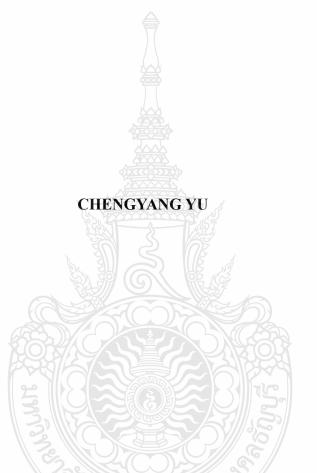# THE DIGITAL TECHNOLOGY IN THE ONLINE HIGH SCHOOL MATHEMATICS CLASSROOM

CHENGYANG YU

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION
PROGRAM IN LEARNING TECHNOLOGY AND INNOVATION
FACULTY OF TECHNICAL EDUCATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THAYANBURI
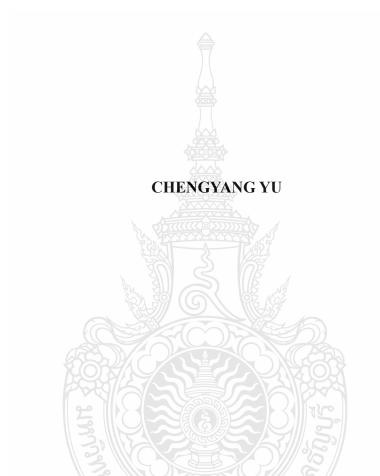ACADEMIC YEAR 2023**

**THE DIGITAL TECHNOLOGY IN THE ONLINE HIGH SCHOOL
MATHEMATICS CLASSROOM**

CHENGYANG YU

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION
PROGRAM IN LEARNING TECHNOLOGY AND INNOVATION
FACULTY OF TECHNICAL EDUCATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THAYANBURI
ACADEMIC YEAR 2023
COPYRIGHT OF RAJAMANGALA UNIVERSITY
OF TECHNOLOGY THAYANBURI**

Thesis Title	The Digital Technology in the Online High School Mathematics Classroom
Name-Surname	Mr. Chengyang Yu
Program	Learning Technology and Innovation
Thesis Advisor	Assistant Professor Naruemon Thepnuan, Ph.D.
Academic Year	2023

THESIS COMMITTEE

.... Chairman

(Assistant Professor Thosporn Sangsawang, Ph.D.)

.... Committee

(Associate Professor Nattaphon Rampai, Ed.D.)

.... Committee

(Assistant Professor Piyanan Pannim Vipahasna, Ph.D.)

.... Committee

(Assistant Professor Naruemon Thepnuan, Ph.D.)

Approved by the Faculty 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.)

21 January 2024

Thesis Title	The Digital Technology in the Online High School Mathematics Classroom
Name-Surname	Mr. Chengyang Yu
Program	Learning Technology and Innovation
Thesis Advisor	Assistant Professor Naruemon Thepnuan, Ph.D.
Academic Year	2023

ABSTRACT

The research objectives were to: 1) develop a quality digital technology in the online high school mathematics classroom, 2) compare the pre-test and post-test scores of students after learning via the digital technology in the online high school mathematics classroom, and 3) study the satisfaction of students who learned via the digital technology in the online high school mathematics classroom.

The samples of this study were 20 students in high school mathematics classroom selected from students who registered for the mathematics subject. The instruments consisted of the digital technology, an evaluation form regarding the quality of media and contents, the pre-test and post-test assessment forms, and an evaluation form regarding student's satisfaction towards the digital technology. The statistics used for data analysis were mean, standard deviation, and t-test for dependent samples.

The research results showed that: 1) the digital technology achieved in media at an excellent level with the average score of 4.57 and quality of contents at an excellent level with the average score of 4.93, 2) the students who learned via digital technology had an average pre-test score of 64.75 and an average post-test score of 79.70, respectively. When comparing the pre-test and post-test scores, it was found that the post-test scores were higher than the pre-test scores with statistical significance at the level of .05 and 3) the students were overall satisfied with the digital technology. The students' satisfaction was at a high level with the average score of 4.44.

Keywords: digital technology, online classroom, high school mathematics

Acknowledgements

Table of Contents

Table of Contents (Continued)

List of Tables

List of Tables (Continued)

List of Figures

CHAPTER 1
INTRODUCTION

1.1 Background and Statement of the Problem

In today's knowledge economy era, mathematics is moving from behind the scenes to the forefront. The combination of mathematics and computer technology has directly created value for society in many aspects and promoted the development of social productivity (Annie, Stoker, & Murray-Ward, 1996). Mathematics is an important component of human culture and has become a fundamental quality that citizens must possess. Mathematics plays a unique and irreplaceable role in the formation of human rational thinking (Smith & Jones, 2000). Since the new curriculum reform, various aspects of high school mathematics teaching have undergone significant changes, but there are still some problems in many aspects. As an important discipline for measuring a person's abilities, many excellent elementary and middle school mathematics students will encounter difficulties in mathematics when entering high school, gradually evolving into a fear of high school mathematics (Brown, 2015). This phenomenon is quite common and should be taken seriously. Countermeasures for this phenomenon. The main manifestations are:

1) Passive learning. Many students have not mastered the learning initiative after entering high school. If you don't make a plan, you sit and wait for class. There is no preview before class. You don't understand what the teacher is going to teach. You are busy taking notes in class and don't really understand what you have learned.

2) Can't listen to the class. In class, teachers should generally explain the context of knowledge, analyze the connotation of concepts, analyze key and difficult points, and highlight the way of thinking. After class, they couldn't consolidate, summarize, and find the connection between knowledge points in time. They just rushed to do homework, randomly set up questions, knew only a little about concepts, rules, formulas, and theorems, mechanically imitated them, and memorized them by rote.

3) Pay no attention to the foundation. Some students who feel good about themselves often belittle the learning and training of basic skills and methods. They often know how to do it, but don't pay attention to the calculation and writing. It is easy to have high vision and low skill. When they arrive at the regular homework or exam, either they make mistakes in the calculation or they get stuck halfway.

4) Compared with junior high school mathematics, senior high school mathematics is a leap in the depth, breadth and ability of knowledge. This requires mastering basic knowledge and skills to prepare for further study. There are many places in high school mathematics with great difficulty, new methods and high requirements for analytical ability. For example, the maximum problem of quadratic function on closed interval, real root distribution and parametric equation, the deformation and flexible application of trigonometric formula, the formation of spatial concept, permutation and

combination problems and practical application problems. Therefore, these foundations must be well prepared for your next step of learning.

5) Teachers only pay attention to teaching, students can only passively receive relevant information, and the flow of information is unidirectional. The central activity of the whole class is "teaching" rather than "learning". Teachers are the theme of the class, and students are just the objects of classroom teaching. This unipolar tendency tends to make students become receivers of knowledge, but they have little opportunity to question and think, and ultimately their understanding of knowledge is superficial.

6) The effect of individualized teaching is poor. Through the survey, it is found that the current teaching plan of high school mathematics teachers focuses on the teaching content, such as teaching focus, teaching difficulties, teaching objectives, etc. Teachers should take these different needs of students into consideration and make corresponding adjustments in the arrangement of teaching content and the choice of teaching strategies. However, it is a pity that the current high school mathematics teachers generally do not make efforts in this regard. In the actual teaching process, they often teach courses at the same level as all students.

7) Effective teaching should be the teaching in which students actively participate and easily achieve the teaching objectives. Specifically, an effective teaching classroom should have the following three characteristics: first, students get cognitive development in teaching, second, students' subjective initiative can be fully mobilized in teaching, and finally, students can creatively apply the knowledge they have learned. But now the high school mathematics teaching is generally centered on teaching.

Under the background of the new curriculum reform, these problems in senior high school mathematics teaching should attract educators' extensive attention. All high school mathematics teachers should take active action to change teaching centered into learning centered, highlight students' dominant position, stimulate students' motivation for independent learning, play their leading role, and effectively improve the effectiveness of high school mathematics teaching.

1.2 Research of Objectives

1.2.1 To develop a quality digital technology in the online High School Mathematics classroom.

1.2.2 To compare the pre-test and post-test score of students after learning via the digital technology in the Online High School Mathematics Classroom.

1.2.3 To study the satisfaction of students who learned via the digital technology in the Online High School Mathematics Classroom.

1.3 Research Questions and Hypothesis

Students who study with the efficiency of digital technology in the online high school mathematics classroom can increase their academic achievement**.**

1.4 Conceptual framework

Independent Variable

Dependent Variables

The Digital Technology in the Online High School Mathematics Classroom	Academics achievements of students after learning via digital technology
	Satisfaction of students who learned via digital technology
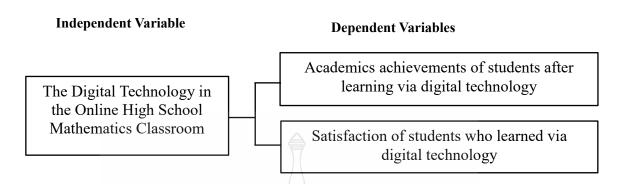
Figure 1.1 Conceptual Framework

1.5 Scope and Limitations of the Study

1.5.1 Content Scope

The main content of this study is the chapter of "Line Plane Parallelism" in Solid Geometry.

1.5.2 Population Scope and Sample

1.5.2.1 Population

The population of this study is 70 students at Shunde No.1 Middle School.

1.5.2.2 Sample

The sample of this study was 20 students at Shunde No.1 Middle School. They were selected by using purposive sampling who selected from students registered for the subject mathematics.

1.5.3 Study Variables

1.5.3.1 Independent variable is digital technology in the online High School Mathematics Classroom.

1.5.3.2 Dependent variables are the results after learned via digital technology in the online High School Mathematics Classroom:

1) Academics achievements of students after learning via digital technology.

2) Satisfaction of students who learned via digital technology.

1.6 Definition of Key Terms

1.6.1 Digital Technology

The digital technology of this thesis is an application which is named DingTalk. DingTalk is an enterprise communication and collaboration platform developed by Alibaba Group. It was founded in 2014 and headquartered in Hangzhou. By 2018, it was one of the world's largest professional communication and

management mobile apps in China with over 100 million users. International market intentions were announced in 2018.DingTalk provides iOS and Android apps as well as Mac and PC clients.

1.6.2 Online Classroom

Online classroom, also known as distance education, generally refers to a web-based learning behavior that utilizes information technology and internet technology for content dissemination and rapid learning. After knowledge imparters place various learning videos on the internet, the classroom becomes a product that thousands of learner's experience and use.

1.6.3 High School Mathematics

High School Mathematics "is a book published by People's Education Press, jointly compiled by People's Education Press, Curriculum and Textbook Research Institute, and Mathematics Curriculum and Textbook Research and Development Center. The book includes sections such as" Sets and Functions, "" Trigonometric Functions, "" Inequalities, "" Series of Numbers, "" Complex Numbers, "" Permutations, Combinations, Binomial Theorems, "Solid Geometry," and "Plane Analytic Geometry.

1.6.4 Academic achievements

Score results from student evaluation after study via digital technology in the online High School Mathematics classroom.

1.6.5 Satisfaction

The level of satisfaction of students towards digital technology in the High School Mathematics classroom.

1.7 Significance of the Study

1.7.1 Quality digital technology in the online high school mathematics classroom is crucial. Developing digital technology for teaching and learning management is particularly important because these technologies serve as tools that can enhance learning experiences for students. They help increase the efficiency of learning and teaching in online high school mathematics classrooms.

1.7.2 Students had higher academic achievement after learning than before learning via digital technology in an online high school mathematics classroom.

1.7.3 Students expressed satisfaction with digital technology in an online high school mathematics classroom.

1.7.4 This helps educators understand the impact of using digital technology in teaching and how it affects student learning. This information can be used to improve teaching methods in the future.

1.7.5 This satisfaction with digital technology can be utilized to further enhance and develop teaching methods in the future. It also helps sustain satisfaction with learning in high school mathematics education.

CHAPTER 2
REVIEW OF THE LITERATURE

This chapter focused on reviewing the previous studies related to the following area relevant to this research

2.1 Digital Technology

2.2 Theoretical Basis

2.3 Research Status at Home and Abroad

2.4 Mathematics

2.5 Academic Achievement

2.6 Satisfaction

2.7 Relevant Researches

2.1 Digital Technology

2.1.1 Digital Technology

2.1.1.1 Application

The digital technology is an application which is named DingTalk. DingTalk is an enterprise communication and collaboration platform developed by Alibaba Group. It was founded in 2014 and headquartered in Hangzhou. By 2018, it was one of the world's largest professional communication and management mobile apps in China with over 100 million users. International market intentions were announced in 2018.DingTalk provides iOS and Android apps as well as Mac and PC clients.

2.1.1.2 The History of DingTalk

On January 16, 2015, DingTalk launched the testing version 1.1.0.

On May 26, 2015, V2.0 was released, adding Ding Mail, Smart OA and shared storage.

On September 19, 2016, V3.0 was released, focusing on B2B communication and collaboration.

On January 15, 2018, DingTalk launched the English version of its application in Malaysia, its first market outside of China (although it can be downloaded and used in other markets such as Bangladesh, US, etc.). At the same time, DingTalk noted that in November 2017 it had launched hardware devices such as the "smart receptionist" that enables employee check-in by fingerprint or facial recognition.

During the COVID-19 pandemic in Wuhan, the app was the target of review bomb after it was used to send homework to quarantined school children.

On April 8, 2020, DingTalk Lite was released on various app stores across key Asian markets, including Japan, Indonesia, Malaysia, and other countries and regions. DingTalk Lite comes with necessary features such as messaging, file sharing, and video conferencing. It supports video-conferencing for over 300 people

simultaneously and a live-broadcast function for more than 1000 participants. The app offers AI-enabled translation of messages in 14 languages including Chinese, Japanese, English.

2.1.1.3 The Features of DingTalk

1) All messaging types including text messages, voice messages, pictures, files, DingMails. The Unique Read/Unread Mode is to improve communication efficiency and messages can be delivered with DING, which can alert the recipients through phone call, SMS, and the app itself.

