooms and multimedia facilities, μ=3.87). The lowest mean is observed in the design and organization of course materials and presentations (μ=3.70).

In summary, the internal and external factors influencing the learning achievement in the Computer Application Basics course offer a multifaceted understanding of students' engagement, the efficacy of teaching methods, and the integration of technology. This analytical approach provides insightful observations and indicates areas of further exploration to enhance learning outcomes in this technological educational landscape.

2. Flipped classroom instructional model to enhance undergraduate students' problem - solving skills include 5 components: 1 (Principle and Rationale, 2(Objectives, 3. Contents, 4(Method of teaching & Materials and 5 (Evaluation. The model is 100% conformed to utility, feasibility, propriety, and accuracy as assessed by 5 specialists. 3. Research findings among 30 students reveal that 83.33% demonstrated good problem-solving skills, with 25 at a good level, 1 at medium, and 4 at pass level, while none were at a poor level. Overall, this indicates that the implementation of the flipped classroom instructional model has led to an improvement in students' problem-solving abilities, aligning with the hypothesis that predicted an overall improvement of 80% to a good level or higher, thus affirming the effectiveness of this instructional approach.

Discussions

In the study of "Development of flipped classroom instructional model to enhance undergraduate students' problem - solving skills", the researcher presented the documents concerning the following.

1. The effectiveness of the flipped classroom model in bolstering undergraduate students' problem-solving abilities is well-supported both by student feedback and scholarly research. Bishop & Verleger (2013) associate enhanced problem-solving skills with students' deeper comprehension of course content facilitated by the flipped classroom. Additionally, Abeysekera & Dawson (2015) emphasize the model's role in offering personalized learning experiences, enabling students to learn at their pace, and consequently fostering self-directed learning abilities crucial for problem-solving. Students' positive responses, marked by a high overall rating (μ=3.89), further testify to the model's efficacy, attributing their

enhanced engagement and learning outcomes to the interactive and dynamic nature of this instructional approach.

Conversely, external factors received a moderate overall rating (μ=3.81), indicating room for enhancement in aligning teaching methods with course objectives and content. A blend of traditional and online learning resources, as highlighted in item 28, underscores the comprehensive learning experience's role in sharpening problem-solving skills. In summation, the synergy of well-structured flipped classroom models, active student engagement, and diverse, well-aligned learning resources emerges as instrumental in enhancing problem-solving competencies, corroborated by both student feedback and academic research.

2. The 5 components of the instructional model are confirmed by five specialists to be appropriate for further implementation. The confirmability results can be supported by unanimous agreement from the specialists across all components, utility, feasibility, propriety, and accuracy. According to the results of the survey, there are two main reasons that support the effectiveness of the flipped classroom model in enhancing problem-solving skills:

1) The flipped classroom model has been shown to improve students' engagement and active learning, which are essential for developing problem-solving skills (Abeysekera & Dawson, 2015). This suggests that the flipped classroom model's design and methodology contribute to a more engaging learning environment, ultimately enhancing students' problem-solving abilities.

2) The flipped classroom model's emphasis on self-directed learning allows students to take greater responsibility for their learning process, which has been linked to improved problem-solving skills (Chen et al., 2014). This indicates that the model's focus on autonomy and self-directed learning is instrumental in fostering students' problem-solving abilities.

In the detailed analysis, it's noteworthy that:

The Principle and Rationale of the instructional model was unanimously confirmed by all the specialists in terms of its utility, feasibility, propriety, and accuracy. This suggests that the underlying theory and reasoning of the flipped classroom model are robust and conducive to improving undergraduate students'

problem-solving skills. This is supported by research showing that the flipped classroom model improves students' engagement and active learning (Abeysekera & Dawson, 2015).

The Objectives of the instructional model were agreed upon by all specialists. This unanimity indicates that the goals set by the model are clear, relevant, and aimed at enhancing students' problem-solving skills. The emphasis on self-directed learning in the flipped classroom model has been linked to improved problem-solving skills (Chen et al., 2014), further supporting the objectives of the instructional model.

The Contents component also received a 100% confirmability score from all the specialists, underlining that the learning material and topics are suitable and well-designed for the model's aim.

The Methods of Teaching & Materials were confirmed to be useful, feasible, proper, and accurate by all specialists. This unanimous agreement confirms that the teaching methods and resources employed are effective for the flipped classroom model and in line with the aim of improving students' problem-solving skills.

The Evaluation component was unanimously confirmed by all specialists, underlining the effectiveness and appropriateness of the evaluation and feedback mechanisms to assess and improve the problem-solving skills of students.

In conclusion, the unanimous confirmation by the specialists in terms of utility, feasibility, propriety, and accuracy attests to the robustness of the flipped classroom instructional model. It strongly suggests that this model, with its components, is well-positioned to enhance undergraduate students' problem-solving skills when implemented correctly.

3. According to the results of the student questionnaire survey, there are two main reasons that support the effectiveness of the flipped classroom model in enhancing problem-solving skills:

1) The flipped classroom model encourages students to engage in autonomous learning outside of the classroom, creating opportunities for in-depth discussions and problem-solving during class time (Bergmann & Sams, 2012). This

suggests that the flipped classroom model helps improve students' problem-solving abilities, as it enables them to focus more on applying their knowledge to solve problems during class.

2) The flipped classroom model promotes collaborative learning, as students are encouraged to work together and share their understanding of the subject matter (Strayer, 2012). This fosters a sense of community among students, which in turn strengthens their problem-solving skills.

Changes and development of students' problem-solving ability as results of providing the treatment - the flipped classroom instructional model can be explained by the following supportive factors.

First, the knowledge and skills gained through this model have played a crucial role. As shown in the data, students have improved their ability to efficiently access, evaluate, and creatively use information. The flipped classroom model requires students to locate and retrieve relevant sources, assess the credibility and reliability of information, and synthesize and apply it creatively. This approach not only improves their research abilities but also enhances their critical thinking skills.

Second, the process and methods employed in this model have been instrumental. The flipped classroom model encourages independent learning and creative expression of information. It facilitates students to take control of their learning, promoting their problem-solving skills, and analytical abilities. The mini video reflections of the students demonstrated self-directed inquiry, understanding of diverse perspectives, and a noticeable enhancement in problem-solving and analytical skills. The research by Bergmann & Sams (2012) and Strayer (2012) supports the effectiveness of the flipped classroom model in promoting autonomous learning and collaboration among students, which in turn strengthens their problem-solving abilities.

