THE LEARNING MANAGEMENT THROUGH THE SCAFFOLDING TEACHING TO IMPROVE LEARNING ACHIEVEMENT FOR 1ST YEAR OF SECONDARY VOCATIONAL STUDENTS

JING SUN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION
PROGRAM IN CURRICULUM DEVELOPMENT
AND INSTRUCTIONAL INNOVATION
FACULTY OF TECHNICAL EDUCATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI
ACADEMIC YEAR 2022

THE LEARNING MANAGEMENT THROUGH THE SCAFFOLDING TEACHING TO IMPROVE LEARNING ACHIEVEMENT FOR 1ST YEAR OF SECONDARY VOCATIONAL STUDENTS

JING SUN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION
PROGRAM IN CURRICULUM DEVELOPMENT
AND INSTRUCTIONAL INNOVATION
FACULTY OF TECHNICAL EDUCATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI
ACADEMIC YEAR 2022

This thesis consists of research materials conducted at Faculty of Technical Education, Rajamangala University of Technology Thanyaburi and hence the copyright owner. I hereby certify that the thesis does not contain any forms of plagiarism.

Jing Sun

(Mrs. Jing Sun)

Thesis Title	The Learning Management through the Scaffolding Teaching to Improve Learning Achievement for 1st Year of Secondary Vocational Students
Name – Surname	Mrs. Jing Sun
Program	Curriculum Development and Instructional Innovation
Thesis Advisor	Assistant Professor Rossarin Jermtaisong, Ph.D.
Academic Year	2022

THESIS COMMITTEE

Somchai Sinok ..... Chairman
(Associate Professor Somchai Sinok, Ph.D.)

..... Committee
(Assistant Professor Pranom Punsawai, Ph.D.)

Pornpirom Lhongsap ..... Committee
(Mr. Pornpirom Lhongsap, Ph.D.)

..... Committee
(Assistant Professor Rossarin Jermtaisong, Ph.D.)

Approved by the Facuity of Technical Education, Rajamangala University of Technology Thanyaburi in Partial Fulfillment of the Requirements for the Master's Degree

..... Dean of Faculty of Technical Education
(Assistant Professor Arnon Niyomphol, M.S.Tech.Ed.)

4 April 2023

Thesis Title	The Learning Management through the Scaffolding Teaching to Improve Learning Achievement for 1st Year of Secondary Vocational Students
Name - Surname	Mrs. Jing Sun
Program	Curriculum Development and Instructional Innovation
Thesis Advisor	Assistant Professor Rossarin Jermtaisong, Ph.D.
Academic Year	2022

ABSTRACT

The objectives of this research were to: 1) compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application studying through the scaffolding teaching to 70 percent criteria, and 2) compare the pre- and post-learning achievement of the students studying through the scaffolding teaching.

The research samples were 10 students, selected by purposive sampling, the 1st year secondary vocational students studying the Fundamentals of Computer Application at Zigong Vocational and Technical School, China, in the academic year 2022. The research instruments consisted of: 1) a learning management plan based on the scaffolding teaching, and 2) an achievement test. The mean, percentage, standard deviations, and t-test were used for data analysis.

The research results showed that:1) the 1st year secondary vocational students' learning achievement on the fundamentals of Computer Application studying through the scaffolding was 70% higher at the statistical significance level of .05, and 2) the post-learning achievement of the students studying through scaffolding was higher than the pre-learning at the statistical significance level of .05.

Keywords: learning management, scaffolding teaching, learning achievement

Acknowledgments

As time flies by, it has already been two years since I studied in Thailand, and my career as a master's graduate student has gradually come to an end. Two years ago, with a thirst for knowledge and academic aspirations, I entered RMUTT and had the privilege of conducting research under the guidance of various instructors. Here, I would like to express my sincere gratitude to them.

First, I am grateful to my adviser, Assistant Professional Dr. Rossarin Jermtaisong, for her careful guidance in completing today's thesis. She has provided me with a large amount of extremely useful construction and specific guidance and has devoted a lot of effort to the writing and review of the thesis. At the same time, I would also like to thank other professors at RMUTT, Associate Professor Dr. Suthiporn Boonsong, Dr. Pornpirom Lhongsap, for their careful guidance and earnest teachings, which will become a part of my precious growth memory.

Secondly, I would like to thank my alma mater, Rajamangala University of Technology Thanyaburi (RMUTT). Here, I have not only learned a wealth of knowledge, but also learned the rigorous and meticulous style of my adviser, which will be the wealth of my life.

Finally, I would like to thank my mother and family for their meticulous care and spiritual support in life. I can still work and study at the same time, and until my master's degree, I cannot do without your care and understanding.

Thank you to my classmates and friends who helped me in the process of completing the thesis. The road ahead is still long, and I will greet the beautiful sun of tomorrow with beautiful memories, believe in myself, and grasp the present.

Jing Sun

Table of Contents

Table of Contents (Continued)

List of Table

List of Figure

CHAPTER 1
INTRODUCTION

1.1 Background and Statement of the Problems

Vocational education was an essential part of China's education system, which undertook the critical task of providing professional and technical talents for social and economic development. In order to promote the quality of Vocational Education in China, the Ministry of Education and other competent departments issued a series of policy documents in recent years, requiring local vocational education schools to make the greatest use of all kinds of emerging educational ideas, methods, technologies, and tools to effectively strengthen the innovation of teaching models. Furthermore, this also improved the teaching quality of vocational education and played an essential role in professional talent training (Cheng Xiangqian, 2021, p.28).

The emergence of information technology has provided good technical conditions for the innovation of the vocational education model. In 2017, the Ministry of Education issued guidelines on further promoting the informatization development of Vocational Education (Hu yunqi et al., 2019, pp.86-87). Subsequently, these guidelines were referred to as the Guiding Opinions. They required vocational education schools at all levels to actively engage in the innovation and practice of teaching modes based on the information environment. The aim was to transform the traditional vocational teaching mode by leveraging information technology and promote the deep and wide development of vocational education informatization (Li Fang and Shi Yuxin, 2020, p.15). As a result of these guiding opinions, many innovative vocational teaching models based on information technology emerged in China.

In general, the innovation of these vocational teaching modes relies on information technology, which primarily offers more efficient and convenient application platforms and tool support for traditional teaching. This helps establish a teaching system that combines online and offline methods to enhance the quality and effectiveness of teaching. Therefore, in order to fully leverage the advantages of information technology in vocational education, it was crucial to integrate it with traditional teaching. Scaffolding teaching, which was an important practical approach based on Constructivism Theory in

pedagogy, has been widely and currently adopted in the domestic vocational education system (Aslan, 2021, pp.237-249).

Based on my teaching practice in a secondary vocational school (referred to as the secondary vocational school from now on), this study integrates information technology with traditional scaffolding teaching. It involves designing online scaffolding teaching and applying it to the teaching activities of the "Fundamentals of Computer Application" course in the secondary vocational school.

"Fundamentals of Computer Application" was a fundamental introductory course offered in secondary vocational schools. The teaching goal of this course was to develop students' computer processing skills, introduce them to basic computer theoretical knowledge, and enhance their abilities in simple information management. The aim was to improve their overall computer application skills and align with the fundamental spirit of "Employment Orientation" in Vocational Education. Consequently, the course "Fundamentals of Computer Application" encompasses both practical and theoretical aspects, as its teaching outcomes significantly influence the successful employment of secondary vocational students.

However, given the relatively low academic proficiency of students in secondary vocational schools, most students have weak computer application skills and limited knowledge in this area prior to enrolling. Additionally, the technical and practical requirements of the course itself are relatively demanding. As a result, traditional teaching methods often fail to achieve the desired teaching objectives. Hence, teachers need to seek innovative approaches in their teaching methodologies.

In recent years, various new teaching modes have emerged, and among them, scaffolding has gained prominence. Scaffolding offers personalized teaching, enhances students' self-directed learning abilities, and reduces frustration. Inspired by the concept of "scaffold" in the construction industry, scaffolding teaching likens the learning goal to a "building." Teachers assume the role of providing the necessary "scaffold" for constructing this "building," assisting students in gradually establishing and completing the required knowledge and technical structure (Han Xiao, 2019, pp.154-156).

In scaffolding teaching, teachers first analyze the teaching objectives and then create the essential "scaffold" to support the learning of relevant concepts and the learning

framework. The teaching process involves creating situations, encouraging independent exploration, facilitating collaborative learning, and more. Finally, a comprehensive evaluation of learning outcomes, students' self-directed learning abilities, and collaborative learning abilities takes place, which can encompass teacher-student evaluation, self-evaluation by students, and peer evaluation. The recent development zone can be utilized to plan and enhance the teaching process and strategies within scaffolding teaching. Teachers should assist students in constructing and dismantling the "scaffold" to foster the development of their knowledge and skill structures. The aforementioned "scaffold" was essential for students to successfully transition from their current level of cognitive development to their potential level of development.

1.2 Research Questions

1.2.1 Was there a statistically significant difference in the learning achievement of 1st year secondary vocational students on the Fundamentals of Computer Application, whose scores reached the 70 percent criterion, after studying through online scaffolding teaching?

1.2.2 Was there a statistically significant difference in the learning achievement of 1st year secondary vocational students on the Fundamentals of Computer Application before and after studying through online scaffolding teaching?

1.3 Purpose of the Study

1.3.1 To compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application course studying through the online scaffolding teaching whose score reached 70 percent.

1.3.2 To compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application course before and after studying through the online scaffolding teaching.

1.4 Research Hypothesis

The researcher tested the following hypotheses:

1.4.1 The learning achievement of 1st year secondary vocational students on the Fundamentals of Computer Application course, while studying through online scaffolding teaching and achieving a score of 70 percent or higher, showed a statistically significant difference at .05.

1.4.2 The learning achievement of 1st year secondary vocational students on the Fundamentals of Computer Application course after studying through online scaffolding teaching showed a statistically significant difference compared to before study at .05.

1.5 Scopes of the Study

1.5.1 Population and Sample

1.5.1.1 The population of this study consisted of 138 1st year secondary vocational students, studying the Fundamentals of Computer Application course at Zigong Vocational and Technical School, Sichuan, China during the academic year 2022.

1.5.1.2 The research sample consisted of 10 1st year secondary vocationnal students who were selected using purposive sampling, studying the Fundamentals of Computer Application course at Zigong Vocational and Technical School, Sichuan, China.

1.5.2 Variables

In this research, there were independent and dependent variables.

1.5.2.1 The independent variable was the learning management through scaffolding.

1.5.2.2 The dependent variable was the learning achievement on the Fundamentals of Computer Application course.

1.5.3 Scope of Contents

The Fundamentals of Computer Application course for the experimental group of first-year secondary vocational students consisted of 8 academic hours, covering the following four topics:

1) The composition of the computer system2 hours.
2) Operation of Windows Operating System2 hours.
3) Excel Spreadsheets2 hours.
4) PowerPoint Basic functions and features 2 hours.

1.5.4 Scope of Time

The duration of this research project was from September 2022 to March 2023.

1.6 Definition of Terms

For ease of understanding, the following terms were conceptually and operationally defined as follows:

1.6.1 Scaffolding refers to analyzing the learning objectives and creating a supportive structure for learning. The learning management process includes situational creation, independent exploration, and collaborative learning.

1.6.2 The learning management through scaffolding provided a supportive structure for the construction of knowledge and technical skills, helping students to gradually establish and complete the required structure. Scaffolding teaching involves analyzing the learning objectives and creating a supportive structure for learning. The learning management process consists of five steps: 1) set up support, 2) enter thesituation, 3) independent exploration, 4) collaborative learning, 5) impact assessment.

1.6.3 Learning achievement refers to the knowledge and skills acquired by students through the learning management process, including knowledge, memory, understanding, and application gained through scaffolding teaching. It was assessed through a test on the Fundamentals of Computer Application course.