2) All organizational contacts are unified into one online platform.

3) Audio conference call support for up to 30 parties.

4) SmartWork OA for managing internal workflows such as employee leaves, travel applications, and reimbursement. Records can be summed up and exported. In the future, more 3rd party applications and functions will be integrated.

5) DingTalk is one of the first Chinese apps to have obtained the ISO/IEC 27001:2013 standard. Data is encrypted to SSL/TLS security standards.

6) Smart hardware C1 and M2, "smart" applications

2.1.2 Online Teaching

Online teaching is to take advantage of the network platform as the carrier of teachers' teaching and students' learning, transcend space constraints, and carry out bilateral teaching activities. With the upgrading of communication technology, teaching activities are accurately monitored and recorded. During the teaching process, the learning content is presented in the form of multimedia. The teaching activities are carried out on the network, and the learning track is presented on the network. Students realize the teaching purpose and plan through online learning and communication. Compared with traditional teaching, online teaching has the characteristics of more flexibility, repetition, small number of restrictions, and higher requirements for learners' self-consciousness. At present, online teaching mainly includes live teaching and recorded teaching. Live teaching has the advantage of timely interaction and adjustment, while recorded teaching has the advantage of free learning time.

2.2 Theoretical Basis

2.2.1 Constructivist Theory

Constructivism learning theory emphasizes student-centered, which not only requires students to change from passive recipients of external stimuli and objects of knowledge instillation into subjects of information processing and active constructors of knowledge meaning; Moreover, teachers are required to transform from knowledge imparters and indoctrinators into helpers and promoters of students' active construction of meaning. The key of constructivist learning is to stimulate students to actively explore the meaning of learning, rather than let students passively accept the course content

taught by teachers. In promoting students' active learning, we should take students as the main body and put students at the core of activities.

Constructivism attaches great importance to the role of teaching situation in students' learning and advocates situational teaching. Constructivism believes that learners' knowledge is acquired through the construction of meaning under certain circumstances with the help of others, such as cooperation, communication, and use of necessary information between people. The ideal learning environment should include four parts: situation, cooperation, communication and meaning construction. The situation in the learning environment must be conducive to the meaning construction of the learning content by learners. The learning situation created by teachers will more or less have differences between online teaching and offline teaching. The collaboration and communication between teachers and students, and between students and students will also have differences accordingly, and the effect will also be affected. Whether digital technology can make up for it, and whether it has an impact on meaning construction How the impact is still to be investigated. After all, the construction of meaning is the ultimate goal of teaching activities, which directly determines the teaching effect of a class.

2.2.2 Meaningful Acceptance of Learning Theory

American psychologist Osubel put forward the theory of meaningful acceptance learning. He believed that acceptance learning is not necessarily mechanical learning, but also meaningful learning. On the contrary, acceptance learning will improve students' learning efficiency. The actual situation of Chinese education and the characteristics of high school mathematics make it difficult for high school mathematics learning to adopt discovery learning in every class. Most high school mathematics teachers adopt the teaching method of acceptance learning, While accepting learning is not equal to mechanical learning, it is necessary to make the learning process more meaningful, so that students can learn actively. Both online and offline teaching should make boring mathematics colorful and interesting, let students know why this problem is solved in this way, clarify the meaning of each step, so as to improve students' learning efficiency and achieve efficient classroom. The conditions for meaningful learning come from two aspects, the learning material itself and the learner's own state. In the process of teaching, we should emphasize meaningful learning. High school mathematics is of logical significance, but some abstract. These abstract knowledge will be concreted through digital technology-assisted teaching to facilitate students' understanding. In addition, the interesting nature of digital technology can attract students' attention and improve their interest in mathematics, which can promote students' meaningful learning.

2.2.3 Duval's Geometric Cognitive Theory

Geometric cognitive theory believes that solid figures can help students acquire abstract knowledge in geometry course learning. In response to this situation, Raymond

Duval, a French mathematics education scholar, put forward four concepts of cognitive understanding in 1995, namely, perceptual understanding, sequential understanding, discursive understanding and operational understanding. Perceptual perception refers to the perception of the appearance (shape, size, etc.) of a figure, which can distinguish and distinguish the subgraphs of a figure, but these subgraphs may not be completely based on the original figure. Sequential perception refers to the fact that different unit components of a figure will be presented in order during the composition process, discussed understanding means that geometric concepts must originate from the naming and hypothesis of the figure, the identification of geometric properties must be based on the discussion, and operational understanding means that students can get the solution idea by operating the figure when observing the figure. Duval's theory focuses on the understanding process of geometric problems, especially how to present geometric figures to geometric reasoning and proof, providing theoretical basis for solving geometric problems.

2.3 Research Status at Home and Abroad

2.3 Domestic Research Status

In recent years, with the continuous development of Internet information technology and the continuous popularity of online education in China, domestic scholars have gradually increased their research on online teaching and related teaching quality management theories. With the outbreak of the COVID-19 in 2020, all schools in China have comprehensively carried out online teaching, and "online teaching" has become a hot topic for many domestic scholars to carry out extensive research.

As of December 31, 2022, the key words were freely combined as the core information of the article and retrieved on CNKI. The distribution is shown in Table 2.1 below:

Table 2.1 Retrieve File Distribution

Key words	Academic journals	Doctoral thesis	Master's thesis	Others	Total
Online Classroom	15400	4	610	886	16668
Total Quality Management	19500	28	1384	1140	21638
Collaborative Governance	7685	323	3989	645	12595
Online Classroom+Total Quality Management	8	1	O	6	O
Online Classroom+Collaborative Governance	168	2	17	26	186
Online Classroom+Quality Assurance	76	1	O	12	89

Table 2.1 shows that the independent research on online teaching, total quality management theory and collaborative governance theory is relatively rich, but the relevant research on online teaching quality assurance and online teaching collaborative governance is very few. From the content of the documents searched, there are many studies on how to improve the educational effect of schools as the main body of education under the information teaching mode, but few studies on the coordination and co-governance of schools, government, society, students and other multiple subjects. With regard to the establishment of online education quality assurance system, domestic scholars in relevant fields have mostly studied the construction of the assurance system, the factors affecting online teaching quality, the process management of teaching quality, and the establishment of evaluation and feedback system. (1) Research on the construction of online teaching quality assurance system According to the research of scholars Qu Zhili and Wang Tongxu, the basic elements of online teaching quality assurance can be divided into four parts: basic conditions for running a school, education system design, teaching implementation process, and education system evaluation. Two scholars believe that in the construction of the quality assurance system of modern distance education, first of all, we must have a scientific and reasonable school scale and professional settings; secondly, we should pay attention to the integration of high-quality online teaching resources and the process management and control of teaching and learning; In addition, we should also pay attention to the provision of good services in the learning process and effectively manage the learning effect. Two scholars believe that the focus of online teaching quality assurance is the design of education system, the core is the management of teaching implementation process, and the key is to meet the basic conditions for running a school "Its guarantee is the effective evaluation of the education system. They pointed out that in terms of the construction of the education quality guarantee system, from the macro level, the government should actively give policy guidance and support, so that the guarantee of the teaching quality of distance education can be coordinated with the development of local economy and cultural development; in terms of the coordination of the main body of running a school, the school is the core body of the internal guarantee system, and should fully cooperate with the administrators and teachers of the education administration department Teachers, students and other internal multiple subjects, fully mobilize the enthusiasm and initiative of all parties, and through continuous improvement and improvement of system construction, form an effective circulation system for improving internal quality management, which is composed of five elements: planning, control, supervision, feedback and improvement (Qu Zhili, Wang Tongxu, 2017). Zhang Jianshe, another scholar, also put forward relevant factors affecting online teaching quality from the macro and micro levels. He believed that the macro factors were policy support, social support, financial support and technical support, and the micro factors were teaching participants, teaching managers, curriculum content and teaching resources. Based on the research of multiple subjects

participating in the governance process in the online teaching quality assurance system. Hu Xuefeng believes that online teaching is not only a matter for college teachers and students. Education is the biggest livelihood of the people. It is related to thousands of families, social and economic development, and also the national development plan. Therefore, ensuring the quality of online teaching is the task of the whole country and society (Hu Xuefeng, 2020). He believed that the country and society should play a leading role in the development of network technology, the standardized management of various online teaching platforms, and the optimization of various teaching software. Schools should ensure teaching quality by strengthening top-level design, establishing teaching teams, using and selecting online resources, and strengthening the establishment of curriculum management and feedback mechanism. Cao Haiqin, a scholar, believes that in the process of multi-agent collaborative governance, the government should clarify its own responsibility orientation, fully delegate power to society and schools, and play a positive role of social organizations (Cao Haiqin, 2017). In their research, Lu Xing and others analyzed the educational governance mechanism in the emergency period worldwide. They believe that the education governance in the emergency period should continue to strengthen the capacity building of the education sector, and this process needs the coordinated promotion of stakeholders. According to Lu Xing and others, multiple subjects in the teaching process, such as teachers, education managers, education experts and platform builders, should carry out collaborative cooperation and actively participate in the formulation of relevant education policies. However, because the relevant governance subjects are multi-level personnel combinations from government departments to school subjects, and then to relevant social departments, the composition of its members is quite complex. In the process of collaborative cooperation, the rights and obligations of all actors and stakeholders should be clarified, and an influential accountability mechanism should be established to enable all stakeholders to actively participate in the formulation of educational decisions under effective incentives, so as to promote the construction process of online teaching security system. In addition, we should also pay attention to the real-time monitoring of the process of improving the quality of online teaching through multi-party collaboration, and pay attention to the changing and developing educational needs of relevant groups (Lu Hang, Wang Huanhuan, 2020).

2.3.2 Research on Online Teaching Quality Management

From the perspective of total quality management, some scholars proposed that online teaching management in colleges and universities should develop the concept of service quality, and should regard online teaching quality as a service process to meet customer needs. Peng Qiaoyan (2020) a scholar, proposed that the key to the quality assurance of online education should be started from three aspects: first, to improve the basic conditions of online education; The second is to provide online teaching skills training for teachers to improve their teaching skills and digital

information capabilities; Third, we need to do a good job in tracking and monitoring online teaching. The coordination and cooperation of related work requires not only the participation of all staff, but also the ability of relevant subjects to perform their respective duties and work in multiple ways, so as to build a comprehensive and multi-dimensional quality assurance and monitoring system and improve the quality of online teaching.

Chen Xin, Sun Yaoting and other (2005) scholars summarized the online teaching quality management system into six elements: concept, specification, organization, process, monitoring and evaluation and feedback system. Qi Yeguo (2009) believes that as a quality management activity, school teaching quality management has different characteristics from other quality management activities: first, according to the characteristics of diversified education in colleges and universities, colleges and universities should combine their own quality view and quality management concept to establish a quality management system; Second, the quality management of colleges and universities should pay attention to communication and exchange, and emphasize that the participants should reach quality consensus with each other; Thirdly, the quality management of colleges and universities should also learn from the relevant management technologies and methods of the quality management of industrial and commercial enterprises, change from focusing only on the quality management results to focusing on the quality formation process, and change from the separated and scattered quality control measures of supervision to the comprehensive quality management system of the management control system.

Han Sufen and Wang Hui (2020) are concerned about how to manage and supervise students' online learning effects. They believe that for students' bad learning habits, such as delaying learning tasks, plagiarizing assignments, and simply coping with the problems of completing online teaching tasks, effective supervision and management should be achieved through improving the teaching APP function. Teachers' analysis of online students' autonomous learning task completion statistics should be based on big data for scientific classification, effective scoring, and automatic summary to reduce teachers' workload.

Yang Xiaodong, Zhong Chongyi, Zhang Min and other (2020) scholars have conducted in-depth analysis on the "Internet plus" intelligent teaching cloud platform in promoting the independent quality assurance mechanism of online teaching. They believe that under the background of the era when the "Internet Ten Education" practice is widely carried out, all schools should actively embark on the construction of online teaching management platform, and can effectively monitor the quality of online education and teaching through the construction of information education. In addition, the school can also use the third-party online teaching platform for systematic collection and analysis of teaching data, give full play to the intelligent management ability, and establish a teaching effect with data sharing function.

2.3.3 Research on Online Teaching Quality Evaluation

(1) With regard to the establishment of online teaching quality evaluation system, Peng Qiaoyan (2020) a scholar, believes that on the one hand, the online teaching evaluation system of schools should be student-centered and guided by teaching output results to continuously promote the improvement of online teaching quality. In the evaluation of students' participation in the teaching process, we should change the previous single evaluation method that only focused on the paper examination results, and try to adopt more flexible, diverse and innovative personalized evaluation methods according to the course setting, teaching objectives and course nature. Based on the particularity of online teaching, its teaching evaluation system should have the characteristics of the whole process, multi-level and diversification; On the other hand, for the evaluation of teachers, it is not enough to only evaluate the teaching content and teaching methods in traditional teaching. It should also conduct a comprehensive and systematic evaluation from the preparation of teaching resources, the management of online teaching network environment, the utilization effect of teaching resources related to the teaching platform, the teaching implementation process, the effect of teaching activities and the realization of teaching objectives.

In addition, the teaching management department should also organize students to actively evaluate and feedback the implementation and effect of online teaching by teachers through satisfaction survey or online evaluation of teaching, and relevant departments should timely publish the results of student evaluation of teaching, and do a professional analysis of the development of online teaching by teachers, so as to put forward valuable improvement suggestions and suggestions for front-line teachers, and effectively help teachers improve the effectiveness of online teaching, Achieve the improvement of teaching quality. Xu Shaoming, Lu Xianhong and Chen Yonghong (2021) believe that to ensure the quality of online teaching, it is necessary to build a comprehensive evaluation system for online course evaluation. In terms of the establishment of evaluation indicators, they believe that the quality of online teaching can be comprehensively evaluated by combining the "QM" standard of the United States and the "national standard" standard of China.