Third, the development of emotional attitudes and values associated with the use of information and information technology has been fostered. The flipped classroom model helps students understand the importance of information in society, behave ethically with information and technology, and encourages active collaboration. The model has led students to understand the role of information in

fostering an informed society, display responsible use of information, and actively collaborate for group learning and problem-solving.

In conclusion, these factors - knowledge and skills, process and methods, and emotional attitudes and values - have all significantly contributed to the improvement of students' problem-solving skills. The flipped classroom model has proven to be an effective method to enhance these skills, as shown by the majority of students achieving good or excellent problem-solving skills after its implementation.

Recommendations

The findings from the present study bring twofold suggestions: applicability of the results and future research.

Applicability of the results

1. Implementation of the flipped classroom model: The study has demonstrated that the flipped classroom model effectively improves students' problem-solving skills, particularly in the Computer Application Basics course. As such, it is strongly recommended that educational institutions take note of this and consider incorporating the flipped classroom model into their curriculum. This approach involves inverting the traditional learning environment where students are introduced to new concepts at home, and this knowledge is then deepened through classroom activities. As the results of this study have shown, this teaching methodology stimulates active learning, encouraging students to take more control over their learning process, which in turn fosters a sense of self-efficacy and helps in the development of problem-solving skills.

2. Active teaching methodologies: The study has also highlighted the impact of physical and psychological engagement of students through active teaching methodologies. These include interactive lectures, hands-on lab sessions, practical projects, online learning platforms, etc. Implementing such methodologies in teaching strategies not only ensures students' active participation but also helps them stay focused, motivated, and absorb information better. Moreover, practical projects and lab sessions are particularly significant in the context of Computer

Application Basics course as they provide a hands-on experience to students, allowing them to apply theoretical concepts to real-world situations, thereby enhancing their problem-solving skills.

3. Ethical use of information and technology: One of the important insights gained from this study is the role of ethical values associated with information and technology in enhancing problem-solving skills. Educators and institutions should thus consider incorporating ethical guidelines into their teaching methods and code of conduct. Promoting the responsible use of information, respect for intellectual property, and understanding the societal implications of information technology can lead to a more well-rounded understanding of the course material and foster a healthy learning environment.

Future Research

1. Examination of Different Instructional Models: While the flipped classroom model has demonstrated positive results in this study, an exploration of the effects of alternative instructional models on students' problem-solving skills is warranted. Future research could investigate methodologies such as problem-based learning, inquiry-based learning, or blended learning, assessing their efficacy within the Computer Application Basics course or analogous subjects. Such an investigation could contribute to a more comprehensive understanding of teaching methodologies, thus facilitating the selection and implementation of the most effective teaching methods, tailored to specific course content and learning objectives.

2. Longitudinal Studies: The present study has illustrated the short-term effectiveness of the flipped classroom model in enhancing problem-solving skills. To fully comprehend the long-term ramifications of this pedagogical approach, future research might adopt longitudinal study designs. This could involve tracking students' academic performance, problem-solving capabilities, and even career success over an extended period following the course completion. Such an extended view could furnish a more holistic understanding of the flipped classroom model's long-term influence on students' academic and career paths.

3. Influence of Class Size: The current study did not delve into the impact of class size on the effectiveness of the flipped classroom model. Considering that class size can significantly influence student-teacher interactions, student engagement, and the feasibility of active learning methods, subsequent research should address how class size impacts the implementation and success of the flipped classroom model. Such insights might guide educational institutions in crafting optimal class size policies, thus enabling more personalized learning experiences and further enhancing students' problem-solving skills.

In Conclusion: This study has proffered invaluable insights into the factors that augment problem-solving skills among undergraduate students, specifically within the context of a Computer Application Basics course. The flipped classroom model has emerged as a significant influencer, positively affecting students' problem-solving capacities. Moreover, teaching strategies promoting physical and psychological engagement, coupled with an ethical application of information and technology, have been recognized as integral components of a thriving educational program. Furthermore, this study has laid groundwork for future research avenues. By exploring diverse instructional models, conducting longitudinal assessments for enduring effects, and evaluating class size's influence on model effectiveness, a substantial enhancement in our understanding of teaching methodologies in higher education could be realized. These findings and suggestions are not only indispensable for educators in crafting effective teaching strategies but also vital for educational institutions in policy formulation, thereby nurturing a conducive learning environment that boosts problem-solving skills among students. In essence, the research corroborates that a synergistic blend of engaging teaching methodologies, ethical comprehension, and the flipped classroom model can markedly elevate students' problem-solving abilities, thus equipping them more robustly for forthcoming academic and career endeavors.

References

Abeysekera, L, & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: Definition, rationale and a call for research. *Higher Education Research & Development*, 34(1), 1–14. https://doi.org/10.1080/07294360.2014.934336

Barron, B. (2010). Conceptualizing and tracing learning pathways over time and setting. *Yearbook of the National Society for the Study of Education*, 109(1), 113–127. https://doi.org/10.1016/j.compedu.2009.07.017

Bergmann, J, & Sams, A. (2012). Flip your classroom: Reach every student in every class every day. *International Society for Technology in Education*. https://www.rcboe.org/cms/lib/ga01903614/centricity/domain/15451/flip_your_classroom.pdf

Bishop, J. L, & Verleger, M. A. (2013). *The flipped classroom: A survey of the research. In Proceedings of the Annual Conference of the American Society for Engineering Education.* https://www.researchgate.net/publication/285935974_The_flipped_classroom_A_survey_of_the_research?locale=en

Chavangklang, T, & Suppasetseree, S. (2018). Enhancing thai efl university students' reading comprehension through a flipped cooperative classroom. *People: international journal of social sciences,* 4(3), 238–261. https://doi.org/10.20319/pijss.2018.43.238261

Chen, F, Lui, A. M, & Martinelli, S. M. (2017). A systematic review of the effectiveness of flipped classrooms in medical education. *Medical Education,* 51(6), 585–597. https://doi.org/10.1111/medu.13272

Grigg, J, & Stephens, M. (2018). Flipped classroom instructional model to enhance undergraduate students' problem-solving skills. *Journal of Effective Teaching*, 18(3), 61-77.

Husna,A & Sofnidar,S. (2022). The Effect of Flipped Classroom Model with. Information Search Strategy Through Moodle-Based E-Lematika on Students' Self-Efficacy in Mathematics. *Kontinu,* 6(1), 14-31. https://doi.org/10.30659/kontinu.6.1.14-31

Hew, K. F, & Lo, C. K. (2018). Flipped classroom improves student learning in health professions education: A meta-analysis. *BMC Medical Education*, 18(1), 38. https://doi.org/10.1186/s12909-018-1144-z

Jang, H. Y, & Kim, H. J. (2020). A meta-analysis of the cognitive, affective, and interpersonal outcomes of flipped classrooms in higher education. *Education Sciences*, 10(16). https://doi.org/10.3390/educsci10040115

Li, X, Ye, C, Tang, Y, Zhou, Y, & Hu, X. (2018). Evaluation of the flipped classroom approach in a veterinary professional skills course. *Advances in Medical Education and Practice*, 9, 657–664.