1.6.4 Secondary vocational students are first-year students studying the "Fundamentals of Computer Application" course at Zigong Vocational and Technical School, Sichuan, China, during the academic year 2022.

1.7 Conceptual Framework

Since the research paper employed an experimental research design, the framework below served as the researcher's guide in the conduct of the study:

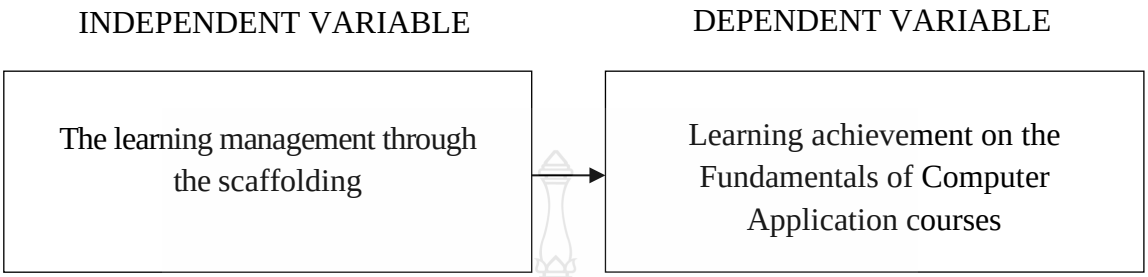

Figure 1.1 Conceptual Research Framework

1.8 Benefits

1.8.1 The study aimed to strengthen students' learning effectiveness and improve their learning achievement in Fundamentals of Computer Application course.

1.8.2 The study aimed to obtain innovative learning management through scaffolding teaching, which was expected to improve learning achievement.

1.8.3 The study aimed to provide guidelines for developing learning management innovation with scaffolding teaching for other subjects.

CHAPTER 2
REVIEW OF THE LITERATURE

This chapter focuses on reviewing the previous studies related to the following areas relevant to this research.

2.1 Learning Management

2.1.1 Definition of learning management

In the past, learning management referred to the design and implementation of teaching methods, strategies, and plans aimed at enhancing the effectiveness of students' learning. It encompassed the integration of various elements, including communication, guidance, assistance, planning, group allocation, teaching materials, and teaching platforms, within teaching strategies and methods. The primary goal of teaching management was to develop a teaching plan that could effectively improve students' learning outcomes

According to Changwong et al. (2018, pp.37-48), learning management was a teaching process in which the teacher guided, organized, and assisted learners in

achieving improved learning outcomes, considering the content, characteristics, and objectives of the target course. Teachers adopted specific teaching modes that took into account the learners' existing knowledge, learning motivation, requirements, as well as the availability of teaching resources and environmental factors. Learning management played a crucial role in various levels of education and was commonly utilized in vocational training and internal employee training.

According to Zhao Jushan (2010, pp.23-25), efficiency and goal orientation were regarded as fundamental concepts in teaching management. Teachers had the ability to develop complementary teaching strategies, plans, and resources in order to enhance students' learning achievements. It was crucial for teachers to execute teaching management in accordance with the established plan and assess whether the expected goals were attained through students' learning outcomes.

Sun Yanhua (2019, pp.55-59) proposed that teaching management consisted of three elements: teaching concept, teaching management mechanism, and platform. Within the context of curriculum reform in Chinese universities, it was imperative to first shift the traditional teaching concept and incorporate new perspectives, theories, and pedagogical methods to innovate teaching management. Based on this foundation, teaching management activities could be enhanced by improving teaching materials, teaching tools, and relevant resources. Additionally, in light of the advancements in information technology, the comprehensive utilization of online and offline teaching platforms served as a crucial foundation for innovation in teaching management.

In the era of information technology, the advent of the Learning Management System (LMS) has offered convenient tools and platform support for teachers' learning management activities. With the assistance of information technology and these tools, online learning has emerged as an effective method for overcoming the geographical limitations inherent in traditional teaching activities. It has also opened up possibilities for innovative approaches to learning management. Online learning has enriched and diversified teaching and learning activities, expanded the range of available learning resources, and introduced new teaching models into learning management. Consequently, it has significantly broadened the scope and significance of learning

management. In this context, the integration of various teaching modes with online instruction has become a standard approach to learning management.

2.1.2 Elements in learning management

Teaching management involved the implementation of specific methods, strategies, and plans to attain teaching objectives. These elements served as prerequisites for the realization of effective teaching management and also served as crucial areas of focus for research in teaching management.

According to Lu Yuying (2019, pp.32-34), the key elements of Learning Management are as follows:

Teacher: The teacher played the role of the learning management leader and was responsible for formulating learning plans and programs, selecting teaching models, arranging learning resources and environments, facilitating learning activities, and assessing learning outcomes.

Students: Students actively engaged in learning activities under the guidance of the teacher, and their test scores served as a central criterion for evaluating the effectiveness and quality of learning management.

Course Content: The course content influenced the choice of teaching mode, learning resources, environmental arrangements, teaching plans, and assessment plans in learning management. Various course contents could result in specific variations in learning management approaches.

Teaching Mode: The teaching mode encompassed the specific teaching methods employed in course instruction. Teachers were required to adaptively choose the most appropriate teaching mode based on the content, characteristics, and requirements of the course, as well as the available teaching resources, learning environment, and the students' learning objectives.

Learning Environment: In learning management, the teaching activities of teachers and the learning activities of students relied on various resources, including learning materials and tools, which composed the learning environment. The learning environment imposed specific constraints on learning management. When selecting a particular teaching mode, teachers needed to take into account the elements of the

learning environment. The emergence of information technology has presented opportunities for online learning.

Luo Yingxia et al. (2020, pp.39-40) maintained that execution was the fundamental element of teaching management, with the focus being on the establishment of execution. The utilization of teaching resources, strategies, and methods entailed early-stage planning, design, and resource integration, as well as the application of teaching management concepts and resources to specific teaching activities. Consequently, executive power played a pivotal role in teaching management. The difficulty of planning and designing teaching management had diminished thanks to the continuous development and innovation of educational theories and methods. At the core of teaching management lay the implementation and execution of teaching management schemes by teachers.

The aforementioned perspective was grounded in the elemental structure of the teaching management system. In traditional teaching management activities, teachers, students, courses, methods and modes, and the teaching environment constituted the core elements of teaching management. From the standpoint of teaching management implementation, the effective execution of teaching concepts, methods, models, and so on could also be considered a crucial element of teaching management. This encompassed how teachers could enhance the implementation of teaching programs and plans to achieve the desired outcomes.

2.1.3 Process of learning management

To achieve effective teaching management, several critical elements were necessary, and meticulous scientific planning and design were vital. As a result, the success of teaching management relied on the design of teaching plans, resource allocation, implementation of teaching plans, and evaluation and assessment of learning outcomes.

Waheeb et al. (2019, pp.232-238) discussed the process of learning management and outlined the following steps:

Step 1: Drawing from their teaching experience, teachers determined the most suitable teaching mode based on the course content, student characteristics, teaching resources, and learning objectives.

Step 2: Teachers designed and formulated the learning plan, incorporating elements such as teaching materials, class hours, learning progression, test questions, and more. This was done in accordance with the selected teaching mode and the overall requirements of teaching activities.

Step 3: Teachers organized and enhanced the teaching environment and resources in alignment with the learning plan.

Step 4: Teachers and students actively engaged in the learning process, with the teacher facilitating and executing the teaching activities as outlined in the teaching plan. Students, in turn, pursued course learning and adhered to the teacher's guidance and requirements.

Step 5: Based on the assessment of learning outcomes, the teacher reflected on and refined the teaching plan and implementation methods. This was done in response to the students' test results and feedback on learning management.

Luo Yingxia (2020, pp.39-40) asserted that execution was a distinct manifestation of the teaching management process. The execution of teaching management could be enhanced by incorporating essential elements such as teachers, courses, teaching resources, teaching methods, teaching platforms, and teaching environments. Hence, within the context of the specific teaching management process, teachers employed various methods in their teaching activities, drawing upon teaching resources, teaching platforms, and teaching environments to align with the curriculum's teaching objectives. Teachers adeptly planned and utilized diverse resources during the implementation stage and adjusted and refined the teaching management process in response to internal and external environmental factors.

The process of teaching management extended beyond mere resource integration and plan implementation. It necessitated teachers to possess extensive teaching experience, the ability to adaptively utilize various teaching methods in accordance with specific teaching objectives and students' individual circumstances, and to harness the value and potential of diverse teaching resources. It also involved maximizing the value of all teaching management elements from the students' perspective, with the aim of enhancing students' learning effectiveness through proper guidance.

2.2 Scaffolding Teaching

2.2.1 Online teaching

Online teaching has emerged within the context of rapid advancements in information technology. It represents a contemporary teaching approach and system that combines traditional teaching methods with various information technologies and tools. More specifically, online teaching pertains to the process, mode, or method of instruction and learning facilitated through the application of information and Internet technology.

According to Elizabeth et al. (2017, pp.80-86), online teaching representted a distinct teaching method rooted in web technology that differed from traditional face-to-face learning. Its distinguishing feature lay in the remote participation of both teachers and learners in teaching and learning activities. Therefore, online teaching was a form of distance education reliant on network technology, tools, and platforms. Leveraging network technology, online teaching transcended geographical barriers, connecting teachers and learners and granting access to audio, video, slides, and other learning resources. Compared to traditional teaching, online teaching offered greater flexibility as learning resources and activities could be stored and accessed online. For instance, teachers could upload instructional videos to online learning platforms, enabling learners to engage with the material at their convenience, aligning with their schedules and learning plans. Furthermore, teaching and assessment activities could also be conducted online.

Online teaching employed a range of methods and modes, such as one-to-one video calls, group video calls, and webinars. The objective of both online and traditional offline teaching was to impart knowledge and enhance students' learning outcomes. However, online teaching placed a greater emphasis on the availability of diverse online learning resources, including online courseware and learning materials. It fully leveraged the advantages of information technology to present these resources in various formats, such as online videos, audio, animations, images, and text. Additionally, online teaching had the capacity to overcome geographical barriers and extend teaching activities to remote areas through virtual online learning spaces.

Online teaching necessitated the acquisition of computer, network, and other technical skills by both teachers and students. At that time, numerous online teaching platforms had emerged (Li Fang and Shi Yuxin, 2020, p.15), and it was imperative for teachers and students to familiarize themselves with the functionality and operational procedures of these platforms.

In the post-epidemic era, the significance of online teaching has become increasingly apparent. With the aid of network tools and platforms, online teaching has greatly broadened the scope of traditional offline classroom instruction, providing convenience for teachers and students to actively participate in teaching activities. Furthermore, online teaching has successfully extended its applications beyond academic education to non-academic fields such as training, exchanges, and discussions. Online learning has emerged as a teaching method of equal importance alongside offline teaching.

2.2.2 Scaffolding the Learning Achievement teaching

Scaffolding Teaching was a teaching mode that was developed based on the constructivist learning theory in the past. Its central focus revolved around students, with the objective of fostering their independent learning and problem-solving skills while progressively attaining the desired learning objectives through the guidance and support of teachers.

According to Hu Yunqi et al. (2019, pp.86-87), scaffolding teaching was a teaching mode that established a student-centered learning environment and activity plan under the guidance of teachers in the past. Through learning situations, team cooperation, and collaborative communication, teachers utilized the elements of the teaching environment to construct scaffolding based on the teaching content. This scaffolding was continuously developed throughout the progression of teaching activities, ultimately leading to the construction of meaningful knowledge.

The scaffolding teaching mode emphasized the idea of student-centered instruction and exerted notable effects in fostering students' practical problem-solving and self-directed learning abilities. In this mode, teachers were required to devise comprehensive teaching plans and provide students with step-by-step learning tips and cues, known as "scaffolding." Students made optimal use of these supportive elements to

acquire knowledge and resolve problems, ultimately attaining mastery of the teaching content and enhancing their practical problem-solving skills, as well as developing independent learning capabilities.