The "QM" evaluation in the United States focuses on process evaluation, while the "national standard" in China focuses on result evaluation. Therefore, according to the views of scholars such as Xu Shaoming, et al. (2021) we should fully combine the advantages of the two evaluation methods, paying attention to both the evaluation of "learning process" and the evaluation of "teaching results". Only by effectively combining the two can we establish a comprehensive evaluation system. Li Guohe (2018) a scholar, believes that online teaching evaluation should make full use of the "cloud teaching" platform of resource sharing, fully analyze the data of online teaching, and excavate the value of relevant digital information, Use powerful digital information to provide data support for online teaching evaluation. Some domestic scholars put forward

the importance of establishing a "third-party" evaluation system to improve teaching quality management based on their research on foreign teaching quality management. Qi Lingling (2014) made a detailed discussion on the third-party evaluation model of American education from five aspects: development process, organizational structure, right structure, behavior mode and supervision mode, and put forward suggestions to promote the quality of senior high education from the aspects of strengthening the legislative construction of quality assurance of senior high education, attaching importance to multiple evaluation. Liang Qing (2020) analyzed the experience of the United States, Japan, the Netherlands and other countries in the legalization of the evaluation system, the legalization of the evaluation institutions, the participation of multiple subjects, and the market demand, and believed that the construction of the third-party evaluation system of vocational education in China should adopt five strategies, such as accelerating the legalization construction, establishing the accreditation system of the third-party evaluation institutions, vigorously developing the third-party evaluation institutions, establishing an open evaluation system, and creating a demand environment.

From the perspective of research, when domestic and foreign scholars study the online teaching quality assurance system, they mostly take schools as the main body of analysis and research, and propose relevant management measures for online teaching quality assurance from the relevant subjects involved in the school, and the research on comprehensive analysis combining the internal and external multiple subjects of the school is relatively lacking. However, in the context of widespread online teaching, the participants involved in online teaching quality management are no longer limited to a single subject of schools, but can be extended to the government, society, teaching platform, employing enterprises and other multiple subjects related to online teaching. Based on the uniqueness of online teaching in the context of the era of information technology development, it is proposed that the quality management and system construction of online teaching should break the boundary of the school wall. Starting from how to carry out collaborative cooperation between the government, schools, relevant social institutions and other multiple entities, and establish a comprehensive quality management of online teaching, it is proposed to explore the optimization of a complete and co-governance online teaching quality assurance system from inside to outside and from top to bottom.

From the perspective of research content, western scholars and Chinese scholars' research on online teaching quality assurance mostly focuses on quality assurance and quality management, fully emphasizes the supervision of teaching process, the establishment of teaching evaluation standards and evaluation systems, and the positive role of big data platform in the process of improving and supervising the quality of modern education and teaching, and mostly discusses based on ISO9000 quality management system and standards. From the perspective of public management, taking

the total quality management theory and collaborative governance theory as the basic research theory, this paper discusses the optimization path of multi-agent collaborative online teaching quality assurance.

（2）Research Status Abroad

Since the 1990s, foreign countries have carried out systematic research on online learning, which has laid the foundation for the research of online teaching in the epidemic period. However, the research results of online teaching are mostly higher education, especially the research of teaching interaction in online teaching. The latest research results mainly focus on online teaching methods. Hye Chang Rhim of Harvard University and Heeyoung Han of the University of Illinois in the United States in "Online teaching: basic concepts and practice guide of online learning" "The article points out that online teaching needs three foundations, namely, the understanding of distance, existence and learners. Effective online teaching can promote the interaction between students and resources, teachers, peers and self through the acceptance of experiential learning methods. The article innovatively proposes that learning communities can make effective online learning continue and strengthen, providing a reference for the innovation of online teaching models Abi Sriharan, University of Lundo, in "Online teaching: skills for students to participate in virtual classroom" "The article puts forward five skills to improve online learning: first, develop a blueprint for the teaching plan and logically plan the teaching objectives, learning activities and learning evaluation of the course. Second, master effective classroom and class management skills to keep learners actively participating in classroom discussions. Third, maintain good interaction with learners by designing classroom activities. Fourth, in the online learning environment, teachers play the role of theme specialists Home and host are two key roles. Fifth, bring enthusiasm for the subject and confidence in teaching to the classroom, and establish a sincere relationship with learners. The views put forward in this article are very comprehensive and have practical significance for reference, but the introduction of specific operation steps is not detailed enough, and only lists the views.

Zheng-Wei Lee and Foong May Yeong, National University of Singapore, in "Online conference platform provides opportunities for interactive teaching" "The article proposes a student-led teaching model based on the idea of reciprocal teaching. The article systematically discusses how to improve students' dominant position in online teaching, and puts forward specific practical strategies. However, the article pays too much attention to students' activities, ignoring whether students' learning objectives can be achieved in teaching.

To sum up, the development of information technology in western countries is earlier than that in China, and the development of online teaching is also earlier, with rich practical experience. Therefore, foreign scholars' research on online teaching quality assurance and quality management is relatively complete, and the proposed solutions and solutions are more specific and clear. There are many studies on

online teaching methods in foreign countries, but due to the influence of factors such as the evaluation system of foreign secondary schools, there are many studies on online teaching in higher education abroad, and there are few studies on online teaching in secondary schools. However, the important research results on online teaching and the relevant teaching methods proposed by them have important reference significance for the development of online and offline teaching models in China. Although online teaching in China is relatively late,

2.4 Mathematics

The online classroom teaching content mainly focuses on learning the knowledge points related to the chapter of "line plane parallelism" in solid geometry and training classroom exercises. The knowledge points mainly include the recognition of the spatial position of line plane parallelism, the determination and property theorems of line plane parallelism. Then, through various classroom training, students can fully understand the methods and skills of using judgment and property theorems. In this process, the stimulation and exercise of spatial imagination ability is particularly important. Taking the judgment of parallel lines and planes as an example, in the teaching stage of new courses, it is necessary to first set teaching objectives, such as knowledge points and key and difficult points, processes and methods, emotional attitudes and values, etc. In online classrooms, educational media is also very important, especially in the chapter on solid geometry, which is crucial for cultivating students' spatial imagination ability. In the online classroom, CAD modeling software has been introduced, which can directly generate very intuitive and visible spatial three-dimensional structures, helping students understand various spatial positional relationships. Of course, the setting of teaching methods is also crucial. Throughout the process, students can use the online classroom platform to listen to classes and receive after-school assignments from teachers, in order to consolidate and strengthen their understanding and application of knowledge points through practice after class.

2.5 Academic Achievement

2.5.1 Academic achievement

Tophat.com (2022) give meaning of academic achievement describes academic outcomes that indicate the extent to which a student has achieved their learning goals. Academic achievement may refer to completing educational benchmarks such as a bachelor's degree. Academic achievement is often measured through examinations or continuous assessments.

Study.com)2022) give meaning of academic achievement is the amount of academic content a student learns in a specific time period. This can be any way a student has achieved short-term or long-term academic goals within an academic setting. Testing and assessments are usually performed to gauge a student's academic achievement.

Academic achievement or academic performance is the extent to which a student, teacher or institution has attained their short or long-term educational goals. Completion of educational benchmarks such as secondary school diplomas and bachelor's degrees represent academic achievement.)Study.com 2022)

Annie, Stoker and Murray-Ward (1996) give meaning of Academic achievement is commonly measured through examinations or continuous assessments but there is no general agreement on how it is best evaluated or which aspects are most important—procedural knowledge such as skills or declarative knowledge such as facts.

Ziedner, Mosche (1998) furthermore, there are inconclusive results over which individual factors successfully predict academic performance, elements such as test anxiety, environment, motivation, and emotions require consideration when developing models of school achievement.

2.5.2 Individual differences influencing academic performance

Stumm, Helland and Tomas (2011) Individual differences in academic performance have been linked to differences in intelligence and personality. Students with higher mental ability as demonstrated by IQ tests and those who are higher in conscientiousness (linked to effort and achievement motivation) tend to achieve highly in academic settings. A recent meta-analysis suggested that mental curiosity (as measured by typical intellectual engagement) has an important influence on academic achievement in addition to intelligence and conscientiousness.

Bossaert, Doumen, Buyse and Verschueren (2011). Children's semi-structured home learning environment transitions into a more structured learning environment when children start first grade. Early academic achievement enhances later academic achievement.

Lassiter (1995) the significance of social relationships in educational contexts is widely recognized, particularly in how these relationships influence learning and academic performance. Notably, the characteristic of reciprocity within social relationships among children has been associated with enhanced academic performance.

2.6 Satisfaction

2.6.1 Satisfaction

Dictionary.cambridge.org (2022) give meaning of satisfaction a pleasant feeling that you get when you receive something you wanted, or when you have done something you wanted to do.

Britannica Dictionary (2022) definition of satisfaction: a happy or pleased feeling because of something that you did or something that happened to you

Vocabulary.coms (2022) said about satisfaction meaning is the act of fulfilling a

need, desire, or appetite, or the feeling gained from such fulfillment. Satisfaction means you've had enough — in a good way. When a product says "Satisfaction guaranteed" it means you'll like it or they'll give you your money back. A good meal provides satisfaction of your hunger. When you graduate from school or get a good job, you have a feeling of satisfaction. This term once meant an act of atonement assigned by a priest to make up for a sin. When something is explained well, it was explained to your satisfaction.

2.6.2 Student Satisfaction

There are a several findings of definition regarding to the concept or term "satisfaction" In the services and marketing literature. According to Oliver (1997), he stated that satisfaction is a pleasurable fulfillment which in general consumers are familiar that consumption completes some goal, desire and consequently this completion creates a pleasurable feeling. As for Halsteadet al. (1994), satisfaction refers to an alternate response that is cantered on matching the result of the product with some standard set prior to the purchase and measured during or after consumption

On the contrary, Fornell (1992) describes satisfaction as a common evaluation based on the result of the product perceived after the purchase and compared with prospects prior to the purchase. Additionally, the term satisfaction has been researched thoroughly in many empirical studies through massive personal interviews and meetings with consumer groups.

Satisfaction according to Giese and Cote (2000) comprises of three crucial elements which are first, a general affective response that varies in its intensity, secondly a focus on the choice of product, purchase or consumption and lastly, the moment of determination that varies according to different situations and duration in time. The term satisfaction itself creates a vast diversity within industry and societal perspectives and varies with regard to the object focus and level of specificity.

According to Yi (1991), satisfaction consists of levels of satisfaction with a product or service, purchase decision experience, performance attribute, consumption-use experience, department or store of the business organization, lastly with a pre-purchasing experience.

Comparatively, Spreng and Olshavsky (1989) argue that consumer desires instead of expecting when comparing the performance of a product or a service while other scholars

Harvey, Plimmer, Moon, and Geall (1997) also indicate that student satisfaction is a quality enhancement tool which is designed to improve the quality of student experience. In addition, Bailey, Bauman and Lata (1998) study shows that student satisfaction can be viewed in a way of associating various multiple factors such as campus community, advertising services, and faculty in the educational environment accounted for the variance in students' satisfaction.

2.7 Relevant Researches

Daniela Fadda, Marta Pellegrini, Giuliano Vivanet, Claudio Zandonella Callegher (2021) Conducted research on effects of digital games on student motivation in mathematics: A meta-analysis in K-12. Objectives to contrast the general decrement in student motivation in mathematics, a multilevel meta-analysis was carried out to synthesize the results of studies concerning the impact of digital games on K-12 student motivation in mathematics. The result was A total of 20 primary studies (43 effect sizes) meeting eligibility criteria was included. Results showed a significant overall effect (dppc2 = 0.27; 95%CI = [0.14; 0.41]) and a great heterogeneity between studies. Moderator analyses showed differences in effect size associated to the duration of intervention and motivational construct in terms of expectancy and value.

Zhang Yaya (2020) Investigation and research on the current situation of solid geometry learning among high school students-taking "Preliminary Solid Geometry" as an example to conduct a questionnaire survey on more than 400 students, and concluded that students' emotional attitudes, geometric knowledge reserves, learning Methods and habits, teachers' teaching and evaluation methods, etc. are the main factors that affect high school students' learning of geometry. It is recommended that teachers pay attention to mathematical culture and basic knowledge, cultivate students' good learning methods and habits, enhance their sense of space and logic, and pay attention to the teaching of geometry. evaluation to improve learning results.

Zhao Hong, Jiang Fei, Tang Xueli and Zhen Zhiping (2021) Online education: Digital divide or digital opportunity? ——Based on the analysis of urban and rural differences in online learning during the epidemic. Taking urban and rural primary and secondary school students as the survey subjects, we studied the differences in online learning between urban and rural students. We used Cronbach's Alpha coefficient test and Bartlett's sphericity test to analyze the survey results and found that network conditions are responsible for the differences. Basic factors, independent learning ability is the key factor, and recognition of online learning is the core factor. Three suggestions are put forward, namely: the government should strengthen the construction of network facilities, especially to improve network service capabilities in rural marginal areas; pay attention to students Cultivate independent learning abilities and information literacy; establish a collaborative teaching model to realize the interconnection of educational resources.

Wang Dan (2020) Studied the limitations and countermeasures of the development of online education at the basic education stage in the paper "The Limitations and Countermeasures of the Development of Online Education at the Basic Education Stage" and pointed out that informatization is an important method for developing the modernization process of education. Especially with the outbreak of the new coronavirus pneumonia epidemic across the country in early 2020, Primary and secondary schools all over the country adopt online teaching methods, which further

reflects the advantages and value of online education. But at the same time, the development of online education in the basic education stage is restricted by many factors, which limits the development of online education to a certain extent.

CHAPTER 3
RESEARCH METHODOLOGY

This research is the digital technology in the online High School Mathematics classroom were selected to study the subjects through educational experiment method, interview method and case tracking observation method. The structure of this chapter is as follows:

3.1 Research Design
3.2 Population and Sample
3.3 Research Instruments
3.4 Data Collection
3.5 Data and Statistical Analysis

3.1 Research Design

The researcher used a quantitative approach in experimental design for conducting this study. The data was collected in a quantitative or numerical form derived from the test, and the researcher used a one-group pretest-posttest design. This design included a pretest measure followed by a treatment and a posttest for a single group. An illustration of the design is as follows:

Group: O1 x O2
O1 = Measurement of the pretest score
X = Digital Technology in the online High School Mathematics
O2 = Measurement of the achievement of the posttest score

3.2 Population and Sample

3.2.1 Population

The population of this study were 70 students at Shunde No.1 Middle School.