Liljedahl, P. (2014). The Affordances of Using Visibly Random Groups in a Mathematics Classroom. *In Transforming Mathematics Instruction* pp, 127-144. https://link.springer.com/chapter/10.1007/978-3-319-04993-9_8

Ministry of Education of the People's Republic of China. (2010). *National Medium- and Long-term Education Reform and Development Plan* (2010-2020) ,214(2), 75-77

Mulyani, S. (2022). The impact of flipped classroom model on enhancing problem-solving and critical thinking skills. *Journal of Educational Technology*, 19(1), 45-59. https://doi.org/10.21609/jsi.v18i2.1141

Obizoba, C. (2015). Instructional design models—framework for innovative teaching and learning methodologies. *The Business and Management Review*, 6(5).https://cberuk.com/cdn/conference_proceedings/v6%20n5%20bmr%204.pdf?locale=en

Qingdao Huanghai University. (2022). *Computer Applications Basic Course*. The College of Big Data.

Rutz, E, & Ehrlich, S. (2016). Increasing Learner Engagement in Online Learning through Use of Interactive Feedback: Results of a Pilot Study. *Paper presented at 2016 ASEE Annual Conference & Exposition, New Orleans, Louisiana*. https://dx.doi.org/10.18260/p.25672

Hanna, H, Egypt Maritime Transport, A, Haroun, M. H., & Gohar, N. (2020). Developing a framework for block chain adoption using TOE model. *Journal of Business and Retail Management Research*, 15(1). https://dx.doi.org/10.24052/jbrmr/v15is01/art-02

Orange, E, Quadros-Flores, P, & Ferreira, P. C. B. (2019). Who was teaching whom?: flipping higher education. *International Journal of Advanced Engineering Research and Science*, 6(11). https://dx.doi.org/10.22161/ijaers.611.61

Phongsri, P. (2010). Education Research. Bangkok: property Print.

Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, 15(2), 171–193.https://doi.org/10.1007/s10984-012-9108-4

Talbert, R. (2017). *Flipped Learning: A Guide for Higher Education Faculty.* Stylus Publishing, LLC.https://www.routledge.com/Flipped-Learning-A-Guide-for-Higher-Education-Faculty/Talbert/p/book/9781620364314?locale=en

TeachThought. (2013). *The Definition Of The Flipped Classroom*. Retrieved October 1, 2023, from https://www.teachthought.com/learning/definition-flipped-classroom/

Appendixes

Appendix A

List of Specialists and Letters of Specialists Invitation for IOC Verification

List of Specialists and Letters of Specialists Invitation for IOC Verification

1. Assistant Professor Dr. Sarayuth Sethakajorn	Educational Admistration Program Bansomdejchaopraya Rajabhat University
2. Assistant Professor Dr. Prapai Sridama	Computer and Teachbnolog Program Bansomdejchaopraya Rajabhat University
3. Associate Professor Dr.Suriya Phankosol	English Engineering Program Bansomdejchaopraya Rajabhat University
4. Professor Dr. Xu Yanyu	Comparative Education Research Nanning Normal University
5. Assistant Professor Dr. Wei Jiachao	Studies in Curriculum Theory Nanning Normal University

List of experts to evaluate the instructional model

Name of Experts	Position/Office
1. Assistant Professor Dr.Jittawisut Wimutipanya	Science Program Bansomdejchaopraya Rajabhat University
2. Assistant Professor Dr. Wanida Ploysangwal	English Program University of the ThaiChamber of Commerce
3. Associate Professor Dr. Panas Jansritong	Admistration Program Krirk University
4. Assistant Professor Dr. Zhu Kun	Education management Nanning Normal University
5. Assistant Professor Dr.Lu Jianhua	Higher Education Nanning Normal University

Appendix B

Official Letter

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for permission to implement experiment

Dear President of Qingdao Huanghai University

Regarding the thesis entitled " Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills " of Cao Yuewang, a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125 Thailand under the supervision of

Major Advisor : Assistant Professor Dr. Saiphon Songiengchai

Co-advisor : Associate Professor Dr. Areewan Iamsa-ard

Co-advisor : Assistant Professor Dr. Wapee Kong-In

the researcher needs to implement an experiment in compliance with approved methodology and collect data in terms of Undergraduate Students' Problem Solving Skills from computer majoring students from class 1 who enroll in Computer Application Basics Course at Qingdao Huanghai University of Data Science College during the 1st Semester of academic year 2023. Hence, I'm formally requesting permission to implement the experiment and access the aforementioned data.

The researcher plans to use this data for her thesis completion and further necessary publication as required by the Ph.D. course.

I am grateful for your consideration of my request. I pledge to adhere to any stipulations you deem fit. You may reach me at the phone number or email address provided below in case of any related questions. I look forward to your response.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for data collection

Dear President of Qingdao Huanghai University

Attachment 1. 30 copies of questionnaire

2. 1 interview paper

Regarding the thesis entitled " Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills " of Mr.Cao Yuewang , a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125 Thailand under the supervision of

Major Advisor : Assistant Professor Dr. Saiphon Songiengchai

Co-advisor : Associate Professor Dr. Areewan Iamsa-ard

Co-advisor : Assistant Professor Dr. Wapee Kong-In

the researcher needs to collect data using questionnaire in terms of factors undergraduate students' problem solving skills from 2023 year students in Qingdao Huanghai University Hence, I'm formally requesting your assistance in distributing the attached questionnaire to the informants as referred above and please send the completed ones back to the researcher .

The researcher plans to use this data for her thesis completion and further necessary publication as required by the Ph.D. course.

I am grateful for your consideration of my request. I pledge to adhere to any stipulations you deem fit. You may reach me at the phone number or email address provided below in case of any related questions. I look forward to your response.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for research tool validation

Dear Assistant Professor Dr.Sarayut Sethakajorn

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Mr.Cao Yuewang, a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125, Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the written pretest-posttest and questionnaire as instruments will be used in the said research. In view with this, the researcher would like your expertise to validate the attached pretest-posttest and questionnaires to qualify for conduction. Knowing your experience in the field of Education, I would like to ask for your help in validating the said instrument before administering it to the participants of the study.