Scaffolding Teaching entailed teachers comprehending the concept of the Zone of Proximal Development and constructing scaffolding based on the current and potential development levels of individual and group students. This approach aimed to facilitate knowledge acquisition and foster overall progress (Li Yingfang et al., 2019, pp.13-15).

The commonly employed teaching methods in scaffolding included demonstration, explanation, association, student discussion, questioning, review, and others. During actual teaching, teachers were required to flexibly select appropriate teaching methods based on the content and objectives of the courses, as well as the individual differences among students. Scaffolding teaching demanded that teachers possess a more extensive theoretical knowledge base and a proficiency in understanding students' variations, enabling them to implement differentiated instruction (Yao Xiujuan, 2019, pp.74-76). Overall, the scaffolding teaching mode was well-suited for courses that emphasized students' practical abilities and problem-solving skills.

2.2.3 Process of Online Scaffolding Teaching

Scaffolding teaching maximizes the benefits derived from constructivist learning theory by addressing the interplay between "teaching" and "learning," thereby transforming the teacher-student dynamic within instructional activities. Over time, it has evolved into a relatively well-established methodological system. The process of online scaffolding teaching encompasses the following steps (Zhou Yanhong, 2017, pp.10-12).

Step 1: Initiate the educational scenario. The teacher employs the online learning environment, course content, and teaching objectives to guide students into the learning scenario. They introduce corresponding problem situations and provide additional tools and hints to facilitate problem-solving.

Step 2: Establish support structures. Drawing upon the principles of the Zone of Proximal Development, the teacher aids students in constructing online scaffolds using teaching resources and tools aligned with the course content and teaching objectives.

Step 3: Independent student exploration. Following the completion of scaffold construction, students engage in independent exploration and research of problems through the internet and various information-based learning tools and platforms, utilizing the scaffolds provided by the teacher.

Step 4: Online collaborative learning. Under the guidance of the teacher, students collaborate and share the outcomes of their individual independent learning and exploration within the group through online discussions, collectively working towards problem-solving. The teacher organizes students into online groups and facilitates internal discussions and negotiations within each group.

Step 5: Assess learning outcomes. The learning effect and quality are comprehensively assessed by means of learner self-evaluation, group peer evaluation, and teacher evaluation. This assessment encompasses the learner's problem research and exploration process as well as standardized tests.

The combination of scaffolding teaching and online learning has inherent advantages. Information technology and tools can provide teachers with more abundant and convenient scaffolding building methods and strategies (Yang Rixin, 2019, pp.10-13). Scaffolding teaching can also give full play to the advantages of online learning and provide more choices for communication and interaction between teachers and students, students, and students.

The fundamental process of online scaffolding teaching amalgamates the attributes of online teaching, including networking, distance, and interactivity, within the scaffolding teaching process. This integration optimizes their benefits and affords teachers and students a more efficient teaching approach, coupled with a relaxed and convenient learning environment.

2.3 Learning Achievement

2.3.1 Definition of leanring achivement

Phairoj Kachentorn (2013, p.49) defines the leanring achivement as the characteristics, including knowledge and abilities, that result from education, teaching, or accumulated experiences that individuals have gained from learning. These factors lead to behavioral changes in various aspects of brain functionality.

Sirisarn Sirithirin (2011, p.18) states that the meaning of learning outcomes refers to the academic achievement of individuals, which can be measured through various assessment methods that do not necessarily rely on testing. These methods include evaluating students' work and observing their behavior, among others.

Thawatchai Bunsawatkanchai (2000, p.4) defines learning outcomes as the knowledge, skills, and brain functionality in various aspects that students acquire from the instruction of teachers, which can be assessed using achievement tests.

Gagne (1985, p.40) stated in the past that Achievement Learning was divided into five aspects, namely intellectual ability, cognitive strategies, verbal information, attitudes, and skills.

According to Bloom in Suharsimi Arikunto (1990, p.110) that learning outcomes canbe divided into three aspects, namely cognitive, affective and psychomotor.

Learning achievement was defined in the past as the enhancement of students' knowledge structure, skill level, and overall competence through the utilization of diverse learning tools, methods, environments, materials, and practical training activities. This progress was achieved through self-learning, group learning, teacher guidance, assistance, coordination, and other instructional approaches. The extent of change in internal abilities and knowledge structures could be quantitatively measured using specific methods and tools.

2.3.2 Learning achievement measured

Yaoawadi Rangchaiakun Viboonsri (2008, p.16) stated in the past that the purpose of using achievement tests was to measure the learning outcomes in terms of subject content and various skills of each academic discipline, especially in multiple subjects taught at different grade levels in each school.

Uthumporn Chamraman (1998, p.1) explained in the past that assessing learning outcomes was the effort to evaluate whether students had achieved the intended goals of learning and teaching, as well as adhered to the content and instructional methods that teachers had arranged for the learning experiences.

1) Quantitative testing, which refers to a series of test questions designed to measure students' learning achievement based on their learning content and

goals through closed or open book methods. The measurement results are quantitative scores, and the level of test scores can largely reflect students' learning level and quality.

2) Non-quantitative tests, which usually referred to non-quantitative face-to-face tests, learning process assessments, etc., were conducted by teachers or other evaluators with students in a one-on-one manner after learning was completed. The purpose was to obtain students' various performances during the learning process and assess the degree of improvement in knowledge, skills, comprehensive qualities, and other aspects after learning.

3) Self assessment, which refers to the comprehensive evaluation of students' performance and final learning outcomes during and after the learning process.

4) Group mutual evaluation was usually applied in situations where students learned in groups. Other students in the same group evaluated the students' performance in the learning process and the learning achievements obtained through the learning process.

In the research on methods of student learning achievement, Li Yingfang et al. (2019) believed that the measurement and evaluation of students' learning achievements should be adaptively chosen according to specific circumstances, with a primary emphasis on various quantitative assessments. Han Xiao (2019) believed that the evaluation of students' learning achievement relied on several crucial factors, including evaluation objectives, evaluation environment, evaluation methods, evaluation tools, evaluation resources, evaluation subjects, and evaluation objects. Among these factors, the evaluation objectives and evaluation environment play a pivotal role in determining the selection and implementation of the other elements.

2.4 Relevant Research

2.4.1 Domestic research

According to Li Yi (2010), scaffolding teaching has witnessed increasing utilization in modern distance online education. Distance online education offers a convenient implementation environment and application space for the implementation of scaffolding teaching. Teachers have the opportunity to create scaffolding through goal guidance, skill instruction, exploration methods, and evaluation mechanisms. They can

design and execute teaching plans tailored to learners' characteristics and needs, conducting teaching activities via online learning tools and platforms. Throughout this process, teachers are required to possess higher quality and abilities, including experience in course teaching, proficiency in scaffolding teaching, and expertise in utilizing various distance online teaching tools and platforms.

The implementation of online scaffolding teaching has demonstrated significant advantages over the traditional classroom teaching mode in various aspects. These include students' enhanced learning enthusiasm, increased concentration, improved critical thinking abilities, heightened collective consciousness, and enhanced reflective capabilities. Moreover, students' test scores have shown improvement as well.

Wang Huijun et al. (2021) conducted research, designed, and executed an online scaffolding teaching plan for the "Information Technology Course and Textbook Analysis for Primary and Secondary Schools" using teaching cases and Wiki services on the blackboard platform.

Yang Ping (2020) conducted research on integrated scaffolding teaching and flipped classrooms and implemented it in the teaching of information technology at a university in China. Through the design, establishment, and implementation of the flipped classroom teaching mode and scaffolding teaching scheme, this teaching mode exhibited significant advantages in addressing issues such as students' lack of enthusiasm for independent learning, limited engagement in teaching activities, and reduced learning efficiency when compared to a simple online teaching mode. The author provided comprehensive suggestions and activity frameworks for the implementation process, encompassing specific teaching scheme design and scaffold construction.

Luo Li (2020) conducted research on the rapid growth of online education in China in light of the COVID-19 pandemic. The investigation revealed that the majority of online teaching in China exhibited relatively low effectiveness and quality, with notable issues such as limited student participation, diminished learning enthusiasm, and reduced learning efficiency. Consequently, based on the inherent characteristics and prevalent challenges of online teaching, the author conducted practical research on the information technology course in senior high school. The study found that, within the online teaching environment, the scaffolding teaching mode showcased

significant advantages. These included offering personalized and targeted teaching programs for students, enhancing their self-directed learning abilities, stimulating their interest in learning, and promoting active classroom participation.

Han Xiao (2019) conducted research on the application of the scaffolding teaching mode in online College English courses in the past. The study involved implementing SMRT teaching method practice activities at Harbin Guangxia University. The SMRT teaching method was an English teaching approach that utilized the Internet, web technology, and mobile devices, employing the scaffolding teaching mode and online learning software. According to the research findings covering the period from 2016 to 2019, the SMRT teaching method exhibited significant improvements in college students' English proficiency. Test scores in oral English, reading, and writing surpassed those achieved through traditional English classroom teaching methods.

2.4.2 Foreign Research

Suwastini et al. (2021) held the belief that online teaching would be the future trend in modern society. They also recognized the significant achievements of scaffolding teaching in enhancing student progress in traditional offline teaching. Therefore, conducting research to adjust and refine scaffolding teaching in the online teaching mode was deemed highly important. The study examined the specific methods, contents, types, and characteristics of scaffolding teaching within the framework of online teaching, utilizing academic information platforms such as ERIC, Google Scholar, and ResearchGate as supportive databases. The research identified key elements of scaffolding teaching under the online teaching framework, including the provision of learning opportunities, addressing waning learning enthusiasm, and the transfer of teachers' responsibilities. The study proposed optimizing and enhancing the procedures, concepts, primary activities, and teaching strategies within the scaffolding teaching process to address these issues. Specific measures encompassed positioning the content and structure of course materials within the online environment, facilitating remote access to digital educational resources and teaching tools, cultivating students' critical thinking skills, providing guidance and assistance in practical problem-solving processes, incorporating digital teaching cases and knowledge points, and establishing a constructive teaching feedback mechanism.

Atipat and Thiadporn (2019) conducted research on the utilization of scaffolded instructions to enhance students' speaking skills and bolster their confidence. The study involved twelve first-year undergraduate students who participated in a self-study club called "Let's Speak." The club aimed to empower students to deliver effective presentations and speak English with confidence. Throughout ten sessions, students engaged in practice sessions focused on five different topics, with each topic being practiced for two weeks. Language support and feedback from teachers and peers were provided as scaffolds to enhance students' performance on a weekly basis. To evaluate changes in their perceived confidence, the researchers administered a confidence in speaking questionnaire (adapted from Griffee) to the participants before the first session and after the tenth session. Additionally, the researchers compared the checklist and presentation scores from the initial and final sessions to measure overall performance changes. At the conclusion of the tenth session, the students watched videos of their performances from the first and tenth sessions and participated in a stimulated-recall interview to reflect on their progress. The findings indicated an increase in students' perceived confidence, higher scores in their actual performance, and self-reported improvements in various aspects. The paper discussed pedagogical implications and provided suggestions based on these findings.

Yee Ling Lee and Meng Yew Tee (2021) conducted research in the past on the scaffolding strategies employed by facilitators in a design-based learning (DBL) context. DBL was an inquiry-based pedagogy that focuses on generating artifacts to address real-life issues through an iterative engineering design process. However, completing design tasks can be challenging, necessitating scaffolding to support student learning in a DBL setting. A literature review revealed significant implementation issues related to scaffolding student learning in this context, and the roles of facilitators in scaffolding student learning in a DBL context were under-researched. This study aimed to investigate facilitators' scaffolding strategies that could aid students in integrating knowledge within a DBL context.