3.2.2 Sample

The sample of this study were 20 students from Shunde No.1 Middle School.They were selected by using purposive sampling who selected from students registered for the subject mathematics.

3.3 Research Instruments

3.3.1 Digital Technology

The digital technology of this thesis is an application which is named DingTalk. DingTalk is an enterprise-level intelligent mobile office platform created by Alibaba Group. It will lead a new generation of working methods in the future and will accompany the growth of every enterprise. It is a collaborative office and application development platform for enterprise organizations in the digital economy era and a new

productivity tool. The following sentences are the steps to ues Dingtalk for an online class:

Figure 3.1 Home page of Dingtalk Program

First, we use DingTalk's group live broadcast function. In-group live broadcast is safe and controllable, and it can easily open up new ways of online teaching, corporate training, large-scale conferences, annual conferences and exhibitions, and video marketing. Before the formal class begins, the teacher will create a new group and bring all students and teachers into the group.

Step 1. Preparation for live broadcast

Only adults who have completed personal real-name authentication and are over 18 years old can initiate live broadcasts.

Send a live broadcast preview: In order to allow everyone to participate on time
- select the meeting DING
- notify the participants in time.

Figure 3.2 Preparation for Live Broadcast

Step 2. Initiate a group live broadcast

In online classes, teachers usually initiate group live broadcasts on the computer. The live broadcast path is: DingTalk on the computer - DingTalk Group - Toolbar - Initiate group live broadcast.

Figure 3.3 Initiate a Group Live Broadcast

By selecting the screen sharing mode, you can share content such as PPT courseware open on the desktop, or some kind of operation demonstration directly to the audience, and you can choose to show your face. Display the camera footage in a certain area of the live broadcast to achieve a picture-in-picture effect. This is also the most commonly used live broadcast mode for teachers. Teachers can directly open the teaching files on the computer to show and teach students.

Step 3. After-class work

Teachers can upload homework files in the group chat, and students can download and print them out in the group chat, and then complete the homework. If students are not proficient enough in the content learned in class, they can choose the live broadcast playback function and view the playback video in "Group Files - Live Playback". The detailed path is as follows: DingTalk on PC--Group File--Live Playback.

Note: Live broadcasts lasting less than 1 minute cannot be saved and played back. Only live video replays within the past 3 months will be saved in the playback list.

3.3.2 Evaluation form Regarding the Quality

3.3.2.1 Evaluation of use of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School from three content experts and three media experts.

3.3.2.1.1 The assessment of content quality aspects of use of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1

31

Middle School for content experts. The content experts who work in the field of online classroom system or mathematical professors were asked to check the appropriateness of the content used in the Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School.

        3.3.2.1.2 The assessment of media quality aspects of use of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School for media experts. The media experts who work in the field of information technology, computer and education technology or related fields were asked to check the appropriateness of the media used in the use of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School.

    3.3.2.2 The researcher did the following steps:

        Step 1: The assessment in this study has been developed to fit the study hypothesis. Consequently, it was developed based on both theories that have been utilized in this study. The study shows that use of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School . The aim of questionnaire has two main sections.

        Part 1: The first section aims to measure experts' opinion with the use of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School . This part was a close-ended questionnaire that was based on the five (5) point Likert-type scales. The participants were asked to rate their degree of agreement on each statement from numbers 1-5. The interpretation of each number is described as follows:

            5 = Excellent
            4 = Good
            3 = Moderate
            2 = Sufficient
            1 = Improvement

Table 3.1 Range of mean and verbal interpretation for assessment of quality

Range Value	Verbal Interpretation
4.50-5.00	Excellent
3.50-4.49	Good
2.50-3.49	Moderate
1.50-2.49	Sufficient
1.00-1.49	Improvement

        Part 2: This part was an open-ended questionnaire. The participants were asked to express their opinions and suggestions through use of

Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School.

Step 2: Before trying out the assessment, three measurement and evaluation experts who work in the field of measurement and evaluation or education were asked to check the appropriateness of the language used in the questionnaire. The data obtained were used to calculate the Item Objective Congruence index (IOC). The results of evaluation assessment with content quality of item objective congruence index (IOC) by measurement and evaluation experts found that the value of item objective congruence index (IOC) was 1.00 then take the assessment to content experts for further evaluation and results of evaluation assessment with media quality of item objective congruence index (IOC) by measurement and evaluation experts found that the value of item objective congruence index (IOC) was 1.00 then take the assessment to media experts for further evaluation. The evaluation criteria were used for checking the congruence between objectives and items of the test as follows:

Table 3.2 Value of item objective congruence index (IOC) and verbal interpretation

+1	item is considered congruent with the objectives.
0	item is considered neutral in terms of whether it was congruent with the objectives.
-1	item is considered not congruent with the objectives.

The total mean score of the Item-Objective Congruence (IOC) Index is supposed to be higher than 0.5 for acceptable data.

Step 3: The assessment will be used by experts. For the assessment of content quality aspects of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School for content experts and the assessment of media quality aspects of Dingtalk for the online classroom system to enhance efficiency usage of students at Shunde No.1 Middle School for media experts.

3.3.3 The Achievement Assessment (Pre-test and Post-test)

A pretest and posttest shared the same items Both contained 15 questions related to the definition, determination, and property theorems of the "line plane parallelism" section in solid geometry that they have learned in the class: 6 items contained The students were assigned to do the pretest before learning "Parallel lines and planes" and do the posttest after learning through this knowledge point The researcher went through the following steps:

Step 1: The researcher selected the test types Multiple choice, blank filling, short answer questions tests were chosen to use in the study.

Step 2: The second section of the questionnaire has been developed to measure students' academic achievement based on DingTalk classroom concept to enhance the

parallel section of higher vocal students

        Step 3: Three measurement and evaluation experts who work in the field of measurement and evaluation or education were asked to check the consistency between objects and items in the test. The data obtained were used to calculate the Item Objective Congruence index (IOC)

        The evaluation criteria were used for checking the consistency between objectives and items of the test as follows:

Table 3.3 Value of item objective congruence index (IOC) and verbal interpretation of achievement assessment

+1	item is considered congruent with the objectives.
0	item is considered neutral in terms of whether it was congruent with the objectives.
-1	item is considered not congruent with the objectives.

        The total mean score of the Item-Objective Congruence (IOC) Index is supposed to be higher than 0.5 for acceptable data.

        Step 4: Both the pretest and posttest were tried out with 50 students in grade 1 at Shunde No.1 Middle school in China, but were not the samples of this study. After the tests have been tried out, used in finding the difficulty index, discrimination index and reliability index of the achievement test. it was found that the 36 difficulty index should be between 0.2-0.8, the discriminant index should be 0.2 or higher and reliability should be 0.8 or higher using Kuder-Richardson's K-R#20 formula.

        Step 5: The pretest and posttest are used with the participants to explore their Mathematical knowledge before and after learning the Parallel lines and planes through the live broadcast lesson based on DingTalk concept to enhance the parallel section of senior high students.

3.3.4 The questionnaire on students' satisfaction

        The questionnaire was used to ask about the students' learning using the live broadcast lesson based on DingTalk concept to enhance the parallel section of senior high students. The researcher did the following steps:

        Step 1: The questionnaire in this study has been developed to fit the study hypothesis. Consequently, it was developed based on both theories that have been utilized in this study. The study shows that using the live broadcast lesson based on DingTalk concept to enhance the parallel section of senior high students. The aim of questionnaire has two main sections,

        Part 1: The first section aims to measure students' satisfaction with the live broadcast lesson based on DingTalk concept to enhance the parallel section of senior high students. This part was a close-ended questionnaire that was based on the five (5) point

Likert-type scales. The participants were asked to rate their degree of agreement on each statement from numbers 1-5. The interpretation of each number is described as follows:

> 5 = Highest
> 4 = High
> 3 = Moderate
> 2 = Poor
> 1 = Very poor

Table 3.4 Range of mean and verbal interpretation for students' satisfaction

Range Value	Verbal Interpretation
4.50-5.00	Highest
3.50-4.49	High
2.50-3.49	Moderate
1.50-2.49	Poor
1.00-1.49	Very Poor

Part 2: This part was an open-ended questionnaire. The participants were asked to express their suggestions and opinions towards learning through the live broadcast lesson based on DingTalk concept to enhance the parallel section of senior high students in terms of achievements and satisfaction.

Step 2: Before trying out the questionnaire, three measurement and evaluation experts who work in the field of measurement and evaluation or education were asked to check the appropriateness of the language used in the questionnaire. The data obtained were used to calculate the Item Objective Congruence index (IOC). The evaluation criteria were used for checking the congruence between objectives and items of the test as follows:

Table 3.5 Value of item objective congruence index (IOC) and verbal interpretation of questionnaire on students' satisfaction

+1	item is considered congruent with the objectives.
0	item is considered neutral in terms of whether it was congruent with the objectives.
-1	item is considered not congruent with the objectives.

The total mean score of the Item-Objective Congruence (IOC) Index is supposed to be higher than 0.50 for acceptable data.

Step 3: The questionnaire will be used by the participants to explore their satisfaction with learning through the live broadcast lesson based on DingTalk concept to enhance the parallel section of senior high students.The questionnaires were applied to secondary students.

3.4 Data Collection

Step 1: Introduce students to the application which is named DingTalk to improve the efficiency of Chinese students' use.

Step 2: Create a pre exam for students in order to obtain scores.

Step 3: Conduct learning activities with students through DingTalk to improve the efficiency of Chinese students' use.

Step 4: After students learn DingTalk, conduct a post-test to improve the efficiency of Chinese students' use, and use statistical methods to analyze grades.

3.5 Data and Statistical Analysis

In this study, data were analyzed by mean deviation, standard deviation and t-test.

3.5.1 Evaluation of use of Digital Technology in the Online Classroom to enhance efficiency usage of students from three content experts and three media experts by mean and standard deviation.

3.5.2 Compare the achievement test before and after study with Digital Technology to enhance efficiency usage of students by applying the t-test dependent.

3.5.3 Study the satisfaction of students in Digital Technology to enhance efficiency usage of students by mean and standard deviation.

CHAPTER 4
RESEARCH RESULT

In line with the research aims, this chapter is designed to show and discuss the results of the experiment by following the structure below.

4.1 Results of evaluating a quality of digital technology in the online High School Mathematics classroom.

4.2 Results of compare the pre-test and post-test scores of students after learning via the digital technology in the Online High School Mathematics Classroom.

4.3 Results of study the satisfaction of students who learned via the digital technology in the Online High School Mathematics Classroom.

4.1 Results of evaluating a quality of digital technology in the online High School Mathematics classroom.

4.1.1 The digital technology quality assessment results from three media experts as shown in Table 4.1

Table 4.1 The digital technology quality assessment results from three media expert

Option	$\overline{X}$	SD.	Meaning
1. Easy of use of the system.	4.67	0.22	Excellent
2. The order in which information is displayed is appropriate.	4.67	0.22	Excellent
3. Easy and convenient access.	4.67	0.22	Excellent
4. The overall screen design is appropriate.	4.67	0.22	Excellent
5. Presentation control buttons are appropriate.	4.67	0.22	Excellent
6. The font style is easy to read and clear.	4.67	0.22	Excellent
7. The font size is appropriate.	4.67	0.22	Excellent
8. Interesting, inviting you to follow the content.	4.00	0.67	Good
9. Choosing the color of the font and background color	4.67	0.22	Excellent
10. The lessons are interesting.	4.33	0.22	Good
Total	4.57	0.27	Excellent

Form table 4.1 presented the results of the digital technology in the online High School Mathematics classroom, overall, it was found that the quality of the digital technology is at an excellent level with the average score of 4.57, and when considering each item, it was found that; the media is easy of use of the system, the order in which information is displayed is appropriate, the online classroom has an easy and convenient access, the overall screen design is appropriate, presentation control buttons are appropriate, the font style is easy to read and clear, the font size is appropriate, choosing

the color of the font and background color are at an excellent level with the average score of 4.67, next is the lessons are interesting is at an good level with the average score of 4.33, and interesting, inviting you to follow the content is at a good level with the average score of 4.00 respectively.

4.1.2 Content quality assessment results from three content experts as shown in Table 4.2

Table 4.2 The content quality assessment results from three content experts

Option	$\overline{X}$	SD.	Meaning
1. The content is easy to read and understand.	5.00	0.00	Excellent
2. The amount of content is appropriate.	4.67	0.22	Excellent
3. The difficulty of the content is appropriate to the student's level.	4.33	0.22	Good
4. The test is appropriate.	4.33	0.22	Good
5. Assessment and evaluation are appropriate.	5.00	0.00	Excellent
6. The font style is easy to read and clear.	5.00	0.00	Excellent
7. The font size is appropriate.	5.00	0.00	Excellent
8. Provide content knowledge just like the teacher.	5.00	0.00	Excellent
9. The sequence of steps in the presentation is appropriate.	5.00	0.00	Excellent
10. Accuracy of the language used.	5.00	0.00	Excellent
Total	**4.93**	**0.07**	**Excellent**

From table 4.2 presents the results of content quality assessments, overall, it was found that the quality of the digital technology is at an excellent level with the average score of 4.93, and when considering each item, it was found that; the content is easy to read and understand, assessment and evaluation are appropriate, the font style is easy to read and clear, the font size is appropriate, provide content knowledge just like the teacher, the sequence of steps in the presentation is appropriate, accuracy of the language used are at an excellent level with the average score of 5.00, next is the amount of content is appropriate is at an excellent level with the average score of 4.67, and The difficulty of the content is appropriate to the student's level ,the test is appropriate are at a good level with the average score of 4.33 respectively.

4.2 Results of compare the pre-test and post-test scores of students after learning via the digital technology in the online High School Mathematics classroom.