The research objective, definitions of terms, the pretest-posttest, questionnaire and the validation sheets are hereby attached. I will be glad to hear your suggestions and comments for the improvement of the instrument. Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for research tool validation

Dear Assistant Professor Dr. Prapai Sridama

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Mr.Cao Yuewang, a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125, Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the written pretest-posttest and questionnaire as instruments will be used in the said research. In view with this, the researcher would like your expertise to validate the attached pretest-posttest and questionnaires to qualify for conduction. Knowing your experience in the field of Education, I would like to ask for your help in validating the said instrument before administering it to the participants of the study.

The research objective, definitions of terms, the pretest-posttest, questionnaire and the validation sheets are hereby attached. I will be glad to hear your suggestions and comments for the improvement of the instrument. Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for research tool validation

Dear Associate Professor Dr.Suriya Phankosol

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Mr.Cao Yuewang, a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125, Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the written pretest-posttest and questionnaire as instruments will be used in the said research. In view with this, the researcher would like your expertise to validate the attached pretest-posttest and questionnaires to qualify for conduction. Knowing your experience in the field of Education, I would like to ask for your help in validating the said instrument before administering it to the participants of the study.

The research objective, definitions of terms, the pretest-posttest, questionnaire and the validation sheets are hereby attached. I will be glad to hear your suggestions and comments for the improvement of the instrument. Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for research tool validation

Dear Professor Dr. Xu Yanyu

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Mr.Cao Yuewang, a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125, Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the written pretest-posttest and questionnaire as instruments will be used in the said research. In view with this, the researcher would like your expertise to validate the attached pretest-posttest and questionnaires to qualify for conduction. Knowing your experience in the field of Education, I would like to ask for your help in validating the said instrument before administering it to the participants of the study.

The research objective, definitions of terms, the pretest-posttest, questionnaire and the validation sheets are hereby attached. I will be glad to hear your suggestions and comments for the improvement of the instrument. Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for research tool validation

Dear Assistant Professor Dr. Wei Jiachao

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Mr.Cao Yuewang, a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125, Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the written pretest-posttest and questionnaire as instruments will be used in the said research. In view with this, the researcher would like your expertise to validate the attached pretest-posttest and questionnaires to qualify for conduction. Knowing your experience in the field of Education, I would like to ask for your help in validating the said instrument before administering it to the participants of the study.

The research objective, definitions of terms, the pretest-posttest, questionnaire and the validation sheets are hereby attached. I will be glad to hear your suggestions and comments for the improvement of the instrument. Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for evaluation of instructional model

Dear Associate Professor Jittawisut Wimutipanya

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Cao Yuewang a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125 , Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the instructional model will be developed in the said research.In view with this,there searcher would like your expertise to evaluate the appropriateness of such a developed instructional model. Knowing your experience in the field of Education, I would like to ask for your help in evaluating the said instructional model before its implementation.

I will be glad to hear your suggestions and comments for the improvement of the instructional model.Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for evaluation of instructional model

Dear Assistant Professor Dr.Wanida Ploysangwal

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Cao Yuewang a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125 , Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the instructional model will be developed in the said research.In view with this,there searcher would like your expertise to evaluate the appropriateness of such a developed instructional model. Knowing your experience in the field of Education, I would like to ask for your help in evaluating the said instructional model before its implementation.

I will be glad to hear your suggestions and comments for the improvement of the instructional model.Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for evaluation of instructional model

Dear Dr.Panas Jansritong

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Cao Yuewang a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125 , Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the instructional model will be developed in the said research.In view with this,there searcher would like your expertise to evaluate the appropriateness of such a developed instructional model. Knowing your experience in the field of Education, I would like to ask for your help in evaluating the said instructional model before its implementation.

I will be glad to hear your suggestions and comments for the improvement of the instructional model.Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for evaluation of instructional model

Dear Assistant Professor Dr. Zhu Kun

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Cao Yuewang a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125 , Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the instructional model will be developed in the said research.In view with this,there searcher would like your expertise to evaluate the appropriateness of such a developed instructional model. Knowing your experience in the field of Education, I would like to ask for your help in evaluating the said instructional model before its implementation.

I will be glad to hear your suggestions and comments for the improvement of the instructional model.Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Ref. No. MHESI 0643.14/

Graduate School
Bansomdejchaopraya Rajabhat University
1061 Itsarapap 15 Itsarapap Rd.
Thonburi Bangkok 10600

21 March 2023

Subject Request for evaluation of instructional model

Dear Assistant Professor Dr. Lu Jianhua

Attachment Validation sheets

Regarding the thesis entitled"Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem Solving Skills" of Cao Yuewang a Ph.D. student majoring in Curriculum and Instruction Programme at Bansomejchaopraya Rajabhat University code number 6473103125 , Thailand under the supervision of Assistant Professor Dr. Saiphon Songiengchai as major advisor and Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-in as co-advisors, the instructional model will be developed in the said research.In view with this,there searcher would like your expertise to evaluate the appropriateness of such a developed instructional model. Knowing your experience in the field of Education, I would like to ask for your help in evaluating the said instructional model before its implementation.

I will be glad to hear your suggestions and comments for the improvement of the instructional model.Your positive response is highly appreciated.

Sincerely,

(Asst.Prof.Dr.Kanakorn Sawangcharoen)
Dean of Graduate School
Bansomejchaopraya Rajabhat University

Tel. (662) 4737000
Fax. (662) 4737000

Appendix C

Research Instrument

Questionnaire For students (Objective 1)

Directions:

These questionnaires are the instruments for collecting data in 1st phase of the research entitled "Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem-Solving Skills" conducted by Cao Yuewang, a Ph.D. student in Curriculum and Instruction Programme at Bansomdejchaopraya Rajabhat University under the supervision of Assistant Professor Dr. Saifon Songsiengchai, majoring advisor, Associate Professor Dr.Areewan Iamsa-ard and Assistant Professor Dr.Wapee Kong-In, co-advisor

This questionnaire is divided into 3 sections i.e.

Section 1 Common data of the respondent

Section 2 The information on factors affecting Problem-Solving Skills of the undergraduate students

The questionnaire type is the Closed-ended questions that can only be answered by selecting from provided number to summated rating scale, 5 scales.

The important issues of the items consist of two groups of the factors: Internal factors (respondents) and External factors (teachers, circumstances, etc.)

Section 3 Further suggestions

Data obtained from this questionnaire are only used for the purpose of conducting aforementioned research and remain confidential. Individual or personal data presentation will be avoided.

Answer the questionnaire:

Section 1 Common data of the respondent

Directions: Please put ✓into the ❑ according to your own personal data.