The study involved a class of 27 Form 1 students in a national school who were assigned the task of designing and constructing a water filter while integrating knowledge from Science, Technology, Engineering, Arts, and Mathematics (STEAM)

subjects. The facilitator provided scaffolding throughout the implementation of this design task, and data were collected through video recordings, student interviews, and researcher's notes. The research findings demonstrated that the facilitator utilized various scaffolding strategies to support student learning based on their emerging learning needs. These scaffolding strategies were categorized into six types, including cognitive, linguistic, metacognitive, motivational, social, and strategic scaffolding. This study shed light on the multiple roles played by facilitators in scaffolding student learning in a DBL context, emphasizing the importance of incorporating diverse scaffolding strategies to enhance student learning outcomes.

In a separate study, Quang Nhat Nguyen (2022) conducted research on teachers' scaffolding strategies in internet-based English language teaching (ELT) classes. The COVID-19 pandemic necessitated social distancing measures, leading to the widespread adoption of internet-based ELT in developing countries. However, the sudden shift from face-to-face to online learning raised concerns about maintaining the quality of ELT education during crises, specifically regarding how teachers scaffolded students in internet-based classrooms. While significant research has focused on scaffolding students' learning in face-to-face ELT classes, effective scaffolding strategies for online classes warranted further scholarly investigation.

This article provides a review of contemporary research on scaffolding strategies for teachers to implement in their internet-based ELT classes. The author synthesizes and systematizes scaffolding functions, intentions, and strategies that can be applied in internet-based English classes, offering practical recommendations for teachers to scaffold students in diverse online teaching and learning contexts. Additionally, the article addresses common challenges and proposes solutions for teachers to effectively employ scaffolding strategies in internet-based ELT classrooms.

Based on the research findings of both domestic and international scholars, the scaffolding teaching mode has emerged as an important approach for implementing constructivism theory in specific teaching practices. Scaffolding teaching offers students the necessary conditions for autonomous learning and self-improvement with the guidance and support of teachers. As online education technology and theories continue to advance, integrating the scaffolding teaching mode with online teaching

technology not only leverages the benefits of scaffolding teaching but also overcomes the limitations of physical teaching spaces. This integration provides a more convenient and supportive environment for implementing the scaffolding teaching mode.

Given these considerations, the researcher was motivated to investigate the potential of scaffolding teaching in enhancing learning management and improving learning achievements among first-year secondary vocational students.

CHAPTER 3
RESEARCH METHODOLOGY

The research on the learning management through scaffolding teaching to improve learning achievement for 1st year of secondary vocational students had the following details or components:

3.1 Research Design

3.2 Population and Sample

3.3 Research Instrument

3.4 Instrument Development

3.5 Data Collection

3.6 Data analysis

3.7 Statistics used in Research

3.1 Research Design

The study's design was quasi-experimental research, and the experimental design used was the one-group pretest-posttest design.

Table 3.1 The One-Group Pretest-Posttest Design

Pre-test	Independent variable	Post-test
T_1	X	T_2

Symbols Used in experimental design

X = learning management through scaffolding teaching on the Fundamentals of Computer Application courses

T_1 = Pre-test

T_2 = Post-test

3.2 Population and Sample

3.2.1 Population

The population of this study consisted of 138 1st year secondary vocational students, studying the Fundamentals of Ccomputer Application course at Zigong Vocational and Technical School, Sichuan, China during the academic year 2022.

3.2.2 Sample

The research sample consisted of 10 1st year secondary vocational students who were selected using purposive sampling method, studying the Fundamentals of Computer Application course at Zigong Vocational and Technical School, Sichuan, China.

3.3 Research Instrument

The research instruments were classified into the types used in the experiment and the instruments used for data collection. With details as follows:

3.3.1 The learning management plan for the Fundamentals of Computer Application course using scaffolding teaching consisted of 8 academic hours for the experimental group of 1st year secondary vocational students. The course content covered four topics, with each topic having 2 hours dedicated to it:

1) Composition of the computer system
2) Operation of Windows Operating System
3) Excel Spreadsheets
4) PowerPoint Basic functions and features

3.3.2 The test of the learning achievement for the Fundamentals of Computer Application course included a test paper with 30 multiple-choice questions.

3.4 Instrument Development

3.4.1 The learning management plan for the Fundamentals of Computer Application course using scaffolding teaching was developed with the following steps for instrument development:

3.4.1.1 The researchers collected and analyzed relevant documents and research papers to explore and analyze the learning management through scaffolding

teaching for first-year secondary vocational students in the Fundamentals of Computer Application course. They studied relevant concepts, theoretical systems, and methodology of learning management through scaffolding teaching. The new teaching mode aims to strengthen students' subjective initiative in learning, optimize the teaching objectives of the course, improve the effectiveness of students' independent learning, and enable students to quickly overcome difficult points of knowledge learning. The process of scaffolding teaching includes the following steps, as identified by Zhou Yanhong (2017, pp.10-12).

Table 3.2 The learning management process of scaffolding teaching

Steps	The learning management process of scaffolding teaching
Step 1	Entering the educational situation involved using the network environment and teaching course content and objectives to guide students into the learning situation. The teacher assisted students in understanding the problem situation and provided additional tools and clues to help solve the problems.
Step 2	The teacher built the support by utilizing online teaching resources and tools to help students construct scaffolds based on the theory and basic requirements of the nearest Development Zone in accordance with the course content and teaching objectives.
Step 3	Students were expected to explore independently after the scaffold construction was completed. They conducted independent research and exploration on problems through the network and various information-based learning tools and platforms. This was achieved through online self-learning in accordance with the scaffold built by the teacher.

Table 3.2 The learning management process of scaffolding teaching (Cont.)

Steps	The learning management through the direct instruction model
Step 4	Online collaborative learning involved teachers, students, and peers sharing the results of their independent learning and exploration within the group through online discussions. They worked together to solve problems encountered during online learning, under the guidance of the teacher. The teacher grouped learners online and facilitated internal discussions and negotiations within each group.
Step 5	Evaluation of learning outcomes was conducted by comprehensively assessing the learner's performance and quality throughout the problem research and exploration process, as well as standardized tests. The evaluation process included learner self-evaluation, group mutual evaluation, and evaluation by the teacher..

3.4.1.2 The teaching content and ideas were determined, and an online scaffolding teaching environment for the Fundamentals of Computer Application course was established on the UMU platform, targeting 1st-year secondary vocational students.

3.4.1.3 The learning management plan with learning management through the scaffolding teaching on the Fundamentals of Computer Application course was created. The learning management contents included:

1) Composition of the computer system
2) Operation of Windows Operating System
3) Excel Spreadsheets
4) PowerPoint Basic functions and features

3.4.1.4 The learning management plan with learning management through the scaffolding teaching on the Fundamentals of Computer Application course was proposed to the thesis advisor to verify the validity of the content and suggestions. It was revised based on suggestions.

3.4.1.5 The learning management plan with learning management through the scaffolding teaching on the Fundamentals of Computer Application course was proposed to 5 experts, including 2 technology experts, 2 curriculum and instructional experts, and 1 measurement and evaluation education expert. The experts checked the correctness and consistency of the learning management plan elements, including learning objectives, learning contents, learning management process, learning materials, and measuring learning outcomes. The scoring criteria were as follows:

Score 1: Ensure the elements of the learning management plan are consistent.

Score 0: When unsure that the elements of learning management plan are consistent.

Score-1: When sure that the elements of learning management plan are not consistent.

3.4.1.6 The analysis results of the item objective consistency (IOC) were considered, selecting items with a score of 0.05 or higher, and revised according to expert suggestions before the try-out. The analysis results showed that the IOC value was between 0.80-1.00.

3.4.1.7 The learning management plan with learning management through the scaffolding teaching on the Fundamentals of Computer Application course was tried out with 1st-year secondary vocational students in Zigong Vocational and Technical, China, who were not part of the sample of 1 classroom.

3.4.1.8 The learning management plan with learning management through the scaffolding teaching on the Fundamentals of Computer Application course was improved before data collection.

3.4.1.9 Data was collected with the learning management plan with learning management through the scaffolding teaching.

3.4.2 The learning achievement test on the Fundamentals of Computer Application course consisted of 30 multiple-choice questions. The steps taken to develop the instrument were as follows:

3.4.2.1 The researchers studied the related concepts and theories of quantitative tests and the methods of creating learning achievement tests.

3.4.2.2 The learning objectives and contents on the Fundamentals of Computer Application course were analyzed to create the learning achievement test.

3.4.2.3 The researchers created the learning achievement test on the "Fundamentals of Computer Application course", which included 40 multiple-choice questions.

3.4.2.4 After creating the learning achievement test on the Fundamentals of Computer Application course, the researchers proposed it to the thesis advisor to verify the validity of the content and suggestions. The test was revised based on the advisor's suggestions.

3.4.2.5 The researchers then proposed the learning achievement test on the Fundamentals of Computer Application course to 5 experts, including 2 technology experts, 2 curriculum and instructional experts, and 1 measurement and evaluation education expert. The experts checked the correctness and consistency of the exam items and learning objectives. The scoring criteria were as follows:

Score 1: When the item of the exam was sure to be congruent with the learning objectives

Score 0: When unsure that the item of the exam was congruent with the learning objectives

Score -1: When sure that the item of the exam was not congruent with the learning objectives

3.4.2.6 The analysis results of item objective consistency (IOC) were obtained by considering the compliance index, selecting items with a score of .05 or higher, and revising according to the expert suggestions before trying it out. The analysis results showed that the IOC value was between 0.80-1.00.

3.4.2.7 The learning achievement test on the "Fundamentals of Computer Application course" was then tried out with the 1st year of secondary vocational students at Zigong Vocational and Technical School, Sichuan, China, who were not a sample of 1 classroom.

3.4.2.8 Difficult items were identified, and the quality criteria of the learning achievement test were specified with a difficulty level of 0.20 - 0.80 and a discriminating power from 0.20 - 1.00. 30 quality items were selected for the test. The analysis results showed that the test had a difficulty level of 0.40 - 0.80 and a discriminating power from 0.50 - 0.80.

3.4.2.9 The total reliability confidence value (Reliability) of the learning achievement test was analyzed by Cronbach's alpha coefficient (α). The analysis results showed that the total confidence value of the test was 0.972.

3.4.3.10 The researchers improved and published a learning achievement test that had passed the quality check and was used for data collection.

3.5 Data Collection

The data collection process was carried out in the following steps:

3.5.1 Preparation steps

3.5.1.1 The researchers contacted the graduate official at the Faculty of Technical Education, Rajamangala University of Technology Thanyaburi to request permission to collect data with a sample from the secondary vocational school in Zigong, China.

3.5.1.2 The researchers also contacted the director of the secondary vocational school in ZigongVocational and TechnicalSchool, China, to seek assistance and cooperation in collecting data from the sample.

3.5.1.3 Using random cluster sampling, the researchers selected a sample of 10 first-year secondary vocational students from a total of 138 students in Zigong Vocational and TechnicalSchool, China. They explained the learning objectives and process of learning management through scaffolding teaching to the selected students to ensure that they understood their roles and responsibilities in the learning management.

3.5.2 Data collection steps

3.5.2.1 Prior to the learning management, the researchers administered a pretest to 10 first-year secondary vocational students in Zigong Vocational and Technical School, China.

3.5.2.2 The researchers collected data through learning management using scaffolding teaching on the Fundamentals of Computer Application course.

3.5.2.3 After the learning management, the researchers administered a posttest to 10 first-year secondary vocational students at Zigong Vocational and Technical School, Sichuan, China.

3.5.3 Summary steps

3.5.3.1 The researchers analyzed the scores using basic statistics and statistics used in hypothesis testing.

3.5.3.2 They summarized the data in tabular form, described the research findings, and discussed them.

3.6 Data Analysis

In the data analysis, the researcher conducted the following data analysis steps:

3.6.1 Analysis of study instrument quality

3.6.1.1 The Index of Item Objective Congruence (IOC) was used to analyze the effectiveness of learning management plan.

3.6.1.2 The Index of Item Objective Congruence (IOC) was used to analyze the effectiveness of the learning achievement test on the Fundamentals of Computer Application course course.