Table 4.3 Compare the pre-test and post-test score of students after learning via the
  digital technology of students

Items	n	$\overline{\text{X}}$	SD.	t-test	Sig. (2-tailed)
Pre-test	20	64.75	11.63	6.67	.000
Post-test	20	79.70	12.26		

**p< .05

From table 4.3 the results of the pre-test and post-test tests of the students had an average score of 64.75 points and 79.70 points, respectively. When comparing the pre-test and post-test scores, it was found that the post-test scores were higher than pre-test scores, with statistical significance at the level. 05

4.3 Results of study the satisfaction of students who learned via the digital technology in the online High School Mathematics classroom.

Table 4.4 The satisfaction of students who learned via the digital technology in the
  online High School Mathematic Classroom.

Option	$\overline{\text{X}}$	SD.	Meaning
1. Easy to use, not complicated	4.54	0.71	Highest
2. There is appropriate positioning of various information on the screen.	4.39	0.86	High
3. Easy and convenient access	4.46	0.81	High
4. The test is appropriate.	4.43	0.70	High
5. Presentation control buttons are appropriate.	4.49	0.74	High
6. The font style is easy to read and clear.	4.50	0.81	Highest
7. The font size is appropriate.	4.49	0.69	High
8. Choosing the color of the font and background color	4.48	0.71	High
9. The difficulty of the content is appropriate to the student's level.	4.46	0.81	High
10. The lessons are interesting.	4.12	1.30	High
Total	**4.44**	**0.81**	**High**

From table 4.4 it was found that the students are overall satisfied with digital technology at the online classroom table 4.44 presents the results of study the satisfaction who studied in the online classroom. Overall, it was found that the quality of the students'

satisfaction was at a high level with the average score of 4.44, and when considering each item, it was found that; the digital technology is easy to use, not complicated is at a highest level with the average score of 4.54. The font style is easy to read and clear is at a highest level with the average score of 4.50. Presentation control buttons are appropriate and the font size is appropriate are at a high level with the average score of 4.49. Choosing the color of the font and background color is at a high level with the average score of 4.48. The digital technology is easy and convenient access and the difficulty of the content is appropriate to the student's level are at a high level with the average score of 4.46. The test is appropriate is at a high level with the average score of 4.43. There is appropriate positioning of various information on the screen is at a high level with the average score of 4.39. The lessons are interesting is at a high level with the average score of 4.12 respectively.

CHAPTER 5
CONCLUSIONS DISCUSSION AND RECOMMENDATION

The digital technology in the online High School Mathematics classroom. The researcher has conclusions, discussion and recommendations are as follows.

5.1 Conclusions

5.2 Discussions

5.3 Recommendations

5.1 Conclusions

5.1.1 Results of evaluating a quality of digital technology in the online High School Mathematics classroom are as follow;

5.1.1.1 The digital technology quality assessment results from three media experts.

The results of the digital technology High School Mathematics evaluated, it was found that the quality of the digital technology is at an excellent level with the average score of 4.57, and when considering each item, it was found that; the media is easy of use of the system, the order in which information is displayed is appropriate, the online classroom has an easy and convenient access, the overall screen design is appropriate, presentation control buttons are appropriate, the font style is easy to read and clear, the font size is appropriate, choosing the color of the font and background color are at an excellent level with the average score of 4.67, next is the lessons are interesting is at an good level with the average score of 4.33, and interesting, inviting you to follow the content is at a good level with the average score of 4.00 respectively.

5.1.1.2 Content quality assessment results from three content experts.

The results of content quality assessments overall, it was found that the quality of the digital technology is at an excellent level with the average score of 4.93, and when considering each item, it was found that; the content is easy to read and understand, assessment and evaluation are appropriate, the font style is easy to read and clear, the font size is appropriate, provide content knowledge just like the teacher, the sequence of steps in the presentation is appropriate, accuracy of the language used are at an excellent level with the average score of 5.00, next is the amount of content is appropriate is at an excellent level with the average score of 4.67, and the difficulty of the content is appropriate to the student's level ,the test is appropriate are at a good level with the average score of 4.33 respectively.

5.1.2 Results of compare the pre-test and post-test scores of students after learning via the digital technology in the Online High School Mathematics Classroom.

The results of the pre-test and post-test tests of the students had an average score of 64.75 points and 79.70 points, respectively. When comparing the pre-test and post-test scores, it was found that the post-test scores were higher than pre-test scores,

with statistical significance at the level. 05.

5.1.3 Results of study the satisfaction of students who learned via the digital technology in the Online High School Mathematics classroom.

The students are overall satisfied with digital technology overall, it was found that the quality of the students' satisfaction was at a high level with the average score of 4.44, and when considering each item, it was found that; the digital technology is easy to use, not complicated is at a highest level with the average score of 4.54. The font style is easy to read and clear is at a highest level with the average score of 4.50. Presentation control buttons are appropriate and the font size is appropriate are at a high level with the average score of 4.49. Choosing the color of the font and background color is at a high level with the average score of 4.48. The digital technology is easy and convenient access and the difficulty of the content is appropriate to the student's level are at a high level with the average score of 4.46. The test is appropriate is at a high level with the average score of 4.43. There is appropriate positioning of various information on the screen is at a high level with the average score of 4.39. The lessons are interesting is at a high level with the average score of 4.12 respectively.

5.2 Discussions

The research results can be discussed as follows.

5.2.1 The Results of evaluating a quality of digital technology in the online High School Mathematics classroom; the digital technology quality assessment results from three media experts was at an excellent level with the average score of 4.57. Different from the research of She Haiyan (2020) the application research of schivo whiteboard in high school mathematics teaching. n the application research of schivo whiteboard in high school mathematics teaching, the author collects media usage and usage feedback in the same form in the form of a questionnaire survey. However, the author's questionnaire is set in the form of multiple-choice questions for the questions in the questionnaire, and the author will calculate the selection proportion of each option in the questionnaire, mainly through the selection proportion to reflect what the author of each type of question wants to know. Regarding the use of media. The author will also conduct a reasonable analysis based on the proportion of each option in each question collected and collect media usage and usage feedback in the form of a questionnaire survey, but the difference is that each question in the questionnaire adopts a scoring mechanism of 1 to 5 points, and each score has its own separate meaning. There will be explanations at the beginning of the questionnaire. What this kind of questionnaire collects is the score of each function of the media. There are very direct numerical results that can directly reflect the quality of each function of the media, and the author will also make corresponding result analysis based on the score of each question. The results of content quality assessments overall, it was found that the quality of the digital technology is at an excellent level with the average score of 4.93. Different from Shao Zhen (2021) the

research of teaching research on"six questions and mind map" in senior high school mathematics. In teaching research on "six questions and mind map" in senior high school mathematics, the author uses the method of showing instructional design cases as an example, here using exponential functions and their properties. The content mainly includes:

1. 1 Teaching materials and academic situation analysis.

1. 2 Teaching objectives: knowledge and skills, processes and methods, emotions, attitudes and values.

1. 3 Analysis of key points and difficulties.

1. 4 Teaching methods: combination of lecture and practice, cooperative learning, inquiry teaching.

1. 5 The teaching process, including a rough process design for the entire lesson, and marking the design intent where necessary. This part is the most meticulous part in the entire teaching design. The role of each step, time-consuming and other factors must be taken into consideration.

1.6 If media application is involved in class, it must also be noted.

5.2.2 Results of compare the pre-test and post-test scores of students after learning via the digital technology in the online High School Mathematics classroom.

The results of the pretest and post-test tests of the students had an average score of 64.75 points and 79.70 points, respectively. When comparing the pretest and post-test scores, it was found that the post- test scores were higher than pretest scores, with statistical significance at the level. 05. Consistent with the research of Qiao Rui (2021) the application of geometer's sketchpad in mathematics teaching in high school and She Haiyan (2020) the application research of schivo whiteboard in high school mathematics teaching. For example, in the application research of schivo whiteboard in high school mathematics teaching, the author used the method of controlled experiment to study the students in Class 10 and Class 11 of a high school in Hefei Economic Development Zone. Both classes had 47 students. Class 11 was an experimental class and class 10 is a control class. Both classes are ordinary classes. They are evenly divided according to their high school entrance examination scores. There is not much difference in the average math scores in the school entrance examination. In order to ensure the reliability of the experiment, both classes used the People's Education Press version of high school mathematics textbooks. They had the same mathematics teachers, the same homework, teaching content and teaching progress. Students were not told any relevant information about the experiment before the experiment, thereby improving the efficiency of the experimental validity and reliability.

This comparison method uses a pretest and post- test there are some differences in details, the overall core idea is to explore the effect of a single variable on another variable while ensuring that other factors are not affected as much as possible, also

conducted t-test and sig significance tests on the two sets of experimental data, which is also of high reference value for determining the use value of the data.

　　5.2.3 The Results of study the satisfaction of students who learned via the digital technology in the online High School Mathematics classroom were overall satisfied via digital technology overall; it was found that the quality of the students' satisfaction is at a high level with the average score of 4.44. Different from the research of Qiao Rui (2021) the application of geometer's sketchpad in mathematics teaching in high school.

　　In the application of geometer's sketchpad in mathematics teaching in high school by the collection of student satisfaction in the form of a questionnaire survey. However, the author's questionnaire is set in the form of multiple-choice questions for the questions in the questionnaire, and the author will calculate the selection ratio of each option in the questionnaire, mainly through the selection ratio to reflect what the author wants to know for each type of question. Regarding student satisfaction and other student attitudes. The author will also conduct a reasonable analysis based on the proportion of each option in each question collected. Based on this result, the author analyzed that most teachers do not pay enough attention to class speed when teaching using geometric sketchpads, ignore the difference between online teaching and offline teaching, and basically display knowledge entirely through software, replacing traditional writing on the blackboard. This seriously leads to students' note-taking efficiency being reduced and their knowledge mastery not being proficient. The geometric sketchpad is only an indispensable electronic technology in teaching. The purpose is to better improve learning efficiency, not to replace writing on the blackboard with media. The geometric sketchpad should be appropriately introduced in the teaching process, rather than relying entirely on this media.

　　The method of collecting student satisfaction is in the form of a questionnaire survey, but the difference is that each question in the questionnaire uses a scoring mechanism of 1 to 5 points. Each score has its separate meaning. This is stated at the beginning of the questionnaire. There will be explanations. What this kind of questionnaire collects is the score of each function of the media. There are very direct numerical results that can directly reflect the quality of each function of the media, and the author will also make corresponding result analysis based on the score of each question.

5.3 Recommendations

　　5.3.1 Recommendations from the research results

　　　　5.3.1.1 Research results analysis

　　　　　According to Excel statistical analysis, the results of the pretest and post-test of the students have an average score of 64.75 points and 79.70 points, respectively When comparing the pretest and post-test scores, it was found that the post test scores were higher than the pre test scores, with statistical significance at the level 05. And

comparing the maximum, minimum, and median values of the two sets of data, post-test is higher than pretest clearly, indicating that the teaching effect of online classrooms is very significant. At the same time, the author conducted t-test on two sets of data to analyze the differences in exam scores between different teaching methods. The significance test was less than 0.05, indicating a significant difference in the experimental data between the two groups.

Through a comprehensive analysis of the test scores of pretest and post-test high school students, it is concluded that online teaching has a good effect. But there are still some bad effects like teachers cannot interact well with classmates and pay attention to every student during the live teaching process; Students believe that the effectiveness of online classes is average, and sometimes there may be distractions and delays, resulting in not keeping up with the teacher's progress.

Online education is a product of the times, spreading traditional teaching content through the internet to every student who chooses to attend classes. Whether it is students from Beijing or Xinjiang, they can share high-quality teaching content from renowned teachers, listen to the same teacher's classes, take the same exams, understand the same world, and balance the teaching staff. Due to the influence of traditional culture and social reality, parents are particularly concerned about the education issues of the next generation. They spare no effort to find good schools, classes, and teachers, spend a lot of money to buy school district houses, and hope that their children can be admitted to Tsinghua and Peking University, becoming the dragon and phoenix among people. However, these resources are often limited and cannot meet everyone's requirements. The more developed the economy, the more famous teachers, the better the teaching results, Excellent students are also gathering more and more in these places. According to a survey, in recent years, there have been fewer and fewer candidates from rural areas among the top ranked domestic universities, and the root cause of the phenomenon of "difficult access to prestigious students" is the imbalance of teaching staff. Online education has to a large extent solved this problem. Famous teachers can create compressed packages of classroom lectures, after-school tutoring, and homework explanations, and share them online. In this way, although students cannot listen to the lectures and tutoring of these famous teachers on site, they also enjoy the same learning resources, promoting educational equality. Those who are slow to accept new knowledge also strive to reach an average or even higher level through their own efforts.

Online education can urge teachers to improve teaching processes, create high-quality lesson plans, enhance the fun and knowledge of classroom teaching, keep up with the times, and innovate. Due to the openness and transparency of the internet, every teacher can read the courseware of other teachers, learn from each other, make progress together, improve and enhance the depth and breadth of the explanation of the knowledge point or exercise, thereby researching methods that are easier for students to understand and master, sharing teaching resources, exchanging educational information, and

"gathering the strengths of a hundred schools, becoming one family's words". Online education provides a communication platform for teachers from around the world, allowing young teachers to learn from the experience of old teachers, improve the quality of comprehensive teaching, and make truly capable teachers shine and shine. In addition, based on big data statistical analysis, teachers can also intuitively understand the teaching status and guide the healthy development of teaching.

Online education also advocates free and personalized learning, where students can charge and learn anytime and anywhere to improve learning efficiency. Each student has different personalities. Some students prefer teachers with divergent thinking, while others prefer teachers with rigorous thinking. Due to school arrangements, it is not possible for students to encounter teachers with their preferred style. However, online, students can freely listen to each teacher's lectures, communicate with netizens through the forum, and expand their knowledge, or have expertise in a certain area, meeting the diverse educational needs of learners.