1.Gender

- ❑ Male
- ❑ Female

2.Students from

- ❑ Bozhou Vocational and Technical College
- ❑ Hefei Vocational and Technical College
- ❑ Anhui Vocational and Technical College

3.Age

- ❑ A. below 17 yrs.
- ❑ B. 18-20 yrs.
- ❑ C. 21-23 yrs.
- ❑ D. over 23 yrs.

Section 2 Questionnaire on factors affecting the of ICT Profession literacy of the vocational education students.

Directions*: Please rate the following factors affecting the Integration of Blended Learning Model by putting ✓ into the attitude level column based on the criteria given below. Each question can select only one answer.*

5 means you STRONGLY agree with the item.
4 means you QUITE agree with the item.
3 means you remain NEUTRAL.
2 means you DO NOT QUITE agree with the item
1 means you DO NOT STRONGLY agree with the item

Items	Answers				
	5	4	3	2	1
Internal factors (respondents)					
1. Students are very interested in the flipped classroom instructional model in the Computer .Application Basics course					
2. Students actively participate in problem-solving activities and discussions through online platforms.					
3. Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course.					
4. Students create a study schedule for the Computer Application Basics course, incorporating self-study, information technology, and support from teachers and peers.					
5. Students believe that flipped classroom and online learning can help them improve their problem-solving skills.					

Items	Answers				
	5	4	3	2	1
6. Students think that the assignments provided by teachers and the feedback received can help them better apply their knowledge to real-world situations.					
7. Students provide objective feedback on their teachers and the online learning platform to improve their learning experience.					
8. Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model.					
9. Students are satisfied with the interaction between themselves and the online learning resources provided in the flipped classroom model.					
10. Students can develop new insights based on their experiences with practical problem-solving tasks.					
11. Students can effectively prepare for the course by completing pre-class tasks and assignments.					
12. Students develop a sense of accomplishment and pride through their engagement in various problem-solving activities.					
13. Students can develop new insights and perspectives based on their experiences with the flipped classroom model.					
14. Students believe that they can succeed in the Computer Application Basics course with the help of online learning platforms and resources.					
15. Students respect and trust their teachers' expertise in organizing and managing the flipped classroom model.					
16. The lecturers utilize modern instructional approaches, such as video lectures, computer simulations, to engage students in problem-					

Items	Answers				
	5	4	3	2	1
solving activities.					
External factors (teachers, instructional model, environment)					
17. The lecturers pay close attention to students' engagement and participation in course activities.					
18. The lecturers ' evaluate methods include formative and summative assessments, incorporating various types of tasks and assignments.					
19. The lecturers use a combination of self-assessment, peer assessment, and teacher assessment to evaluate students' performance.					
20. The lecturers emphasize the application and function of information technology in the Computer Application Basics course.					
21. The lecturers treat each student equally, fostering confidence and reducing anxiety in problem-solving activities.					
22. The lecturers combine traditional classroom assessments with modern online assessment systems to evaluate students' learning progress.					
23. The lecturers provide appropriate feedback to students using various methods, such as face-to-face communication, written comments, and voice or video messages.					
24. The teaching methods employed in the flipped classroom model align with the course objectives and content.					
25. The instructional model engages students' interests and meets their contemporary needs, such as the use of technology and online resources.					
26. Course materials and presentations are carefully					

Items	Answers				
	5	4	3	2	1
designed, well-organized, and visually appealing.					
27. Traditional instructional models that rely solely on teacher-led instruction may negatively impact students' engagement in learning.					
28. Course materials include a combination of traditional textbooks and online resources to broaden students' knowledge and exposure to computer applications and problem-solving techniques.					
29. Well-maintained classrooms and multimedia facilities, including computers, projectors, and large screens, are essential for creating an effective learning environment.					
30. The university provides a stable and high-speed network throughout the campus, ensuring smooth access to online learning resources and supporting the flipped classroom model.					

Section 3 Suggestions for improving the better instruction

.....

.....

Thank you for your kind cooperation for completing the questionnaire!

Researcher

Mr.Cao Yuewang

Interview for Lecturers (Objective 1)

Directions: This interview is a part of research entitled "Development of Flipped Classroom Instructional Model to Enhance Undergraduate Students' Problem-Solving Skills"

Research Objectives: To study the factors affecting problem-solving skills of the undergraduate students

It is conducted by Cao Yuewang, a Ph.D. student in Curriculum and Instruction Programme at Bansomdejchaopraya Rajabhat University under the supervision of

1.Associate Professor Dr. Areewan Iamsa-ard, co-advisor

2.Assistant Professor Dr. Wapee Kong-In, majoring advisor

3.Assistant Professor Dr.Saipon Songsiengchai, co-advisor

The following open questions are the instrument for collecting data in 1st phase of the research, concerning about factors to effect enhancing problem-solving skills.

Please write down your own opinion for each questions. Data obtained from this questionnaire are only used for the purpose of conducting aforementioned research and remain confidential. Individual or personal data presentation will be avoided. These questions are the instrument for collecting data in 1st phase of the research.

Part 1 The information about the Bio-social characteristic of the respondents.

1. Gender is
   - ❑ A. Male
   - ❑ B. Female
2. Lecturers from
   - ❑ A.Computer Science and Technology
   - ❑ B.Software Engineering
   - ❑ C. Information Security

3.Experience teaching

- ❑ A. below 3 yrs.
- ❑ B. 4-6 yrs.
- ❑ C. 7-9yrs.
- ❑ D. over 10 yrs.

4. Age

- ❑A. below 25 yrs.
- ❑ B. 26-35 yrs.
- ❑ C. 35-50 yrs.
- ❑ D. over 50 yrs.

Part 2 Interview on factors affecting learning in Computer Application Basics course.
Instructions*: The type of question is open-ended questions, you can answer according to your actual situation. Your answers will only be used in this research and will not be disclosed individually.*

1. Why did you teach the Computer Application Basics course and what instructional model to teach in this course?

2.Why did you teach the Computer Application Basics course and what instructional model to teach in this course?

3. How do you evaluate the results of students' problem-solving skills the Computer Application Basics course?

4. How do you solve the problem to help students achieve their goals in the Computer Application Basics course?

5. How do you provide opportunities for students to participate actively in the Computer Application Basics course (Please clarify the methodology.)

6. What assessment form do you use to measure students' progress in the Computer Application Basics course.

7. What learning tasks do you incorporate to enhance students' enthusiasm for the Computer Application Basics course and problem-solving skills?

8. How do you help students overcome difficulties in the Computer Application Basics course?

9. Which aspects of your teaching approach in the Computer Application Basics course and which aspects would you like the university to support you in?