3.6.1.3 The Cronbach Alpha Coefficient (α formula) was used to assess the reliability of the learning achievement test on the "Fundamentals of Computer Application course " with a confidence assessment of the alpha coefficient.

3.6.1.4 The difficulty of the learning achievement test on the Fundamentals of Computer Application course was analyzed, with a passing threshold set between 0.20 to 1.00.

3.6.1.5 The discriminating power of the learning achievement test on the Fundamentals of Computer Application course was analyzed, with a minimum value set at 0.20.

3.6.2 Analysis used in hypothesis testing

3.6.2.1 The one-sample t-test was used to compare the learning achievement of 1st year secondary vocational students studying the Fundamentals of Computer Application course through online scaffolding teaching, whose score reached the 70 percent criteria.

3.6.2.2 The dependent samples t-test was used to compare the learning achievement of 1st year secondary vocational students on the Fundamentals of Computer Application course before and after the study through online scaffolding teaching.

3.7 Statistics used in Research

3.7.1 Basic statistics

The researcher used descriptive statistics such as mean and standard deviation to analyze the data gathered from the experimental units primarily.

3.7.1.1 Mean

$$\bar{x} = \frac{\sum x}{N}$$

$\bar{x}$ = refers to the mean

$\sum x$ = is the summation of all observations

N = is the number of observations

3.7.1.2 Standard Deviation

$$\bar{x} = \frac{\sum (x-\bar{x})^2}{n-1}$$

$x - \bar{x}$ = was the difference between the observation (score) and the mean of the distribution

$(x-\bar{x})^2$ = was the squared deviation of the scores from the mean

$n - 1$ = was the number of observations minus the 1

3.7.2 Statistics used in quality inspection of tools

3.7.2.1 Index of item Objective Congruence (IOC)

$$IOC = \frac{\sum R}{N}$$

IOC = was the Item Objective Congruence Index

$\sum R$ = was the summation of 1 in all raters

N = was the number of items

3.7.2.2 Reliability (Cronbach Alpha Coefficient)

$$\propto = \frac{k}{k\text{-}1}\left[1\text{-}\frac{\sum s_i^2}{s_i^2}\right]$$

$\propto$ = was the Cronbach alpha coefficient

k = was the number of items

$\sum s_i^2$ = was the sum of the variances of each item

s_i^2 = was the variance of the total column

3.7.2.3 Difficulty

$$P = \frac{R}{N}$$

P = Difficulty index of an item

R = Number of correct answers to item

N = Number of correct answers plus the number of incorrect answers to item

3.7.2.4 Discriminating power

$$B = \frac{U}{n_1} - \frac{L}{n_2}$$

B = Discriminating Index

U = Correct answer in the upper group

L = Correct answer in a lower group

n_1 = No. of the examinee in upper

n_1 = No. of the examinee in the lower

3.7.3 Statistics used in hypothesis testing

3.7.3.1 The one-sample t-test was used to compare the mean of the learning achievement of 1st year secondary vocational students on the Fundamentals of Computer Application course who studied through online scaffolding teaching. The difference between the actual and hypothetical means was divided by the standard deviation of 70 percent.

3.7.3.2 The dependent samples t-test (also known as the paired t-test or paired-samples t-test) was used to compare the means of the learning achievement of the 1st year of secondary vocational students on the Fundamentals of Computer Application course before and after studying through online scaffolding teaching, to determine whether there was a statistically significant difference between these means.

$$t = \frac{\sum D}{\sqrt{\frac{n\sum D^2 - (\sum D)^2}{n-1}}}$$

$\sum D$ = Sum of the differences

$\sum D^2$ = Sum of the squared differences

$(\sum D)^2$ = Sum of the squared differences, squared

CHAPTER 4
RESEARCH RESULTS

The study the learning management though the scaffolding teaching to improve learning achievement for 1st year of secondary vocational students. The objectives to answer the following: 1) to compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application course studying through the online scaffolding teaching whose score reached 70 percent, and 2)to compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application course before and after studying through the online scaffolding teaching. This section will also present the following:

4.1 The comparative results of students' learning achievement who studied through scaffolding teaching and reached the score criteria of 70%.

4.2 The comparative results of the student's learning achievement before and after studying through scaffolding teaching.

4.1 The comparative results of students' learning achievement who studied through scaffolding teaching and reached the score criteria of 70%.

The results compared the learning achievement of the 1st year of secondary vocational students on the Fundamentals of Computer Application course studying through the online scaffolding teaching, with a criteria of reaching a score of 70 percent. This section also presents Table 4.1 and Figures 4.1.

Table 4.1 The results of the student's learning achievement studying through scaffolding teaching.

Number of Students	Learning management through scaffolding teaching			
	Before Study		After Study	
	Score	Percent (%)	Score	Percent (%)
1	16	53.33	26	86.67
2	14	46.67	25	83.33

Table 4.1 The results of the student's learning achievement studying through scaffolding teaching. (Cont.)

Number of Students	Learning management through scaffolding teaching			
	Before Study		After Study	
	Score	Percent (%)	Score	Percent (%)
3	14	46.67	28	93.33
4	13	43.33	30	100.00
5	13	43.33	29	96.67
6	13	43.33	28	93.33
7	15	50.00	27	90.00
8	15	50.00	26	86.67
9	15	50.00	26	86.67
10	13	43.33	26	86.67
Mean ($\bar{x}$)	14.16	47.00	27.10	90.33
S	1.101		1.595	

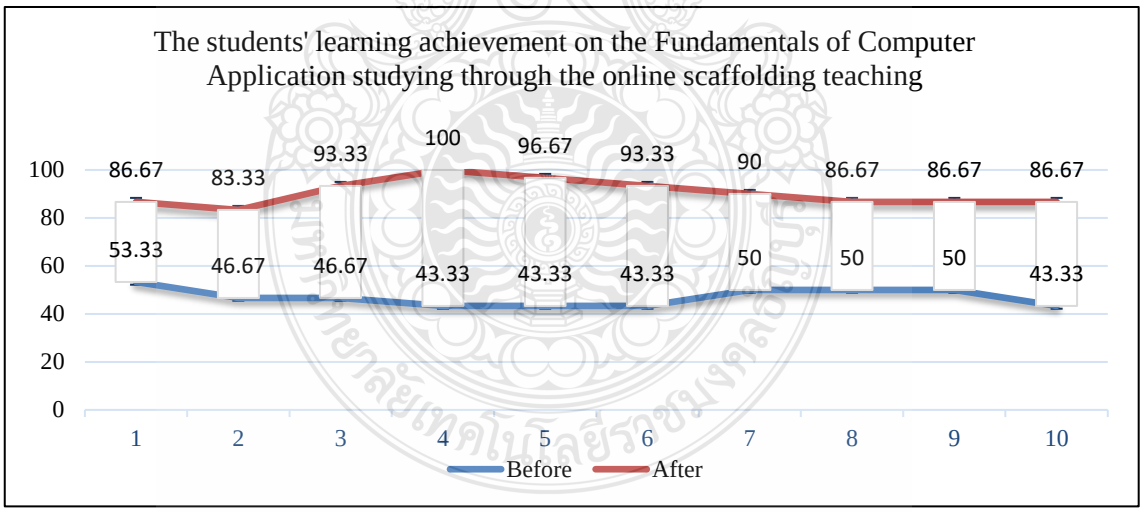

Figure 4.1 The students' learning achievement studying through the online scaffolding teaching.

From Table 4.1 and Figure 4.1, the results reveal that the before-study test scores of students studying through scaffolding teaching were ($\bar{x}$ =14.16, S=1.101) 47%, and the after-study test scores were ($\bar{x}$ =27.10, S=1.595) 90.33%.

Table 4.2 The results of the comparison of students' learning achievement who studied through scaffolding teaching and achieved a score of 70 percent criteria.

Learning management through scaffolding teaching	(Number of Units) n	Mean ($\bar{x}$)	Standard Deviation (s)	% of Mean	t	Sig. (1-tailed)
After Study	10	27.10	1.595	54.20	-15.66*	0.000

The results from Table 4.2 revealed that the post-study test scores of students who studied through scaffolding teaching were 90.33% ($\bar{\mathbf{x}}$ =27.10, S=1.595). When comparing the students' learning achievements through scaffolding teaching, it was found that their achievements were significantly higher than the 70% criterion at a statistical significance level of .05.

4.2 The comparative results of the student's learning achievement before and after studying through scaffolding teaching.

The results compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application course between the before and the after study through the online scaffolding learning management. This section will also present Table 4.3.

Table 4.3 The comparative results of the student's learning achievement before and after studying through scaffolding teaching.

scaffolding teaching	(Number of Units) n	Mean ($\bar{x}$)	Standard Deviation (s)	Computed t-value (t)	Degrees of Freedom (df)	Sig. (p-value)
Before Study	10	14.10	1.101	17.103*	9	0.000
After Study	10	27.10	1.595			

From Table 4.3, the results reveal that the after-study test scores of students studying through scaffolding teaching were higher ($\bar{\mathbf{x}}$=27.10, S=1.595) than the before-study test scores ($\bar{\mathbf{x}}$=14.10, S=1.101). When comparing the student's learning achievement studying through scaffolding teaching, it was found that the after-study scores were significantly higher than the before-study scores at the statistical significance level of .05.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

The study the learning management though the scaffolding teaching to improve learning achievement for 1st year of secondary vocational students. The objectives to answer the following: 1) to compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application course studying through the online scaffolding teaching whose score reached 70 percent, and 2) to compare the 1st year of secondary vocational students learning achievement on the Fundamentals of Computer Application course before and after studying through the online scaffolding teaching. The research sample consisted of 10 1st year vocational secondary students studying the Fundamentals of Computer Application course at Zigong Vocational and Technical School, Sichuan, China, during the academic year 2022, selected through cluster sampling. The research instruments included a learning management plan based on scaffolding teaching and a learning achievement test. Mean, percentage, standard deviations, and t-tests were utilized for data analysis.

5.1 Conclusion of Research Results

5.1.1 The comparative results of the student's learning achievement studying through scaffolding teaching whose score reached 70 percent criteria.

The results revealed that the after studying test scores of students studying through scaffolding teaching were 90.33% ($\bar{x}$ =27.10, S=1.595). When comparing the student's learning achievements studying through scaffolding teaching, it was found that the student's learning achievements were higher than the 70% criteria with statistical significance at the.05 level.

5.1.2 The comparative results of the student's learning achievement before and after studying through scaffolding teaching.

The revealed that after studying test scores of students studying through scaffolding teaching were ($\bar{x}$=27.10, S=1.595) higher than the before ($\bar{x}$=14.10, S=1.101). When comparing the student's learning achievement studying through scaffolding

showed that the after-study scores were higher than the before-study scores statistically significant difference at the level of .05.

5.2 Discussion and Recommendation

5.2.1 The comparative results of students' learning achievement, who studied through scaffolding teaching and achieved a score of 70 percent or higher, showed statistically significant improvement at the 0.05 significance level. This can be attributed to the student-centered teaching approach emphasized in scaffolding teaching, which has a noticeable impact on fostering students' practical problem-solving abilities and autonomous learning skills. In scaffolding teaching, teachers develop comprehensive teaching plans and provide students with step-by-step learning tips and guidance (Wang Liqun, 2021, pp.183-185). Laetitia (2020, pp.157-173) conducted a study on the application of scaffold teaching in computer education and found that scaffolding teaching involves the systematic construction of support structures for students under the guidance of teachers. As students gradually develop their capacity for independent exploration, the scaffolding was gradually removed. This approach highlights both the guidance provided by teachers and the gradual reduction of teacher guidance during the implementation process. The ultimate goal was to help students become more proficient in independent exploration, comprehension, and information construction, shifting the learning process from a teacher-centered approach to a learner-centered one. Elizabeth et al. (2017, pp.80-86) conducted a study on online computer education courses based on scaffolding teaching theory. They found that scaffolding teaching creates a conceptual framework for students' knowledge acquisition within their zone of proximal development. This allows students to construct meaning through social interactions while solving task problems, gradually acquiring new knowledge and mastering skills within their potential development. By creating scaffolding within the students' nearest development zone, teachers assist students in bridging the gap and reaching their potential development levels during the teaching process. Scaffolding teaching was particularly suitable for courses that emphasize practical abilities and problem-solving skills (Luo Li, 2020, pp.243-245). Dar et al. (2019, pp.79-92) confirmed the effectiveness of scaffolding teaching, as students exposed to the scaffolding strategy outperformed their counterparts who were taught using traditional methods. This explains why the students in the study achieved scores higher than the 70 percent threshold.