Long term exposure to electronic products can lead to decreased vision, lack of concentration, lack of communication between classmates, and a tendency to be withdrawn. Without the supervision of a teacher, it is easy to relax and rely on powerful online resources to find homework answers, which is not conducive to students developing the habit of independent thinking. Teachers also cannot know the real-time learning effect of students. Online training institutions have a thriving development potential and attractive high salaries. Once public school teachers form a wave of resignations, it will have an impact on the teaching staff. In addition, some online education apps have inadequate teaching staff, hidden online games, hidden vulgar information, and advertisements, which are not conducive to the physical and mental health of minors.

5.3.1.2 Recommendations from students

Based on the collected results of the satisfaction questionnaire survey distributed to students, 14 relatively reasonable suggestions were summarized, which are the following:

1) The live playback function has time permission, but over time, there is no permission to play back.

2) Sometimes you have to queue up to enter a online classroom.

3) Sometimes the visuals in the online classroom may get stuck and delayed, and even the entire live room may flicker. It is recommended to optimize it in a timely manner.

4) Official information and advertising windows often pop up during online classroom.

5) The group administrator has the function of querying the personal information of group members, which exposes students' privacy.

6) Sometimes information cannot be sent out.

7) I hope the operation interface is simpler. The distribution of button positions is a bit messy.

8) When using the multi window function, the prompt will disappear and sometimes the screen will go black.

9) The font should be larger, and the color is too monotonous.

10) Dingtalk often proactively push irrelevant information to users.

11) I hope the teacher can become more familiar with the process of using Dingtalk and save time in class.

12) It is recommended to add an artificial AI system.

13) The page is somewhat chaotic, it is recommended to reorganize and arrange it.

14) It is recommended to add rewards and likes functions in online classroom.

5.3.1.3 Recommendations from teachers

Regarding the teaching content of the section on parallel lines and planes, teachers should give more initiative to students, allowing them to explore independently, making full use of powerful teaching resources on the internet, and assigning learning tasks in advance. For example, students should watch a video before class about "Dimensions: A Mathematical Walk", which starts with two-dimensional things in a first person tone and uses familiar dimensions, Step by step, guide us to understand and perceive the changes in dimensions in the real world: a point is zero dimensional, a line is one-dimensional, a plane is two-dimensional, a stationary three-dimensional figure is three-dimensional, and a moving three-dimensional figure is four-dimensional. Ordinary students can fully understand the changes from two-dimensional to three-dimensional through movies, and those who have spare energy may become interested in four-dimensional space, thus independently absorbing more knowledge. Utilize multimedia technology to more vividly reflect the parallel relationships of the three-dimensional world. Teachers can adopt guiding and generative teaching strategies in teaching, guiding students to independently determine goals, plan learning content, and organize, understand, strengthen, and transfer them, cultivating students' ability to learn independently and explore the unknown, and enhancing self-discipline.

In the online teaching mode, most of the online teaching software used by teachers, such as Tencent Meeting and DingTalk, have screen sharing and message sending functions. Teachers can receive real-time synchronous feedback from students while playing PPTs remotely, and engage in real-time communication and Q&A sessions between students and teachers. Therefore, teachers can keep chat and message passing functions open during class, encourage students to connect to their phones or send messages in text form, sharing examples of parallel lines and planes in daily life. This can not only increase students' attention, but also increase the frequency of teacher-student communication. Using software such as GeoGebra and the Geometry Sketchpad

to deeply integrate information technology into the educational process, achieve innovation in teaching concepts, and better leverage the advantages of online teaching.

Based on interviews with teachers, summarize the following four points:

1) Interest is the best teacher

The study of high school mathematics is dull and tasteless, and it requires students to calm down and carefully think. Due to the complex knowledge structure of high school solid geometry, students are prone to fear difficulties when learning. Therefore, when explaining the knowledge of solid geometry, teachers should create classroom situations, enrich classroom content, stimulate classroom atmosphere, guide students to interact more, and make students have the desire to explore solid geometry knowledge, in this way, students can focus and optimize classroom learning outcomes. In online parallel teaching, teachers can allow students to observe the parallel relationships in life, connect mathematics with practice, and develop teaching plans based on the psychological characteristics of students aged 16 or 17, such as watching science popularization videos, allowing students to try making three-dimensional models using software such as GeoGebra and CAD, etc. Through hands-on operations, they can experience the conversion between two- dimensional and three- dimensional space, simultaneously improving students' information technology skills. Under the guidance of teachers, students can easily enter a learning state and actively and actively engage in learning.

2) Adopting reasonable and effective teaching methods, infiltrating mathematical ideas, and improving mathematical literacy

The learning of solid geometry requires students to be proficient in converting textual language into graphic and symbolic language, and to have spatial concepts and drawing abilities. The parallel section of the line and plane is the beginning of the transition from two- dimensional graphics to three- dimensional graphics, serving as a connecting link between the preceding and the following. The teaching process of this lesson can be designed as creating scenarios, asking questions, inspiring teaching, exploring discoveries, deductive reasoning, and summarizing. Teachers need to change their teaching concepts, learning to use multimedia technologies, such as creating 3D images and animated demonstrations, to make three- dimensional geometry vivid is beneficial for cultivating and developing students' sense of space and geometric intuition. The online classroom adopts a "flipped classroom" mode, allowing students to try to prepare and give lectures themselves, and other students and teachers to comment and supplement, enhancing students' thinking and language expression abilities. In the classroom, teachers should cleverly set up problem chains, stimulate enthusiasm for thinking, deepen knowledge understanding, optimize teaching effectiveness, use online teaching platforms and other functions such as "check-in" and "raising hands" to give students a sense of crisis, reduce the number of evasions, and connect with student videos to allow students to see the teacher's face, giving students an illusion of face-to-face

learning between teachers and students in the classroom, which is conducive to improving teaching efficiency. Some students have poor grades and lack confidence in their studies. Teachers should pay more attention to students and encourage teaching.

3) Pay attention to question type training and impart problem-solving skills

After the teacher explains the property theorem and decision theorem of parallel lines and surfaces, they should be supplemented with an appropriate number of exercises to help students combine new and old knowledge, pay attention to the teaching of general principles and the cultivation of students' reverse thinking, encourage students to ask more "why", think independently first, and then collaborate to discuss, brainstorm and divergent thinking together, explore different problem-solving methods, summarize and summarize similar problem types, and practice more, Draw pictures skillfully, prepare a problem book, extract incorrect questions at any time, and regularly review them. Utilize internet resources appropriately to cultivate students' spirit of cooperation.

4) Reasonable teaching design

During online teaching, teachers need to spend more time on teaching design, comprehensively analyzing the content of textbooks and students' situations. What knowledge teachers teach online and what knowledge students learn offline need to be reasonably arranged by teachers based on past experience. It is also necessary to pay attention to the connection between various knowledge points, cleverly combine questioning with games, and make the classroom organized and have a strong sense of participation.

5. 3. 1. 4 Significant recommendations or research findings useful for mathematics teachers:

1) Utilization of digital technology in teaching mathematics: Teachers can utilize various applications and computer programs to enhance students' learning experiences in the classroom. Emphasis should be placed on making learning more engaging and effective.

2) Use of data and data analysis: Teachers can use data obtained from digital technology usage in teaching to improve their teaching methods. This data can be used to adjust lesson plans and respond to students' needs effectively.

3) Creation and sharing of learning content: Teachers can use digital technology to create engaging and effective learning content. They can also share this content with other teachers to serve as references and share best teaching practices within the mathematics teaching community.

4) Enhancement of technology skills for teachers: Teachers should receive training and support in using digital technology for teaching. Focus should be on developing skills and fostering creativity in using these technologies for teaching mathematics in the classroom.

5.3.2 Suggestions for Future Research

In this thesis, a major regret is that due to the lack of time, the author's selection of quantity and samples is not sufficient, and the number of questionnaire surveys is insufficient. The survey results may have some deviations. Regarding the control experiment on the effectiveness of online teaching, due to the sudden outbreak of the epidemic but effective control under the leadership of the government, only a portion of high school students were able to learn three-dimensional geometry content online. Therefore, the author selected 20 of them, with a small sample size, which may lead to biased results and lack universality. If given the opportunity, we hope to investigate and comprehensively analyze more students, Draw more convincing conclusions.

With the continuous development of the times and technology, people will develop more software suitable for online teaching. By collecting data on students' learning process through the Internet and processing statistical models, students can be better provided with learning modes that are suitable for themselves, thereby enabling them to obtain more personalized and efficient learning modes. In addition, with the advancement of virtual reality technology, it may be possible to achieve simple VR teaching in the future, allowing mathematics from books to truly move and reach students. Online teaching cannot become the main way for primary and secondary school students to learn, but it can greatly assist teaching and improve teaching efficiency. As the saying goes, being prepared is safe, and once a catastrophic epidemic occurs again, students can continue to learn as usual. Even after completing the day's learning plan, they can use the powerful and rich video resources of the Internet to learn knowledge that they are interested in. Therefore, It is necessary to explore teaching strategies for online teaching, but there are far more than these three types of teaching strategies. Other scholars have also proposed many strategies worth learning in their published papers, such as teachers should evaluate students reasonably and teach students according to their aptitude; Students should make reasonable plans, actively learn, and so on. Is online teaching possible to completely replace school teaching in the future? How can we better improve the effectiveness of online teaching? These are all questions worth pondering. I believe that with manual labor
With the development of information technology such as intelligence, online learning will accompany people throughout their lives.

Bibliography

Annie, P., Stoker, J., & Murray-Ward, M. (1996). Academic achievement: A conceptual framework. **In Proceedings of the International Conference on Education Evaluation (ICEE),** 45-56.

Bailey, B. L., Bauman, C., & Lata, K. A. (1998). **Student retention and satisfaction: Theevolution of a predictive model**. (ERIC Document Reproduction Service No. ED424797).

Britannica Dictionary. (2022). **Satisfaction**. Retrieved from, https://www.britannica.com/dictionary/satisfaction

Bossaert, G., Doumen, S., Buyse, E., & Verschueren, K. (2011). Predicting children's academic achievement after the transition to first grade: A two-year longitudinal study. **Journal of Applied Developmental Psychology**, 32(2), 47–57. https://doi.org/10.1016/j.appdev.2010.12.002

Brown, C. (2015). Challenges in high school mathematics education. **Journal of Education Research**, 25(4), 321-335.

Clark, A. (2018). Setting teaching objectives. **Journal of Educational Strategies**, 25(3), 45-58.

Clark-Wilson, Alison, Robutti, Ornella & Thomas, Mike. (2020). **Teaching with digital technology. ZDM – Mathematics Education**. 7(52), 1223-1242. https://doi.org/10.1007/s11858-020-01196-0

Cui Jiaqi.(2019). **Research on the Effect of Students' Autonomous Learning under the Online Education Mode - Taking Mathematical Function Knowledge in Senior One as an Example**. Guilin: Guangxi Normal University.

Dictionary.cambridge.org. (2022). **Satisfaction**. Retrieved from, https://dictionary.cambridge.org/dictionary/english/satisfaction

Duval, R. (1995). Geometric cognitive theory: A theoretical perspective on the teaching of geometry. **Educational Studies in Mathematics**, 30(1), 65-98

Fornell, C. (1992). A National Customer Satisfaction Barometer: The Swedish Experience. **Journal of Marketing**. 56(1), pp. 6–21

Garcia, E. (2019). Enhancing spatial imagination ability through CAD modeling software. **Educational Technology Research**, 12(2), 87-102.

Giese, J. and Cote, JA. (2000). Defining consumer satisfaction. **Academy of marketing science Journal Review**. Retrieved from, https://www.researchgate.net/publication/235357014_Defining_Consumer_Satisfaction

Gu Jinfen.(2020). **Investigation and Research on Deep Mathematics Learning for High School Students**. Kunming: Yunnan Normal University.

Bibliography (Cont.)

Halstead D, Hartan D, and Schmidts. (1994). Multisource effects on the satisfaction
formation process. **Journal of the Academy of Marketing Science**. 22, 114-29.

Harvey. L., Plimmer, L., Moon, S., & Geall, V. (1997). **Student Satisfaction Manual**.
Buckingham, UK: SRHE/Open University Press.

Hattie, J. (2003). **Teachers make a difference: What is the research evidence? Paper
presented at the Australian Council for Educational Research Annual
Conference   on Building Teacher Quality**. Melbourne, Australia.

Hu Lijie. (2020). **Research on Teaching Strategies for High School Mathematical
Solid Geometry**. Chongqing: Southwest University.

Jones, R., & Brown, T. (2020). Understanding judgment and property theorems in
geometry. **Journal of Mathematics Education**, 17(1), 23-36.

Johnson, K. (2019). The importance of spatial imagination in geometry learning.
International. **Journal of Mathematics Education**, 34(4), 567-580.

Khan Mohammad Monirujjaman. (2021). Rahman SM Tahsinur; Islam Sabik
Tawsif Anjum. **Online Education System in Bangladesh during COVID-19
Pandemic**.   12(12):441-452, Bangladesh:Creative Education.

Kieran, C., Krainer, K., & Shaughnessy, J. M. (2013). **Linking research to practice:
Teachers as key stakeholders in mathematics education research**. In M. A.
Clements, A. J. Bishop, C. Keitel, J. Kilpatrick, & F. K. S. Leung (Eds.), Third
international handbook of mathematics education, pp. 361–392. London:
Springer

Lai Dexin, Li Yifei. （2020）.**The Current Situation, Problems, and
Countermeasures of Primary and Secondary School Teachers'
Participation in Online Teaching during the Epidemic**. 9 (35), 10-13.
Guangxi: Education Observation.

Lassiter, K. S., & Bardos, A. N. (1995). The relationship between young children's
academic achievement and measures of intelligence. **Psychology in the Schools**,
32(3), 170–177. https://doi.org/10.1002/1520-6807(199507)32:3<170::AID-
PITS2310320303>3.0.CO;2-K

Liang Yujing, Liang Bin, Luo Ziqian. (2018). Research on the Current Situation
and Trends of Online Education Development in K12 Extracurricular
Counseling Institutions in China. **Education Informatization** (11), 12-15.