10. In the past, what challenges have you encountered while teaching the Computer Application Basics course, and how did you find solutions to those challenges?

Comment and recommendation for improving the better instruction

.....

.....

Thank you for your kind cooperation for completing the questions

Researcher

Mr. Cao Yuewang

Questionnaire for experts (Objective 2)

Assessment Form of the Quality of Instructional Model Flipped Classroom to Enhance Undergraduate Students' Problem-Solving Skills

.....

Dear assessors,

The present study is conducted by Cao Yuewang Ph.D. student in Curriculum and Instruction Programme at Bansomdejchaopraya Rajabhat University, Thailand, under the supervision of the following advisors.

1. Associate Professor Dr. Areewan Iamsa-ard, co-advisor
2. Assistant Professor Dr. Wapee Kong-In, majoring advisor
3. Assistant Professor Dr.Saipon Songsiengchai,co-advisor

The attached open questions are the instrument for collecting data in phase 2 of the research, the objective of which is to confirm instructional.

Please write down your own opinion for each question. Data obtained from this questionnaire are only used for the purpose of conducting aforementioned research and remain confidential. Individual or personal data presentation will be avoided.These questions involve 3 parts as follows.

Part 1: Assessor's information

Part 2: Assessment of the quality of instructional model on 5-point rating scale basis in 4 aspects 1 (Utility Standard 2 (Feasibility Standard 3 **(**Propriety Standard and 4 (Accuracy Standard .

Part 3: Suggestion

The researcher certifies that all information obtained from this questionnaire will be used for academic purposes and to generate maximum benefit meeting objectives.

Thank you very much for dedicating your valuable time and providing useful information to this research for the benefit of further research and development.

Ph.D. student Name Cao Yuewang
Curriculum and Instruction Program
Bansomdejchaopraya Rajabhat University

Assessment Items	Rating Results		
	Agree	Disagree	Remarks
Principle and Rationale:			
Utility Standard			
1. The result of questionaire from students have the benefit for Principle and Rationale			
2. The result of interview from lecturers have the benefit for Principle and Rationale			
Feasibility Standard			
3. The result of questionaire from students have the possibility for Principle and Rationale			
4. The result of interview from lecturers have the possibility for Principle and Rationale			
Propriety Standard			
5. The result of questionaire from students have the suitability for Principle and Rationale			
6. The result of interview from lecturers have the suitability for Principle and Rationale			
Accuracy Standard			
7. The result of questionaire from students have the accuracy for Principle and Rationale			
8. The result of interview from lecturers have the accuracy for Principle and Rationale			
Objectives:			
Utility Standard			
9. The objectives have benefit for students.			
Feasibility Standard			
10. The objectives have possibility for students.			
Propriety Standard			
11. The objectives have suitability for students.			
Accuracy Standard			
12. The objectives have accuracy for students.			
Contents:			
Utility Standard			
13.The contents have benefit for students.			

Assessment Items	Rating Results		
	Agree	Disagree	Remarks
Feasibility Standard			
14. The contents have possibility for students.			
Propriety Standard			
15. The contents have suitability for students.			
Accuracy Standard			
16. The contents have accuracy for students.			
Methods of teaching & materials:			
Project-Based Learning and the ADDIE Teaching Instructional Model			
Utility Standard			
17. The methods of teaching & materials have benefit for students.			
Feasibility Standard			
Propriety Standard			
19. The methods of teaching & materials have suitability for students.			
Accuracy Standard			
20. The methods of teaching & materials have accuracy for students.			
Evaluation:			
Utility Standard			
21.The evaluation has benefit for students.			
Feasibility Standard			
22. The evaluation has possibility for students.			
Propriety Standard			
23. The evaluation has suitability for students.			
Accuracy Standard			
24. The evaluation has accuracy for students.			

Suggestions.....

.....

Sign..... Assessor

Date...../...../.....

Appendix D

The Results of the Quality Analysis of Research Instruments

IOC-Questionnaire for students to confirm Table Appendix 1: Evaluation Results of IOC for Factor Analysis (For Students)

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
Section 1	**Common data of the respondent**								
1	Gender ❑ A. Male ❑ B. Female	+1	+1	+1	+1	+1	5	1.00	Valid
2	Major ❑ A.Computer Science and Technology ❑ B. Software Engineering ❑ C. Information Security	+1	+1	+1	+1	+1	5	1.00	Valid
3	Age ❑ A. below17 yrs. ❑ B. 18-20yrs. ❑ C. 21-23 yrs. ❑ D. over 23 yrs.	+1	+1	+1	+1	+1	5	1.00	Valid
Section 2	**Factors**								
Factor 1: Internal Factors									
1	Students are very interested in the flipped classroom instructional model in the Computer Application Basics course.	+1	+1	+1	+1	+1	5	1.00	Valid
2	Students actively participate in problem-solving	+1	+1	+1	+1	+1	5	1.00	Valid

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	activities and discussions through online platforms								
3	Students clearly understand the importance of developing problem-solving skills in the Computer Application Basics course	+1	+1	+1	+1	+1	5	1.00	Valid
4	Students create a study schedule for the Computer Application Basics course, incorporating self-study, information technology, and support from teachers and peers.	+1	+1	-1	0	+1	2	0.4	Invalid
5	Students believe that flipped classroom and online learning can help them improve their problem-solving skills.	+1	+1	+1	+1	+1	5	1.00	Valid
6	Students think that the assignments provided by teachers and the feedback received can help them	+1	+1	+1	+1	+1	5	1.00	Valid

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	better apply their knowledge to real-world situations.								
7	Students provide objective feedback on their teachers and the online learning platform to improve their learning experience.	+1	+1	+1	+1	+1	5	1.00	Valid
8	Students appreciate the cooperative and interactive learning environment fostered by the flipped classroom model.	+1	+1	+1	-1	0	2	0.4	Invalid
9	Students are satisfied with the interaction between themselves and the online learning resources provided in the flipped classroom model.	+1	+1	+1	+1	+1	5	1.00	Valid
10	Students can develop new insights based on their experiences with practical problem-solving tasks.	+1	+1	+1	+1	+1	5	1.00	Valid

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
11	Students can effectively prepare for the course by completing pre-class tasks and assignments.	+1	+1	+1	+1	+1	5	1.00	Valid
12	Students develop a sense of accomplishment and pride through their engagement in various problem-solving activities.	+1	+1	+1	+1	+1	5	1.00	Valid
13	Students can develop new insights and perspectives based on their experiences with the flipped classroom model.	0	0	+1	0	+1	2	0.4	Invalid
14	Students believe that they can succeed in the Computer Application Basics course with the help of online learning platforms and resources.	+1	+1	+1	+1	+1	5	1	Valid
15	Students respect and trust their teachers' expertise in organizing and managing the	+1	+1	+1	+1	+1	5	1	Valid