The comparative results of students' learning achievement before and after studying through scaffolding teaching revealed that the students' post-learning achievement, after being exposed to scaffolding teaching, was significantly higher than their pre-learning achievement at the 0.05 significance level. This improvement can be attributed to the use of scaffolding in teaching, as students' academic performance significantly increased compared to their previous performance. Therefore, scaffolding teaching has a significant positive impact on students' academic performance. Scaffolding teaching involves breaking down the curriculum knowledge into basic elements necessary for teaching activities and providing students with corresponding tools and structural support to learn the fragmented knowledge with the guidance and assistance of teachers (Lu Yuying, 2019, pp.32-34). In the context of information technology classroom teaching, the application of scaffolding teaching has transformed the traditional teaching methods, placing students at the center and promoting their construction of a knowledge framework. In the classroom, students shift from passive knowledge recipients to active knowledge seekers, enhancing their learning enthusiasm through collaborative learning and inquiry activities. Teachers have transitioned from being the leaders of classroom teaching to observers of student learning, assisting students in completing exploratory learning and fostering students' confidence in their own learning. This transformation in teaching forms has allowed every student to participate in classroom learning, providing them with more opportunities for learning (Wang Lixin, 2021, pp.19-20). Consequently, through the implementation of scaffolding teaching, students' scores in the Basic Computer Application course have significantly improved, surpassing their previous performance.

5.3 Implication for Practice and Future Research

5.3.1 Suggestions for applying the research results.

5.3.1.1 The application of scaffolding teaching has had a positive impact on the current teaching situation of the "Computer Application Foundation" course in secondary vocational schools, as evident in the following aspects: Firstly, within the teaching process, teachers effectively engage students and enhance their focus on learning by incorporating relatable scenarios that resonate with students with new knowledge to be acquired. This stimulates students' interest in learning and creates an engaging learning environment. Secondly, during the process of autonomous exploration, students are assigned a series of small learning tasks by the teacher, which helps them enhance their self-ability and develop essential skills. Additionally, in collaborative learning activities

conducted in groups, students not only learn from each other but also enhance their language expression and cooperation skills. In conclusion, compared to traditional teaching methods, the implementation of scaffolding teaching in the "Fundamentals of Computer Application" curriculum in secondary vocational schools effectively improves students' academic performance, thus confirming the experimental hypothesis.

5.3.1.2 The implementation of scaffolding teaching yielded positive results in enhancing the classroom teaching effectiveness of the "Computer Application Foundation" course in secondary vocational schools. Despite the initial weak basic knowledge and abilities of students in computer application, the provision of timely and appropriate learning scaffolds facilitated deeper understanding and mastery of new knowledge, thereby improving their learning effectiveness and performance. Furthermore, through the analysis of assigned learning tasks and post-class work quality, it was evident that students had successfully acquired and applied the content covered in class.A comparison between the experimental group and the control group, in terms of classroom learning quality and final test scores, clearly demonstrated the improved learning ability and efficiency of students in the experimental group. Their proficiency in mastering knowledge points and application abilities in the "Fundamentals of Computer Application" course surpassed that of the control group.

5.3.1.3 The implementation of scaffolding teaching in secondary vocational schools can bring about significant improvements in information technology teaching. It effectively stimulates students' interest in learning, fosters their collaborative learning and autonomous exploration abilities, and positively impacts teaching effectiveness. These findings provide valuable insights for the classroom teaching practice of the "Computer Application Foundation" course in secondary vocational schools. To further promote the use of scaffolding teaching, it was essential to cultivate the educational concepts of information technology teachers in these schools. Currently, most teachers in secondary vocational schools were unfamiliar with this teaching approach, limiting its widespread application in courses such as "Fundamentals of Computer Application". Therefore, in future teaching practices, it was crucial to prioritize the enhancement of teachers' educational concepts and skills. Teachers should be equipped with the knowledge of scaffolding teaching principles and processes, enabling

them to achieve better teaching outcomes through the implementation of scaffolding teaching strategies.

5.3.2 Suggestions for future research

For future research, it was recommended to focus on the following topics:

5.3.2.1 Exploring the application of scaffolding teaching in improving other skills or competencies, beyond the scope of the current study. This could involve investigating how scaffolding teaching can enhance critical thinking, problem-solving, communication, or other essential skills among students.

5.3.2.2 Investigating the integration of scaffolding teaching with different teaching methods to enhance learning achievement or develop specific skills in students. This could involve examining the combination of scaffolding teaching with active learning strategies, project-based learning, flipped classrooms, or other innovative teaching approaches to determine their effectiveness in improving students' learning outcomes.

5.3.2.3 By exploring these areas, further insights can be gained regarding the potential benefits and applications of scaffolding teaching in diverse educational contexts, contributing to the advancement of effective teaching practices and student learning.

List of Bibliography

Aslan, A. (2021). Problem-based learning in live online classes: Learning achievement, problem-solving skill, communication skill, and interaction. **Computers & Education, 171**(104): 237-249.

Atipat, B., and Thidaporn, J. (2019). Using Scaffolded Instructions to Improve Students' Skills. **Eric, 26**(3): 2-4.

Bunsawatkulchai, T. (2000). **In order to achieve academic achievement and use skills Science is necessary for Year 6 to provide skills practice activities.** (Master of Education, Khon Kaen University).

Changwong, K., Sukkamart A., and Sisan, B. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. **Journal of International Studies, 11**(2):37-48.

Cheng, X. (2021). Reform plan of computer network technology and Application Curriculum. **Computer, 5**(14): 28.

Dar, F., Faruqui, A., and Asad, M. (2019). Scaffolding English Language Teaching through Technology. **Journal of Education & Social Sciences, 7**(2): 79-92.

Elizabeth, A. S., and Amy, D. (2017). Broemmel. Authenticity, relevance, and connectedness: Graduate students' learning preferences and experiences in an online reading education course. **The Internet and Higher Education**, (32): 80-86.

Gagne, R. M. (1985). **The Conditions of Learning.** New York: Rinehart and Winston.

Han, X. (2019). Characteristics of SMRT English teaching program - Taking Harbin Guangxia College as an example. **Journal of Jiamusi vocational college**, (09): 154-156.

Hu, Y., Li, L., and Wang, X. (2019). Literature review on Scaffolding Teaching in Chinese universities. **China Press**, (21): 86-87.

Jamonman, U. (1998). **Higher Education Quality Assurance according to the criteria of the Ministry of University Affairs.** Bangkok, Thailand: Chulalongkorn University.

List of Bibliography (Continued)

Kachentorn, P. (2013). **Measurement of academic achievement.** Retrieved 16 May 2021, from : https://:www.wattoongpel.com.

Laetitia, M. (2020). Scaffolding Content in an Online Content and Language Integrated Learning (CLIL) Module. **International Journal of TESOL Studies, 2**(2): 157-173.

Li, F., and Shi, Y. (2020). Practice of Online Computer Network Course Teaching Reform. **RTVU Science and Engineering**, (04): 15.

Li, Y. (2010). Manifestation and specific application of teaching support in Distance Education. **Journal of Hebei Radio and Television University, 15**(03): 1-4.

Li, Y., Tang, Z., and Wang, J. (2019). A practical study of timely feedback on the effectiveness of professional English teaching in higher vocational colleges. **Guangdong Vocational and Technical Education and Research**, (06): 13-15.

Lu, Y. (2019). Formation and Management of Student Information Staff in Higher Vocational Colleges. **Education Modernization, 6**(95): 32-34.

Luo, L. (2020). Improving the quality of online education with Scaffolding Teaching Mode taking high school information technology as an example. **Information and computer (theoretical Edition), 32**(06): 243-245.

Luo, Y., Li, B., and Qi, J. (2020). Thoughts on teaching management execution in universities in the new era. **Beijing Education: Higher Education Edition**, (2): 39-40.

Quang, N. (2022, May 1). Teachers' Scaffolding Strategies in Internet-based ELT Classes. **TESL-EJ, 26**:1-35.

Rangchaikul, W. V. (2008). **Project evaluation.** Concepts and Practices, 6th edition. Bangkok, Thailand: Chulalongkorn University Press.

Suharsimi, A. (1990). **Manajemen pengajaran secara Manusiawi.** Jakarta: PT. Rineka Cipta.

List of Bibliography (Continued)

Sun, Y. (2019). Innovating teaching management to promote ideological and political reform and exploration of the college curriculum. **China University teaching, 13(**5): 55-59.

Suwastini, N. K., Ersani, N. P., Padmadewi, N. N., and Artini, L. P. (2021). Schemes of Scaffolding in Online Education. **RETORIKA: Jurnal Ilmu Bahasa, 7**(1): 10-18.

Waheeb, S., and Albiladi, K. K. (2019). Blended learning in English teaching and learning: A review of the current literature. **Journal of Language Teaching and Research, 10**(2): 232-238.

Wang, H., He, C., Zhao, Z., and Guo, N. (2021). Research on the design and practice of Wiki based scaffolding online collaborative learning activities. **China education informatization**, (18): 73-77.

Wang, L. (2021). Research on Scaffolding Teaching Strategy of practical English writing in senior high school. **English teacher, 21**(24):183-185.

Wang, L. (2021). The application of Scaffolding Teaching in senior high school writing teaching. **Anhui Education and scientific research, 18**(36):19-20.

Yao, X. (2019). Problems in Practice Teaching of Preschool Education and Reform Countermeasures. **Journal of Henan University of Science and Technology, 39**(12): 74-76.

Yee, L., and Meng, Y. (2021, September 2). Facilitator's Scaffolding Strategies in a Design-based Learning Context. **ESTEEM Journal of Social Sciences and Humanities, 11**(9): 15-33.

Zhao, J. (2010). Ideas and Thoughts on effective teaching and teaching management in universities. **China University teaching, 21**(1): 23-25.

Zhou, Y. (2017). Research on the Evaluation and Feedback of Teachers in the Whole Course Teaching Class in Non directly Affiliated Hospitals of Local Medical Colleges and Universities. **Science and Education Literature (Midterm Journal), 32**(12): 10-12.

APPENDICES

APPENDIX A

- **List of Experts Reviewing Research Instruments**
- **Sample Letter to Experts and Specialists for Research Instruments Validation**

List of Experts Reviewing Research Instruments

Specialists

1. Asst. Professor Shuwen Zhou
   Sichuan University of Science and Engineering, Zigong, China.

2. Asst. Professor Danna Luo
   Sichuan University of Science and Engineering, Zigong, China.

3. Dr. Saengrung Poolsuwan
   Aksorn CharoenTat ACT Co., Ltd., Thailand

4. Dr. Surat Kwanboonchan.
   Faculty of Technical Education, Rajamangala University of Technology Thanyaburi, Thailand.

5. Asst. Prof. Dr. Methee Pikunthong
   Faculty of Technical Education, Rajamangala University of Technology Thanyaburi, Thailand.