Lockee Barbara. (2021). **Online education in the post COVID era**. 4 (1), 5-6.
Retrieved from, https://www.nature.com/articles/s41928-020-00534-0

Martin, Florence, Sun, Ting, Westine, Carl D.. (2020). A systematic review of
research on online teaching and learning from 2009 to 2018. **Computers &
Education**. 159. Retrieved from https://doi.org/10.1016/j.compedu.2020.104009
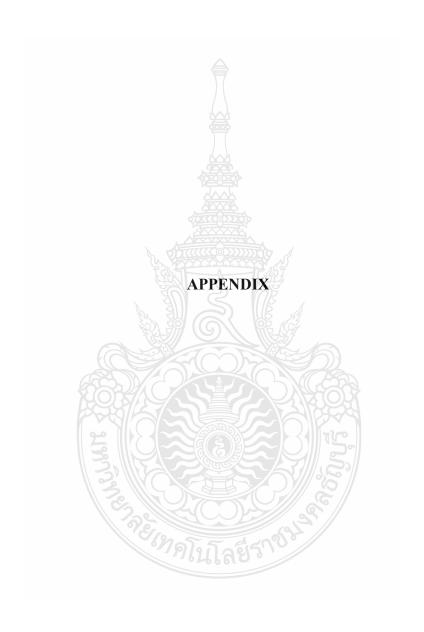
Bibliography (Cont.)

Miller, S. (2017). The role of educational media in solid geometry teaching. **Educational Media Quarterly**, 39(4), 321-335.

Nastaran Peimani, Hesam Kamali.(2021). **Pour Online Education and the COVID -19 Outbreak: A Case Study of Online Teaching during Lockdown**. Retrieved from, https://www.mdpi.com/2227-7102/11/2/72

Oliver, R.L. (1997). **Satisfaction: A Behavioral Perspective on the Consumer**. New York: McGraw-Hill.

Olshavsky, Richard W. and Richard A. Spreng. 1989. "A 'Desires as Standard' Model of Consumer Satisfaction." **Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior**. 2, 49-54.

Qiao Rui. (2021). **The application of geometer's sketchpad in mathematics teaching in high school**. (Thesis Master degree). Wuhan,Hubei,P.R: Central China Normal University.

Robinson, L. (2020). Utilizing online classroom platforms for mathematics education. **Journal of Online Learning**, 12(4), 201-215.

Shao Zhen. (2021).**The research of teaching research on"six questions and mind map" in senior high school mathematics**. (Thesis Master degree). Liaocheng City, Shandong: LiaoCheng University).

She Haiyan. (2020). **The application research of schivo whiteboard in high school mathematics teaching**. (Thesis Master degree). Anhui, Anqing: AnQing Normal University.

Smith, A., & Jones, B. (2000). The role of mathematics in human culture. **Journal of Cultural Studies**, 15(2), 87-102.

Smith, J. (2021). Line plane parallelism in solid geometry. **Journal of Mathematics Education**, 10(3), 45-56.

Study.com. (2022). **Academic achievement**. Retrieved from, https://study.com/learn/lesson/academic-achievement-overview-factors.html

Tophat.com. (2022). Academic **achievement**. Retrieved from, https://tophat.com/glossary/a/academic-achievement/

Vocabulary.coms. (2022). **Satisfaction**. Retrieved from, https://www.vocabulary.com/dictionary/satisfaction

Wang Dan.(2020). **Limitations and Countermeasures for the Development of Online Education in the Basic Education Stage**. Changchun: Jilin University.

Xie Youru, Qiu Yi, Huang Yuling, et.(2020). **Characteristics, Problems, and Innovations of the Online Teaching Method of "Suspension without Suspension" during the Epidemic Prevention and Control Period**. Lanzhou: Research on Audiovisual Education. (3), 20-28.

Bibliography (Cont.)

Xu Xiaoqin, Lan Yu, Wang Yunwu. (2020). **Opportunities and challenges of online education under the COVID-19**. Wuhan: modern commerce and trade industry. (32), 129-130.

Yao Fuzhou.(2020) **Teaching Strategies for "Solid Geometry" from the Perspective of Core Literacy**. Hunan: Paper Equipment and Materials.(1), 178.

Yi, Y. (1991). A critical review of customer satisfaction. **Journal of the Academy of Marketing Science**. pp. 68-123.

Zhang Yaya. (2020). **Investigation and Research on the Current Situation of High School Students' Learning of Solid Geometry - Taking "Preliminary Study of Solid Geometry" as an Example**. Lanzhou: Northwest Normal University Learning.

Zhao Hong, Jiang Fei, Tang Xueli, et.(2021) **Online Education: Digital Divide or Digital Opportunity—— Analysis of urban-rural differences in online learning during the epidemic**. 27 (2), 62-68. Shanghai: Open Education Research.

Zeidner, M. (1998). **Test anxiety: The state of the Art**. New York: Plenum.

Ward, A., Stoker, H. W., & Murray-Ward, M. (1996). Achievement and ability tests-Definition of the domain. **Educational Measurement**, 2, 2-5.

APPENDIX

Appendix A

-List of Experts Reviewing Research Instruments
-Invitation to Experts to Examine Research Instruments

- List of Experts Reviewing Research Instruments

Measurement and Evaluation Name Specialists
1. Assoc. Prof. Dr.Pimolpun. Phetsombat, Lecturer in Educational Administration Department Faculty of Industrial Education Rajamangala University of Technology Thanyaburi
   e-mail : Master_tom22@yahoo.com
2. Asst. Prof. Dr.Sorasak Chiewchan ,Department of Liberal Arts, Faculty of Business Administration and Liberal Arts, Rajamangala University of Technology Lanna
   e-mail : dorakeng@hotmail.co.th
3. Asst. Prof. Dr.Wiroj Mongkolthep, Major of Applied Statistics, Department of Science, Faculty of Science and Agricultural Technology, Rajamangala University of Technology Lanna Nan, Phu Phiang District, Nan, 55000, Thailand
   e-mail : wiroj@rmutl.ac.th

Content Specialists
1. Mr.Qiu Yangcong, Associate Professor of Applied Mathematics, Shunde Vocational and Technical College
   e-mail :153475904@qq.com
2. Mr.Chen Weidong, Senior Mathematics Teacher at Middle School, Shenzhen Beihuan Middle School
   e-mail :917695545@qq.com
3. Mr.Xiao Jun, Senior Mathematics Teacher at Middle School, Shunde No.1 Middle School
   e-mail :534465723@qq.com

Media Specialists
1. Asst. Prof. Dr.Narumon Rodniam, The Faculty of Education, Thailand National Sports University, Chumphon Campus.
   e-mail : patumariya@gmail.com
2. Asst. Prof. Dr.Kampanat Kusirirat, Ph.D. Department of Animation Game and Digital Media, Faculty of Science and Technology, Bansomdejchaopraya Rajabhat Universit
   e-mail : ajdankampanat@gmail.com
3. Asst. Prof. Dr.Santi krongyuth, Lecturer of Education Faculty of Management Technology Rajamangala University of Technology Isan Surin Campus
   e-mail : santikrongyuth@gmail.com

MHESI 1351/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Assoc. Prof. Dr.Pimolpun. Phetsombat
Lecturer in Educational Administration Department Faculty of Industrial Education
Rajamangala University of Technology Thanyaburi

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1351.1/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Asst. Prof. Dr.Sorasak Chiewchan
Department of Liberal Arts, Faculty of Business Administration and Liberal Arts,
Rajamangala University of Technology Lanna

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1351.2/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Asst. Prof. Dr.Wiroj Mongkolthep
Department of Science, Faculty of Science and Agricultural Technology, Rajamangala
University of Technology Lanna Nan Rajamangala University of Technology Lanna

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1351.4/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Mr. Chen Weidong
Senior Mathematics Teacher at Middle School, Shenzhen Beihuan Middle School

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

    I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

    If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1351.3/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Mr. Qiu Yangcong
Associate Professor of Applied Mathematics, Shunde Vocational and Technical College

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1351.8/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Xiao Jun
Senior Mathematics Teacher at Middle School, Shunde No.1 Middle School

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

     I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

     If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1351.6/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Asst. Prof. Dr.Kampanat Kusirirat,
Ph.D. Department of Animation Game and Digital Media, Faculty of Science and
Technology, Bansomdejchaopraya Rajabhat Universit
Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

     I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics", under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

     If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang_y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1351.5/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023

Dear Asst. Prof. Dr.Narumon Rodniam
The Faculty of Education, Thailand National Sports University, Chumphon Campus.
Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

65

MHESI 1351.7/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

25 October, 2023
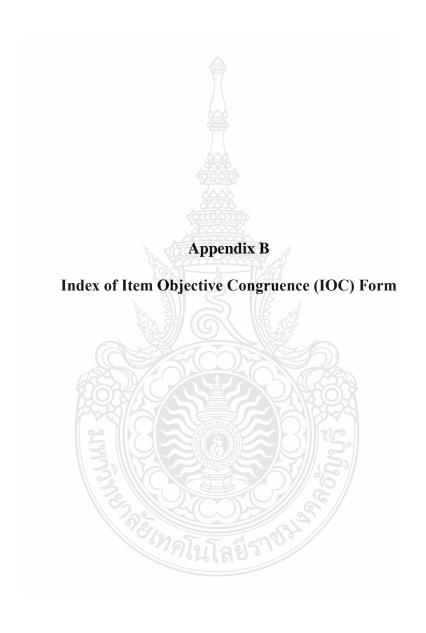
Dear Asst. Prof. Dr.Santi krongyuth, Lecturer of Education Faculty of Management
Technology Rajamangala University of Technology Isan Surin Campus

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Mr.Chengyang Yu, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "The Digital Technology in the Online and Offline Classroom of High School Mathematics". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Mr. Chengyang Yu, on the e-mail: chengyang _y @mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

Appendix B

Index of Item Objective Congruence (IOC) Form

Index of item objective congruence (IOC) form to create a quality assessment form for the digital technology in the online High School Mathematics classroom: content (for measurement and evaluation experts)

<u>Explain</u>

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

+1 item is considered congruent with the objectives.

0 item is considered neutral in terms of whether it was congruent with the objectives.

-1 item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	0	-1	
1. The content is easy to read and understand.				
2. The amount of content is appropriate.				
3. The difficulty of the content is appropriate to the student's level.				
4. The test is appropriate.				
5. Assessment and evaluation are appropriate.				
6. The font style is easy to read and clear.				
7. The font size is appropriate.				
8. Provide content knowledge just like the teacher.				
9. The sequence of steps in the presentation is appropriate.				
10. Accuracy of the language used				

Suggestion

....

....

....

....

Index of item objective congruence (IOC) form to create a quality assessment form for the digital technology in the online High School Mathematics classroom: media
(For measurement and evaluation experts)

Explain

   Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

   +1   item is considered congruent with the objectives.
    0   item is considered neutral in terms of whether it was congruent with the objectives.
   -1   item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	0	-1	
1. Ease of use of the system				
2. The order in which information is displayed is appropriate.				
3. Easy and convenient access				
4. The overall screen design is appropriate.				
5. Presentation control buttons are appropriate.				
6. The font style is easy to read and clear.				
7. The font size is appropriate.				
8. Interesting, inviting you to follow the content.				
9. Choosing the color of the font and background color				
10. The lessons are interesting.				

Suggestion

....
....
....
....

Index of item objective congruence (IOC) form to create an assessment of student satisfaction who learned with the digital technology in the online High School Mathematics classroom.
(For measurement and evaluation experts)

Explain

        Please place a check mark ($\checkmark$) in the quality level box that corresponds to your opinion. The quality levels are as follows:

    +1 item is considered congruent with the objectives.
     0 item is considered neutral in terms of whether it was congruent with the objectives.
    -1 item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	0	-1	
1. Easy to use, not complicated				
2. There is appropriate positioning of various information on the screen.				
3. Easy and convenient access				
4. The test is appropriate.				
5. Presentation control buttons are appropriate.				
6. The font style is easy to read and clear.				
7. The font size is appropriate.				
8. Choosing the color of the font and background color				
9. The difficulty of the content is appropriate to the student's level.				
10. The lessons are interesting.				

Suggestion

....
....
....
....

Index of item objective congruence (IOC) form to create academic achievement test (pre-test and post-test) the digital technology in the online High School Mathematics classroom
(For measurement and evaluation experts)

Explain:

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

+1   item is considered congruent with the objectives.

0   item is considered neutral in terms of whether it was congruent with the objectives.