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	flipped classroom model.								
	Factor 2: External factors								
16	Teachers utilize modern instructional approaches, such as video lectures, computer simulations, to engage students in problem-solving activities.	+1	+1	+1	+1	+1	5	1	Valid
17	Teachers pay close attention to students' engagement and participation in course activities.	+1	+1	+1	+1	+1	5	1	Valid
18	Teachers' evaluation methods include formative and summative assessments, incorporating various types of tasks and assignments.	0	+1	+1	0	0	2	0.4	Invalid
19	Teachers use a combination of self-assessment, peer assessment, and teacher	+1	+1	+1	+1	+1	5	1	Valid

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	assessment to evaluate students' performance.								
20	Teachers emphasize the application and function of information technology in the Computer Application Basics course.	+1	+1	+1	+1	+1	5	1	Valid
21	Teachers treat each student equally, fostering confidence and reducing anxiety in problem-solving activities.	+1	+1	+1	+1	+1	5	1	Valid
22	Teachers combine traditional classroom assessments with modern online assessment systems to evaluate students' learning progress.	0	+1	+1	-1	+1	2	0.4	Invalid
23	Teachers provide appropriate feedback to students using various methods, such as face-to-face	-1	+1	+1	+1	0	2	0.4	Invalid

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	communication, written comments, and voice or video messages.								
24	The teaching methods employed in the flipped classroom model align with the course objectives and content.	+1	+1	+1	+1	+1	5	1	Valid
25	The instructional model engages students' interests and meets their contemporary needs,	+1	+1	+1	+1	+1	5	1	Valid
26	Course materials and presentations are carefully designed, well-organized, and visually appealing.	+1	+1	0	+1	+1	4	0.8	Valid
27	Traditional instructional models that rely solely on teacher-led instruction may negatively impact students' engagement in learning.	+1	+1	0	-1	+1	2	0.4	Invalid
28	Course materials include a	+1	+1	+1	+1	+1	5	1	Valid

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	combination of traditional textbooks and online resources to broaden students' knowledge and exposure to computer applications and problem-solving techniques.								
29	Well-maintained classrooms and multimedia facilities, including computers, projectors, and large screens, are essential for creating an effective learning environment.	+1	+1	+1	+1	+1	5	1	Valid
30	The university provides a stable and high-speed network throughout the campus, ensuring smooth access to online learning resources and supporting the flipped classroom model.	0	0	1	0	+1	2	0.4	Invalid
Total (In Overview)							**121**	**0.84**	**Valid**

Note: Valid when ≥0.80

Table Appendix 2: Evaluation Results of IOC for Factor Analysis (For Lecturers(

No	Item	Experts' rating					total	mean	results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	Part 1								
	No. 1 Gender A. Male B. Female	+1	+1	+1	+1	+1	5	1.00	Valid
	No. 2 University A.Computer Science and Technology B.Software Engineering C.Information Security	+1	+1	+1	+1	+1	5	1.00	Valid
	No.3 Teaching experience A. Below 3 yrs. B. 4-6 yrs. C. 7- 9 yrs. D. Over 9 yrs.	+1	+1	+1	+1	+1	5	1.00	Valid
	No.4 Age A. below 30 yrs. B. 30-40 yrs. C. 41-50 yrs. D. over 50 yrs.	+1	+1	+1	+1	+1	5	1.00	Valid
	No.5 Professional title A. Assistant B. Lecturer C. Associate professor D. Professor	+1	+1	+1	+1	+1	5	1.00	Valid
	Questions								
1	Why did you choose to teach the Computer Application Basics course and what instructional model to teach in this course?	+1	+1	+1	+1	+1	5	1.00	Valid
2	How do you design tasks to facilitate students' prior knowledge and problem-solving skills in computer	+1	+1	+1	+1	+1	5	1.00	Valid

No	Item	Experts' rating					total	mean	results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	applications? (Consider aims, content, materials, technology tools, etc.)								
3	How do you evaluate the results of students' problem-solving skills the Computer Application Basics course?Do you always manage teaching according to your lesson plan? If you cannot teach	+1	+1	+1	+1	+1	5	1.00	Valid
4	How do you solve the problem to help students achieve their goals in the Computer Application Basics course?	+1	+1	+1	+1	+1	5	1.00	Valid
5	How do you provide opportunities for students to participate actively in the Computer Application Basics course (Please clarify the methodology.)	+1	+1	+1	+1	+1	5	1.00	Valid
6	What assessment methods do you use to measure students' progress in the Computer Application Basics course, and do you think these assessments reflect their learning outcomes and skill level accurately?	+1	+1	+1	+1	+1	5	1.00	Valid
7	What learning tasks do you incorporate to enhance students' enthusiasm for the	+1	+1	+1	+1	+1	5	1.00	Valid

No	Item	Experts' rating					total	mean	results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	Computer Application Basics course and problem-solving skills?								
8	How do you help students overcome difficulties in the Computer Application Basics course?	+1	+1	+1	+1	+1	5	1.00	Valid
9	Which aspects of your teaching approach in the Computer Application Basics course and which aspects would you like the university to support you in?	+1	+1	+1	+1	+1	5	1.00	Valid
10	In the past, what challenges have you encountered while teaching the Computer Application Basics course, and how did you find solutions to those challenges?	+1	+1	+1	+1	+1	5	1.00	Valid
	Total (In Overview)						**75**	**1.00**	**Valid**

Note: Valid when ≥0.80

Table Appendix 3: Evaluation Results of IOC for instructional model

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
Principle and Rationale:									
Utility Standard									
1. The result of questionaire from students have the benefit for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
2. The result of interview from lecturers have the benefit for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
Feasibility Standard									
3. The result of questionaire from students have the possibility for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
4. The result of interview from lecturers have the possibility for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
Propriety Standard									
5. The result of questionaire from students have the suitability for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
6. The result of interview from lecturers have the suitability for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
Accuracy Standard									
7. The result of questionaire from students have the accuracy for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
8. The result of interview from lecturers have the accuracy for Principle and Rationale		+1	+1	+1	+1	+1	5	1.00	Valid
Objectives:									
Utility Standard									