No. 0649.02/0206

Faculty of Technical Education
Rajamangala University of Technology
Thanyaburi
39 Moo 1, Rangsit-Nakhon Nayok Road,
Klong Hok, Khlong Luang, Pathum Thani
Postal Code 12110, Thailand

17 February 2022

Subject Invitation letter inviting experts to validate research instruments

Dear Dr. Saengrung Poolsuwan

Due to Mrs. Jing Sun , a student who is taking up Master of Education Program in Curriculum Development and Instructional Innovation, Faculty of Technical Education, Rajamangala University of Technology Thanyaburi (RMUTT), is currently processing a thesis for this semester entitled "The Learning Management Though the Scaffolding Teaching to Improve Learning Achievement for 1st Year of Secondary Vocational Students" with Asst. Prof. Dr. Rossarin Jermtatsong , a research advisor.

In relation to this, the researcher has a strong desire to be assisted with regard to the validation of the instruments required studies. The curriculum administration committee consider that you are the most qualified professional with knowledge and capabilities to provide such, the researcher has chosen and would like to ask approval from your good office to be the evaluator. I would like to invite you to be an expert to the validation research instruments for Mrs. Jing Sun for the benefit of further education. I am highly anticipating your kind approval regarding this matter.

Thank you for your kind consideration.

Sincerely Yours,

(Asst. Prof. Arnon Niyomphol)
Dean, Faculty of Technical Education

Department of Education
Tel: +66-2549-3207
Fax: +66-2577-3207

No. 0649.02/0206

Faculty of Technical Education
Rajamangala University of Technology
Thanyaburi
39 Moo 1, Rangsit-Nakhon Nayok Road,
Klong Hok, Khlong Luang, Pathum Thani
Postal Code 12110, Thailand

17 February 2022

Subject Invitation letter inviting experts to validate research instruments

Dear Dr.Surat Kwanboonchan

Due to Mrs. Jing Sun , a student who is taking up Master of Education Program in Curriculum Development and Instructional Innovation, Faculty of Technical Education, Rajamangala University of Technology Thanyaburi (RMUTT), is currently processing a thesis for this semester entitled "The Learning Management Though the Scaffolding Teaching to Improve Learning Achievement for 1st Year of Secondary Vocational Students" with Asst. Prof. Dr. Rossarin Jermtatsong , a research advisor.

In relation to this, the researcher has a strong desire to be assisted with regard to the validation of the instruments required studies. The curriculum administration committee consider that you are the most qualified professional with knowledge and capabilities to provide such, the researcher has chosen and would like to ask approval from your good office to be the evaluator. I would like to invite you to be an expert to the validation research instruments for Mrs. Jing Sun for the benefit of further education. I am highly anticipating your kind approval regarding this matter.

Thank you for your kind consideration.

Sincerely Yours,

(Asst. Prof. Arnon Niyomphol)
Dean, Faculty of Technical Education

Department of Education
Tel: +66-2549-3207
Fax: +66-2577-3207

No. 0649.02/0206

Faculty of Technical Education
Rajamangala University of Technology
Thanyaburi
39 Moo 1, Rangsit-Nakhon Nayok Road,
Klong Hok, Khlong Luang, Pathum Thani
Postal Code 12110, Thailand

17 February 2022

Subject Invitation letter inviting experts to validate research instruments

Dear Asst. Prof. Dr. Methee Pikunthong

Due to Mrs. Jing Sun , a student who is taking up Master of Education Program in Curriculum Development and Instructional Innovation, Faculty of Technical Education, Rajamangala University of Technology Thanyaburi (RMUTT), is currently processing a thesis for this semester entitled "The Learning Management Though the Scaffolding Teaching to Improve Learning Achievement for 1st Year of Secondary Vocational Students" with Asst. Prof. Dr. Rossarin Jermtatsong , a research advisor.

In relation to this, the researcher has a strong desire to be assisted with regard to the validation of the instruments required studies. The curriculum administration committee consider that you are the most qualified professional with knowledge and capabilities to provide such, the researcher has chosen and would like to ask approval from your good office to be the evaluator. I would like to invite you to be an expert to the validation research instruments for Mrs. Jing Sun for the benefit of further education. I am highly anticipating your kind approval regarding this matter.

Thank you for your kind consideration.

Sincerely Yours,

(Asst. Prof. Arnon Niyomphol)
Dean, Faculty of Technical Education

Department of Education
Tel: +66-2549-3207
Fax: +66-2577-3207

No. 0649.02/0206

Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
39 Moo 1, Rangsit-Nakhon Nayok Road,
Klong Hok, Khlong Luang, Pathum Thani
Postal Code 12110, Thailand

17 February 2022

Subject Invitation letter inviting experts to validate research instruments

Dear Asst. Prof. Shuwen Zhou

Due to Mrs. Jing Sun , a student who is taking up Master of Education Program in Curriculum Development and Instructional Innovation, Faculty of Technical Education, Rajamangala University of Technology Thanyaburi (RMUTT), is currently processing a thesis for this semester entitled "The Learning Management Though the Scaffolding Teaching to Improve Learning Achievement for 1st Year of Secondary Vocational Students" with Asst. Prof. Dr. Rossarin Jermtatsong , a research advisor.

In relation to this, the researcher has a strong desire to be assisted with regard to the validation of the instruments required studies. The curriculum administration committee consider that you are the most qualified professional with knowledge and capabilities to provide such, the researcher has chosen and would like to ask approval from your good office to be the evaluator. I would like to invite you to be an expert to the validation research instruments for Mrs. Jing Sun for the benefit of further education. I am highly anticipating your kind approval regarding this matter.

Thank you for your kind consideration.

Sincerely Yours,

(Asst. Prof. Arnon Niyomphol)
Dean, Faculty of Technical Education

Department of Education
Tel: +66-2549-3207
Fax: +66-2577-3207

No. 0649.02/0206

Faculty of Technical Education
Rajamangala University of Technology
Thanyaburi
39 Moo 1, Rangsit-Nakhon Nayok Road,
Klong Hok, Khlong Luang, Pathum Thani
Postal Code 12110, Thailand

17 February 2022

Subject Invitation letter inviting experts to validate research instruments

Dear Asst. Prof. Danna Luo

Due to Mrs. Jing Sun , a student who is taking up Master of Education Program in Curriculum Development and Instructional Innovation, Faculty of Technical Education, Rajamangala University of Technology Thanyaburi (RMUTT), is currently processing a thesis for this semester entitled "The Learning Management Though the Scaffolding Teaching to Improve Learning Achievement for 1st Year of Secondary Vocational Students" with Asst. Prof. Dr. Rossarin Jermtatsong , a research advisor.

In relation to this, the researcher has a strong desire to be assisted with regard to the validation of the instruments required studies. The curriculum administration committee consider that you are the most qualified professional with knowledge and capabilities to provide such, the researcher has chosen and would like to ask approval from your good office to be the evaluator. I would like to invite you to be an expert to the validation research instruments for Mrs. Jing Sun for the benefit of further education. I am highly anticipating your kind approval regarding this matter.

Thank you for your kind consideration.

Sincerely Yours,

(Asst. Prof. Arnon Niyomphol)
Dean, Faculty of Technical Education

Department of Education
Tel: +66-2549-3207
Fax: +66-2577-3207

APPENDIX B

Instrument of Research

Course content structure

Topic	Title	Content	Duration
1	The composition of the computer system	1.1 Elements of computer system 1.2 Types of computer hardware 1.3 Types and functional levels of computer hardware 1.4 Operating principle and characteristics of computer software and hardware	2 hours
2	Operation of Windows Operating System	2.1 File and folder operation under Windows operating system environment 2.2 Basic settings, personalized settings and account management operation of Windows operating system 2.3 Application operation in Windows operating system	2 hours
3	Excel Spreadsheets	3.1 Operation method of Excel worksheet, workbook and cell 3.2 Editing and modifying methods of common objects such as text, pictures and tables in Excel 3.3 Formula, function, sorting, filtering and other data operation functions in Excel 3.4 Simple data analysis method in Excel	2 hours

Course content structure

Topic	Title	Content	Duration
4	PowerPoint Basic functions and features	4.1 PowerPoint Basic functions and features 4.2 PowerPoint Start and Exit 4.3 PowerPoint Window 4.4 PowerPoint View mode	2 hours
	Total		**8 hours**

Example

Lesson Plan 1: Scaffolding teaching

Lesson Plan:	**Unit 1**	**Course Code:**	**10111001**
Subject/ Course	Fundamentals of Computer Application		
Lesson Title	PowerPoint Summary		
Level	Grade 1 of secondary vocational school		
Lesson Duration	2hours		

Lesson objectives

1. Students can master the components of a computer system
2. Students can master the types of computer hardware
3. Students can master the types and functional levels of computer hardware
4. Students can master the operating principles and characteristics of computer software and hardware

Learning content

1. Elements of computer system
2. Types of computer hardware
3. Types and functional levels of computer hardware
4. Operating principle and characteristics of computer software and hardware

Activity

The learning management through the scaffolding teaching	**Activity of Learning Management through the scaffolding teaching**
Set up support.	1. Teachers welcomed students to participate in learning. 2. The teacher asked the students if they had used computers and for how long they had used them.

The learning management through the scaffolding teaching	Activity of Learning Management through the scaffolding teaching
Set up support	3. The teacher asked the students if they were familiar with the components of a computer, the common hardware systems included in a computer, the types of software systems, and their functional roles. 4. Based on the students' answers and their understanding of computer software and hardware systems, the teacher provided a brief history of computer development and explained the content of computer systems, the composition and functional orientation of computer software and hardware systems. This helped establish the initial framework for the course teaching based on the teaching materials.
Enter the situation	5. The teacher used actual computer equipment as examples to demonstrate to the students the various hardware devices that comprise a computer. 6. The teacher briefly introduced the types and functional characteristics of the operating system and application software in the computer software system. 7. Teachers provided resources to students through the UMU online teaching platform, combining them with the content of teaching materials. Students watched teaching videos on their computers, integrating them with the content of teaching materials.

The learning management through the scaffolding teaching	Activity of Learning Management through the scaffolding teaching
Independent exploration	8. The teacher summarized the composition of the computer system, as well as the composition and functional characteristics of the computer hardware system and software system, based on the content of the textbook. 9. The teacher guided the students to sort out and analyze the content of the textbook and studied the operating principle of the computer system. 10. The teacher assigned independent exploration tasks to the students, and through the UMU platform, the students were required to document the types of equipment included in the computer hardware system and their functional positioning, the composition and functional level of the computer software system, and the basic process of command execution when the computer system runs. 11. Through the UMU platform, teachers provided tips and answers for the students' independent exploration process, checked their progress, and offered assistance when needed.
collaborative learning	12. The teacher grouped students on the UMU platform and facilitated online discussions based on their individual progress in independent exploration. 13. After the discussion and exchange, each group selected one student to summarize and share their knowledge and experience regarding the computer system and its operating principle, which included

The learning management through the scaffolding teaching	Activity of Learning Management through the scaffolding teaching
collaborative learning	the hardware composition, software composition, and operating principles. 14. The teacher assigned the learning tasks to each group, which included exploring how the computer software and hardware systems interact during instruction execution, identifying the types of various devices in the computer hardware system and their information interactions during operation, and examining the information interactions of the computer software system during instruction execution. 15. The teachers provided an online answering service for students during the collaborative learning process of each group. 16. After completing the learning task, each team submitted the results of their collaborative learning on the composition and operating principle of the computer system through the UMU platform.
impact assessment	17. The teacher checked the learning results of each group and summarized the completion of the learning tasks for each group. 18. The teacher organized teams to evaluate each other and team members to evaluate each other, and they submitted their evaluations on the UMU platform.

The learning management through the scaffolding teaching	Activity of Learning Management through the scaffolding teaching
impact assessment	19. The teacher summarized the learning situation of each group and made a comprehensive evaluation of the students' mastery of the learning content, as well as their autonomous learning ability and collaborative ability. This evaluation was based on the group mutual evaluation and intra-group mutual evaluation. 20. The teacher released the homework after class through the UMU platform. The students completed the homework and submitted the results through the UMU platform. The teacher corrected the homework and provided feedback on the learning results.

Materials/Resources

1. Computer
2. PPT
3. Teaching material
4. UMU platform
5. Network Learning Resources for Principles of Computer Composition

Assessment

Assessment method	Assessment Tool	Assessment Criteria
Work Sample	Autonomous and collaborative learning tasks were assigned to the students, focusing on the computer system and its operating principles.	Pass 70 Percentage
Test	After-class homework in Textbook	Pass 70 Percentage
Class attendance	Class attendance Form	Pass 70 Percentage

Learning achievement of the Fundamentals of Computer Application

1. The collection of programs, data, and corresponding documents running in the computer system is referred to as _____.
   A. Host
   B. Software system
   C. System software
   D. Application software
2. The computing speed of the computer is _____.
   A. Equivalent to human computing speed
   B. Lower than human computing speed
   C. Equivalent to human computing speed
   D. Much faster than human computing speed.
3. The ASCII code can represent _____ characters.
   A. 127
   B. 256
   C. 255
   D. 128
4. Translating an assembly language source program into an object program requires _____.
   A. Monitoring procedures
   B. Assembler
   C. Machine language program
   D. Diagnostic procedures
5. Eight bytes contain _____ binary bits.
   A. 8
   B. 16
   C. 64
   D. 32

6. The main reason computers can work automatically according to people's will is that they use _____.

   A. Binary number system

   B. High-speed electronic components

   C. Stored program control

   D. Programming language

7. MHz is used to measure the performance of a computer. It refers to _____.

   A. CPU clock dominant frequency

   B. Memory capacity

   C. Word length

   D. Operation speed

8. In a microcomputer, _____ is integrated on the microprocessor chip.

   A. Controller and memory

   B. Controller and arithmetic unit

   C. Calculator and I/O interface

   D. CPU and display

9. The following external equipment does not belong to a microcomputer _____.

   A. CPU and main memory

   B. Input device

   C. Output equipment

   D. External memory

10. In the Explorer, after selecting a file, the operation to open the File Properties dialog box is _____.

    A. Click "File" → "Properties" menu item

    B. Click "Edit" → "Attribute" menu item

    C. Click "View" → "Properties" menu item

    D. Click "Tools" → "Properties" menu item

11. In Word, the currently entered text is displayed in _____.

    A. Mouse pointer

    B. The end of the document

    C. At the insertion point

    D. Before the first paragraph of the document

12. In the main interface window of Excel 2010, the label of each spreadsheet is displayed in _____ of the worksheet.

    A. Left

    B. Right

    C. Lower edge

    D. Top

13. In Excel 2010, select a cell range and press Delete to perform the operation of _____.

    A. Clear content

    B. Clear comments

    C. Clear Format

    D. Clear all information

14. In Excel, in addition to direct input, you can also use the () function.

    A. SUM()

    B. AVERAGE()

    C. COUNT()

    D. TEXT()

15. In Excel, the function to calculate the average value of all values in the parameter is ().

    A. SUM()

    B. AVERAGE()

    C. COUNT()

    D. TEXT()

16. The graphical representation of worksheet data is called ().

A. Graphics

B. Table

C. Chart

D. Form

17. In PowerPoint 2019 slide editing, to proofread all text compositions, the operation should be performed in _____.

A. In the "Format" tab

B. In the "Review" tab

C. In the "Start" tab

D. In the "Design" tab

18. PowerPoint2019 provides users with_____ Automatic layout.

A. 25

B. 28

C. 31

D. 30

19. The operation that cannot be completed in the slide view of PowerPoint 2019 is _____.

A. Adjust the position of individual slides.

B. Delete individual slides.

C. Edit individual slides.

D. Copy individual slides

20. The presentation extension in PowerPoint 2019 is _____.

A. POT

B. PPT

C. DOC

D. DOT

21. When referencing absolute cells in Excel, you need to add () before the address of the worksheet.

A. &

B. $

C. @

D. #

22. The characteristic of binary number is _____.

A. There are two numbers: 1 and 2

B. Every two into one

C. It's people's mathematical habit

D. Complicated calculation

23. Microcomputer host is composed of_____ form.

A. Calculator and display

B. Calculators and peripherals

C. Solvers and printers

D. CPU and main memory

24. The type of presentation provided in PowerPoint for beginners to quickly create electronic presentations is _____.

A. Online Meeting Wizard

B. Content Prompt Wizard

C. Minutes

D. Preset animation

25. The desktop is the initial screen after the system is started. Which of the following must be the components of the desktop _____.

A. Scroll bar

B. Taskbar

C. Dialogs

D. "Control Panel" icon

26. In Windows menu operation, if the color of a menu item is dim, it means _____.
    A. Just double-click to select.
    B. You must hit three consecutive times to select.
    C. After clicking to be selected, a box will also be displayed to ask the operator to enter further information.
    D. In the current situation, this choice is meaningless, and there will be no reaction if it is selected.
27. The following procedure is not an attachment.
    A. Drawing
    B. Disk Cleanup
    C. Outlook
    D. Explorer
28. Under Windows Chinese input mode, the key to switch between Chinese and English input modes is _____.
    A. Ctrl+Alt
    B. Ctrl+Shift
    C. Shift+Space
    D. Ctrl+Space
29. In Word, the setting of the drop cap command is _____.
    A. Clipboard ribbon
    B. "Text" Ribbon
    C. "Paragraph" function area
    D. "Window" ribbon
30. In Excel, each cell has a corresponding reference coordinate, called ().
    A. Cell absolute address
    B. Cell reference position
    C. Cell relative address
    D. Cell working area

APPENDIX C

IOC (Index of Item Objective Congruence)

IOC (Index of Item Objective Congruence)

Learning Management Plan through the scaffolding teaching

for 1st year of secondary vocational students

	Research Instrument	Expert results					total	IOC	Result
		1	**2**	**3**	**4**	**5**			
Learning Management Plan using the traditional approach									
Unit 1	**The composition of the computer system**								
	1. Learning Objectives	1	1	1	1	1	5	1	yes
	2. Learning Subject Matter	1	1	1	1	1	5	1	yes
	3. Learning Media Resources	0	1	1	1	1	4	0.8	yes
	4. Teaching and Learning Activities	1	0	1	1	1	4	0.8	yes
	5. Measurement and Evaluation	1	1	1	1	1	5	1	yes
Unit 2	**Operation of Windows Operating System**								
	1. Learning Objectives	1	1	1	1	1	5	1	yes
	2. Learning Subject Matter	0	1	1	1	1	4	0.8	yes
	3. Learning Media Resources	1	1	1	1	1	5	1	yes
	4. Teaching and Learning Activities	1	1	1	1	1	5	1	yes
	5. Measurement and Evaluation	1	1	1	1	1	5	1	yes
Unit 3	**Excel Spreadsheets**								
	1. Learning Objectives	1	1	1	1	1	5	1	yes
	2. Learning Subject Matter	0	1	1	1	1	4	0.8	yes
	3. Learning Media Resources	1	1	1	1	1	5	1	yes
	4. Teaching and Learning Activities	1	1	1	1	1	5	1	yes
	5. Measurement and Evaluation	1	1	1	1	1	5	1	yes
Unit 4	**PowerPoint Basic functions and features**								
	1. Learning Objectives	**1**	**1**	1	1	1	5	1	yes
	2. Learning Subject Matter	**1**	**1**	1	1	1	5	1	yes
	3. Learning Media Resources	**1**	**1**	1	1	1	5	1	yes
	4. Teaching and Learning Activities	**1**	**0**	1	1	1	4	0.8	yes
	5. Measurement and Evaluation	**1**	**1**	1	1	1	5	1	yes

IOC (Index of Item Objective Congruence)

Learning Management Plan through the scaffolding teaching

for 1st year of secondary vocational students

Research Instrument		Expert results					Total	IOC	Result
		1	2	3	4	5			
Learning Management Plan through the scaffolding teaching									
Unit 1	**The composition of the computer system**								
	1. Learning Objectives	1	1	1	1	1	5	1	yes
	2. Learning Subject Matter	1	1	1	1	1	5	1	yes
	3. Learning Media Resources	1	1	1	1	1	5	1	yes
	4. Teaching and Learning Activities	1	1	1	1	1	5	1	yes
	5. Measurement and Evaluation	1	1	1	1	1	5	1	yes
Unit 2	**Operation of Windows Operating System**								
	1. Learning Objectives	1	1	1	1	1	5	1	yes
	2. Learning Subject Matter	1	1	1	1	1	5	1	yes
	3. Learning Media Resources	1	1	1	1	1	5	1	yes
	4. Teaching and Learning Activities	1	1	1	1	1	5	1	yes
	5. Measurement and Evaluation	1	1	1	1	1	5	1	yes
Unit 3	**Excel Spreadsheets**								
	1. Learning Objectives	1	1	1	1	1	5	1	yes
	2. Learning Subject Matter	1	1	1	1	1	5	1	yes
	3. Learning Media Resources	1	1	1	1	1	5	1	yes
	4. Teaching and Learning Activities	1	1	1	1	1	5	1	yes
	5. Measurement and Evaluation	1	1	1	1	1	5	1	yes
Unit 4	**PowerPoint Basic functions and features**								
	1. Learning Objectives	1	1	1	1	1	5	1	yes
	2. Learning Subject Matter	1	1	1	1	1	5	1	yes
	3. Learning Media Resources	1	1	1	1	1	5	1	yes
	4. Teaching and Learning Activities	1	1	1	1	1	5	1	yes
	5. Measurement and Evaluation	1	1	1	1	1	5	1	yes

IOC (Index of Item Objective Congruence)

Learning achievement test

on The Fundamentals of Computer Application

Item test	Expert results					Total	IOC	Result
	1	2	3	4	5			
1	1	1	1	1	1	5	1	yes
2	1	1	1	1	1	5	1	yes
3	0	1	1	1	1	4	0.8	yes
4	1	1	1	1	1	5	1	yes
5	1	1	1	1	1	5	1	yes
6	1	1	1	1	1	5	1	yes
7	1	1	1	1	1	5	1	yes
8	1	1	1	1	1	5	1	yes
9	1	1	1	1	1	5	1	yes
10	1	1	1	1	1	5	1	yes
11	0	1	1	1	1	4	0.8	yes
12	1	1	1	1	1	5	1	yes
13	1	1	1	1	1	5	1	yes
14	1	0	1	1	1	4	0.8	yes
15	1	1	1	1	1	5	1	yes
16	1	1	1	1	1	5	1	yes
17	1	1	1	1	1	5	1	yes
18	1	1	1	1	1	5	1	yes
19	1	0	1	1	1	4	0.8	yes
20	1	1	1	1	1	5	1	yes
21	1	1	1	1	1	5	1	yes
22	1	1	1	1	1	5	1	yes
23	1	1	1	1	1	5	1	yes
24	1	1	1	1	1	5	1	yes
25	1	1	1	1	1	5	1	yes

IOC (Index of Item Objective Congruence)

Learning achievement test

on The Fundamentals of Computer Application

Item test	Expert results					Total	IOC	Result
	1	2	3	4	5			
26	1	1	1	1	1	5	1	yes
27	1	1	1	1	1	5	1	yes
28	1	1	1	1	1	5	1	yes
29	1	1	1	1	1	5	1	yes
30	1	1	1	1	1	5	1	yes

Biography

Name – Surname	Mrs. Jing Sun
Date of Birth	March 2, 1981
Address	317 Administrative Building, Hui nan Campus, Sichuan University of Science and Engineering, Zigong, Sichuan Province, China
Education	Major in Accounting At Southwest Jiaotong University
Work Experience	Sichuan University of Science and Engineering, From May 2009 up to Present
Telephone Number	13990095125
Email Address	jing_s@mail.rmutt.ac.th