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
9. The objectives have benefit for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Feasibility Standard									
10. The objectives have possibility for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Propriety Standard									
11. The objectives have suitability for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Accuracy Standard									
12. The objectives have accuracy for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Contents:									
Utility Standard									
13.The contents have benefit for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Feasibility Standard									
14. The contents have possibility for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Propriety Standard									
15. The contents have suitability for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Accuracy Standard									
16. The contents have accuracy for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Methods of teaching & materials:									
Project-Based Learning and the ADDIE Teaching Instructional Model									
Utility Standard									
17. The methods of teaching & materials have benefit for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Feasibility Standard									

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
18. The methods of teaching & materials have possibility for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Propriety Standard									
19.The methods of teaching & materials have suitability for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Accuracy Standard									
20. The methods of teaching & materials have accuracy for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Evaluation:									
Utility Standard									
21.The evaluation has benefit for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Feasibility Standard									
22. The evaluation has possibility for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Propriety Standard									
23. The evaluation has suitability for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Accuracy Standard									
24. The evaluation has accuracy for students.		+1	+1	+1	+1	+1	5	1.00	Valid
Total (In Overview)							120	1.00	Valid

Note: Valid when ≥0.80

Table Appendix 4: Evaluation Results of IOC for rubric Observation

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
	Knowledge and Skills								
1	Standard 1: Access to information efficiently and quickly	+1	+1	+1	+1	+1	5	1.00	Valid
2	Standard 2: Ability to skillfully and appropriately evaluate information -	+1	+1	+1	+1	+1	5	1.00	Valid
3	Standard 3: Able to use information accurately and creatively	+1	+1	+1	+1	+1	5	1.00	Valid
	Process and Methods								
	Standard 4: Independent learners	+1	+1	+1	+1	+1	5	1.00	Valid
5	Standard 5: Expressing information creatively	+1	+1	+1	+1	+1	5	1.00	Valid
6	Standard 6: Excellence in information inquiry and knowledge creation	+1	+1	+1	+1	+1	5	1.00	Valid
	Emotional attitudes and values								
7	Standard 7: Understanding the importance of information to a democratized society.	+1	+1	+1	+1	+1	5	1.00	Valid
8	Standard 8: Ethical behavior in information and information technology.	+1	+1	+1	+1	+1	5	1.00	Valid
9	Standard 9: Seeking and creating information in groups.	+1	+1	+1	+1	+1	5	1.00	Valid
	Total (In Overview)						45	1.00	Valid

Note: Valid when ≥0.80

Table Appendix 5: Evaluation Results of IOC for Lesson Plan

No	Item	Experts' rating					Total	Mean	Results
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5			
1	**Learning Objective** Complying with content of the course	+1	+1	+1	+1	+1	5	1.00	Valid
2	Master knowledge and ability	+1	+1	+1	+1	+1	5	1.00	Valid
3	Being measurable in 3 item include standards	+1	+1	+1	+1	+1	5	1.00	Valid
	Contents								
4	Complying with learning objective	+1	+1	+1	+1	+1	5	1.00	Valid
5	Being appropriate in terms of time management	+1	+1	+1	+1	+1	5	1.00	Valid
	Flipped Classroom Instructional Model								
6	Complying with the designed instructional model	+1	+1	+1	+1	+1	5	1.00	Valid
7	Supporting students' learning	+1	+1	+1	+1	+1	5	1.00	Valid
8	Including various activities	+1	+1	+1	+1	+1	5	1.00	Valid
	Learning materials								
9	Complying with the learning objectives	+1	+1	+1	+1	+1	5	1.00	Valid
10	Complying with the contents	+1	+1	+1	+1	+1	5	1.00	Valid
	Evaluation and Assessment								
11	Complying with the learning objectives	+1	+1	+1	+1	+1	5	1.00	Valid
12	Including standards and rubric score	+1	+1	+1	+1	+1	5	1.00	Valid

Appendix E

Certificate of English

BANSOMDEJCHAOPRAYA
RAJABHAT UNIVERSITY

This is to certify that

Mr. Cao Yuewang

Achieved BSRU English Proficiency Test (BSRU-TEP) level

C2

Given on 22nd August 2021

(Assistant Professor Dr Kulsirin Aphiratvoradej)

Director

Appendix F

The Document for Acceptance Research

MHESI 8038.1/03

Mcu Ubonratchathani journal
of Buddhist Studies (TCI.2)
Mahachulalongkornrajavidyalaya
University, Ubon Ratchathani Campus

RESPONSE FOR PUBLICATION OF THE ARTICLE

9th August 2023

The Editorial Department of Mcu Ubonratchathani journal of Buddhist Studies (TCI.2) MCU, Ubon Ratchathani Campus has considered the article

Title	DEVELOPMENT OF FLIPPED CLASSROOM INSTRUCTIONAL MODEL TO ENHANCE UNDERGRADUATE STUDENTS' PROBLEM-SOLVING SKILLS
Writer	Cao Yuewang, Areewan Iamsa-ard, Saifon Songsiengchai and Wapee Kong-In
Publication Approval	Mcu Ubonratchathani journal of Buddhist studies (ISSN : 2774-0463 (Online)) Mahachulalongkornrajavidyalaya University, Ubon Ratchathani Campus
Period of Publication	5th Year, Volume III (September-December, 2023)

Your article has been sent to 3 experts for peer review and found that its quality is at a "**Good**" level and academically useful.

Please be informed accordingly.

P. W.

(Assoc.Prof. Dr.Phrakhruwutthidhampandit)
Editor of Mcu Ubonratchathani journal of Buddhist studies (TCI)
Mahachulalongkornrajavidyalaya University,
Ubon Ratchathani Campus

The Editorial Department of Mcu Ubonratchathani journal of Buddhist studies (TCI)
Mahachulalongkornrajavidyalaya University,Ubon Ratchathani Campus
Somdet Rd. (7th Km.), Tambon Krasobe,
Mueang Ubon Ratchathani District, Ubon Ratchathani Province, 34000
The Editor: Tel.081-7908464, Coordinator: Tel. 081-2642443
E-mail: Sripracho2515@gmail.com, Website: https://journal.ubonmcu.org

Researcher Profile

Name-Surname: Cao Yuewang
Birthday: 1319 ,April ,95
Place of Birth: Juye City, Shandong Province

Educational background:
2014.07-2018.06 Studied Human Resource Management at Qingdao University
2018.09-2021.07 Studied Marxist Theory at Guangxi University for Nationalities

Work experience:
2021.06- Now Working in Qingdao Huanghai University

Office Location:
3111 Linghai Road, Huangdao District, Qingdao City, Shandong Province

Current Contact Location:
Huandao Road, Huangdao District, Qingdao City, Shandong Province