-1   item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	**0**	**-1**	
Line and plane parallel test paper Exam time: 45 minutes 1. Multiple choice questions (5 points each, 40 points in total).				
.1The condition that can ensure that the straight line a is parallel to the plane α is ( ) A. b⊂α, a∥b B. b⊂α, c∥α, a∥b, a∥c C.b⊂α, A, B∈a, C, D∈b, and AC∥BD D. a⊄α, b⊂α, a∥b				
2. There are three different points A, B, and C on a straight line l that are equidistant from the plane α. Then the positional relationship between the straight line l and the plane α is ( ) A. l∥α B. l⊥α C. l intersects α but is not perpendicular D. l∥α or l⊂α				
3. If the straight line l is not parallel to the plane α, and l⊄α, then ( ) A. All straight lines in α are out of plane with l B. There is no straight line parallel to l in α C. The only straight line in α memory is parallel to l D. All straight lines in α intersect l				
4. It is known that the straight line m, n and the plane α, m∥n, m∥α, and the plane β and α passing through m intersect the straight				

line a, then the positional relationship between n and a is ( ) A. Parallel B. intersect C. Different side D. All of the above are possible				
5. If M and N are the midpoints of sides AB and AC of △ABC respectively, the positional relationship between MN and the plane β passing through the straight line BC is ( ) A. MN∥β B. MN intersects β or MN⊂β C. MN∥β or MN⊂β D. MN∥β or MN intersects β or MN⊂β				
6. α, β, and γ are three planes, a and b are two straight lines, and there are the following three conditions: ①a∥γ, b⊂β; ②a∥γ, b∥β; ③b∥β, a⊂γ. If the proposition "α∩β=a, b⊂γ and _____, then a∥b" is a true proposition, then the condition that can be filled in on the horizontal line is () A. ① or ② B. ② or ③ C. ① or ③ D. Only ②				
7. (Multiple choice) Among the following four cube figures, A and B are the two vertices of the cube, and M, N and P are respectively the midpoints of the edges where they are located. The figure that can be drawn as the AB∥ plane MNP is ( ) Figure Appendix C.1 Question 7				
8. As shown in the figure, in the triangular prism ABC-A1B1C1, AM=2MA1, BN=2NB1, draw a plane through MN and intersect the sides BC and AC of the base triangle ABC at points E and F, then () 				

Figure Appendix C.2 Question 8 A. MF∥NE B. Quadrilateral MNEF is a trapezoid C. Quadrilateral MNEF is a parallelogram D. A1B1∥NE				
2. Fill-in-the-blank questions (6 points for each question, 24 points in total).				
9. Straight line a∥plane α, there are n straight lines in α that intersect at one point, then among these n straight lines, there are ( ) straight lines parallel to straight line a.				
10. In the cube ABCD-A1B1C1D1, AB=2, point E is the midpoint of AD, point F is on CC1, if EF∥plane AB1C, then EF=( ).				
11. As shown in the figure, the edge length of the cube is 4. Points E and F are the midpoints of A1D1 and AA1 respectively. Then the perimeter of the section passing through C1, E and F is ( ). Figure Appendix C.3 Question 11				
12. If a straight line is parallel to two intersecting planes at the same time, the positional relationship between the straight line and the intersection of the two planes is ().				
3. Answer the questions (write down the necessary calculation steps, no points will be awarded for writing only the final result, 12 points for each question, 36 points in total).				
13. As shown in the figure, quadrilateral ABCD is a parallelogram, P is a point outside plane ABCD, M and N are the midpoints of AB and PC respectively. Prove: MN∥Plane PAD.				

 Figure Appendix C.4 Question 13				
14. In the geometry as shown in the figure, quadrilateral ABCD is a parallelogram, ∠ACB=90°, EF∥AB, FG∥BC, EG∥AC, AB=2EF, M is the midpoint of line segment AD, prove: GM∥ plane ABFE. Figure Appendix C.5 Question 14				
15. As shown in the figure, P is a point outside the plane where ▱ABCD is located. Find a point E on PC to make PA∥ plane BED, and give the proof. Figure Appendix C.4 Question 15				

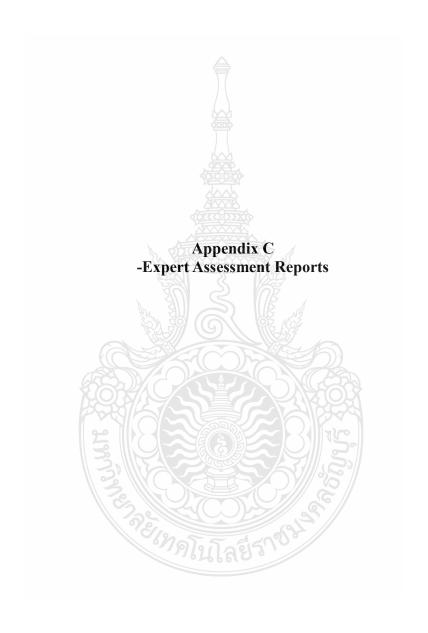**Appendix C
-Expert Assessment Reports**

Table C-1 Results of the Index of Conformity (IOC) evaluation to create a quality
assessment form for the digital technology in the online High School
Mathematics classroom: content (for measurement and evaluation experts)

No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
Total average					1.00	Can be used

From Table C-1, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create content quality assessment form.

Table C-2 Results of the Index of Conformity (IOC) evaluation to create a quality
assessment form for the digital technology in the online High School
Mathematics classroom: media (for measurement and evaluation experts)

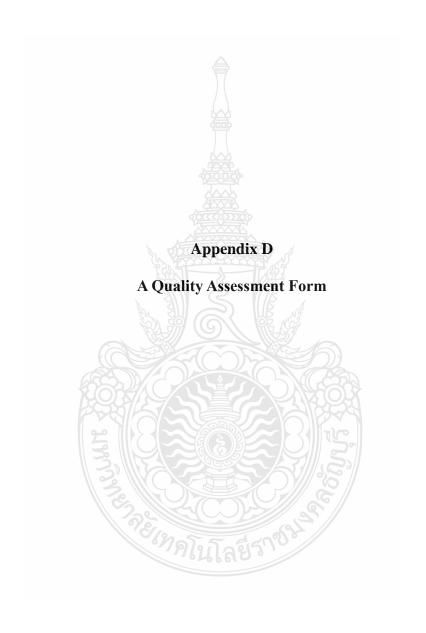| No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
Total average					1.00	Can be used

From Table C-2, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create media quality assessment form.

Table C-3 Results of the Index of Conformity (IOC) evaluation to create an assessment of student satisfaction who learned with the digital technology in the online High School Mathematics classroom. (For measurement and evaluation experts)

No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
Total average					1.00	Can be used

From Table C-3, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create an assessment of student satisfaction form.

Table C-4 Results of the Index of Conformity (IOC) evaluation to create academic
achievement test (pre-test and post-test) the digital technology in the online
High School Mathematics classroom (For measurement and evaluation
experts)

No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
11	+1	+1	+1	3	1.00	Can be used
12	+1	+1	+1	3	1.00	Can be used
13	+1	+1	+1	3	1.00	Can be used
14	+1	+1	+1	3	1.00	Can be used
15	+1	+1	+1	3	1.00	Can be used
Total average					1.00	Can be used

From Table C-4, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create academic achievement test (pre-test and post-test) form.

Appendix D

A Quality Assessment Form

Quality assessment form for the digital technology in the online High School Mathematics classroom: content

<u>Explain</u>

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

Level 5 means excellent
Level 4 means good
Level 3 means moderate
Level 2 means sufficient
Level 1means improvement

Option	Consistency value					Suggestions
	5	4	3	2	1	
1. The content is easy to read and understand.						
2. The amount of content is appropriate.						
3. The difficulty of the content is appropriate to the student's level.						
4. The test is appropriate.						
5. Assessment and evaluation are appropriate.						
6. The font style is easy to read and clear.						
7. The font size is appropriate.						
8. Provide content knowledge just like the teacher.						
9. The sequence of steps in the presentation is appropriate.						
10. Accuracy of the language used						

Suggestion

....
....
....
....

Quality assessment form for the digital technology in the online High School Mathematics classroom: media

<u>Explain</u>

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

Level 5 means excellent
Level 4 means good
Level 3 means moderate
Level 2 means sufficient
Level 1means improvement

Option	Consistency value					Suggestions
	5	4	3	2	1	
1. Ease of use of the system						
2. The order in which information is displayed is appropriate.						
3. Easy and convenient access						
4. The overall screen design is appropriate.						
5. Presentation control buttons are appropriate.						
6. The font style is easy to read and clear.						
7. The font size is appropriate.						
8. Interesting, inviting you to follow the content.						
9. Choosing the color of the font and background color						
10. The lessons are interesting.						

Suggestion

....
....
....
....

Assessment of student satisfaction who learned with the digital technology in the online High School Mathematics classroom.

<u>Explain</u>

        Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

                Level 5 means highest
                Level 4 means high
                Level 3 means moderate
                Level 2 means poor
                Level 1 means very poor

Option	Consistency value					Suggestions
	5	4	3	2	1	
1. Easy to use, not complicated						
2. There is appropriate positioning of various information on the screen.						
3. Easy and convenient access						
4. The test is appropriate.						
5. Presentation control buttons are appropriate.						
6. The font style is easy to read and clear.						
7. The font size is appropriate.						
8. Choosing the color of the font and background color						
9. The difficulty of the content is appropriate to the student's level.						
10. The lessons are interesting.						

Suggestion

....
....
....

Academic achievement test)pre-test and post-test) the digital technology in the online High School Mathematics classroom

Line and plane parallel test paper
Exam time: 45 minutes
1. Multiple choice questions (5 points each, 40 points in total).
1. The condition that can ensure that the straight line a is parallel to the plane α is ( )
A. b⊂α, a∥b
B. b⊂α, c∥α, a∥b, a∥c
C．b⊂α, A, B∈a, C, D∈b, and AC∥BD
D. a⊄α, b⊂α, a∥b

2. There are three different points A, B, and C on a straight line l that are equidistant from the plane α. Then the positional relationship between the straight line l and the plane α is ( )
A. l∥α
B．l⊥α
C．l intersects α but is not perpendicular
D. l∥α or l⊂α

3．If the straight line l is not parallel to the plane α, and l⊄α, then ( )
A. All straight lines in α are out of plane with l
B. There is no straight line parallel to l in α
C. The only straight line in α memory is parallel to l
D. All straight lines in α intersect l

4. It is known that the straight line m, n and the plane α, m∥n, m∥α, and the plane β and α passing through m intersect the straight line a, then the positional relationship between n and a is ( )
A. Parallel
B. intersect
C. Different side
D. All of the above are possible

5. If M and N are the midpoints of sides AB and AC of △ABC respectively, the positional relationship between MN and the plane β passing through the straight line BC is ( )
A. MN∥β
B. MN intersects β or MN⊂β
C. MN∥β or MN⊂β
D. MN∥β or MN intersects β or MN⊂β

6. α, β, and γ are three planes, a and b are two straight lines, and there are the following three conditions: ① a∥γ, b⊂β; ② a ∥γ, b∥β; ③ b∥β, a⊂γ. If the proposition "α∩β=a, b⊂γ and _____ , then a∥b" is a true proposition, then the condition that can be filled in on the horizontal line is ()

A. ① or ②
B. ② or ③
C. ① or ③
D. Only ②

7. (Multiple choice) Among the following four cube figures, A and B are the two vertices of the cube, and M, N and P are respectively the midpoints of the edges where they are located. The figure that can be drawn as the AB∥ plane MNP is ( )

Figure Appendix C.1 Question 7

8. As shown in the figure, in the triangular prism ABC-A1B1C1, AM=2MA1, BN=2NB1, draw a plane through MN and intersect the sides BC and AC of the base triangle ABC at points E and F, then ()

Figure Appendix C.2 Question 8
A. MF∥NE
B. Quadrilateral MNEF is a trapezoid
C. Quadrilateral MNEF is a parallelogram
D. A1B1∥NE

2. Fill-in-the-blank questions (6 points for each question, 24 points in total).
9. Straight line a∥plane α, there are n straight lines in α that intersect at one point, then among these n straight lines, there are ( ) straight lines parallel to straight line a.

10. In the cube ABCD-A1B1C1D1, AB=2, point E is the midpoint of AD, point F is on CC1, if EF∥plane AB1C, then EF=( ).

11. As shown in the figure, the edge length of the cube is 4. Points E and F are the midpoints of A1D1 and AA1 respectively. Then the perimeter of the section passing through C1, E and F is ( ).

Figure Appendix C.3 Question 11

12. If a straight line is parallel to two intersecting planes at the same time, the positional relationship between the straight line and the intersection of the two planes is ().

3. Answer the questions (write down the necessary calculation steps, no points will be awarded for writing only the final result, 12 points for each question, 36 points in total).

13. As shown in the figure, quadrilateral ABCD is a parallelogram, P is a point outside plane ABCD, M and N are the midpoints of AB and PC respectively. Prove: MN∥Plane PAD.

Figure Appendix C.4 Question 13

14. In the geometry as shown in the figure, quadrilateral ABCD is a parallelogram, ∠ACB=90°, EF∥AB, FG∥BC, EG∥AC, AB=2EF, M is the midpoint of line segment AD, prove: GM∥ plane ABFE

Figure Appendix C.5 Question 14

15. As shown in the figure, P is a point outside the plane where ▱ABCD is located. Find a point E on PC to make PA∥ plane BED, and give the proof.

Figure Appendix C.4 Question 15

Appendix E

- Teaching Documents
- Online Classroom Login Method

Parallelism of Straight Lines and Planes in Space
By Chengyang Yu

Thesis Title: The Digital Technology on The online classroom of High School Mathematics

(1) Basic Fact 4 and Congruent Angles Theorem
1. Basic facts 4
1.1 Natural language: Two straight lines parallel to the same straight line are parallel to each other.
1.2 Symbolic language: a, b, c are three different straight lines, a∥b, b∥c.
1.3 Function: judge or prove that two straight lines in space are parallel.
The property expressed by Axiom 4 is also often called the transitivity of parallel lines in space.
Steps to use basic fact 4 to prove that two straight lines in space are parallel
Step 1.Find the straight line b;
Step 2. Prove a∥b, b∥c;
Step 3.Get a∥c.
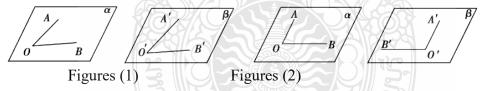
2. Theorem of equal angles
2.1 Natural language: If the two sides of two angles in space are parallel, then the two angles are equal or complementary.
2.2 Symbolic language:
As shown in Figures (1) and (2), in ∠AOB and ∠A′O′B′, OA∥O′A′ and OB∥O′ B′, then ∠AOB=∠A′O′B′☐ Or ∠AOB+∠A′O′B′=180°.

Figures (1)   Figures (2)

(2) Theorem for determining whether a straight line is parallel to a plane

Definition description	If a straight line outside a plane is parallel to a straight line in this plane, then the straight line is parallel to this plane.
graphic language	
mathematical symbolic language	$a\not\subset\alpha$, $b\subset\alpha$, 且$a\|b\Rightarrow a\|\alpha$

effect	Prove that a straight line is parallel to a plane

(3) Theorem for determining whether a plane is parallel to a plane

Definition description	If two intersecting straight lines in a plane are parallel to another plane, then the two planes are parallel
graphic language	
mathematical symbolic language	$a \subset \beta$, $b \subset \beta$, $a \cap b = P$, $a /\!/ \alpha$, $b /\!/ \alpha \Rightarrow \alpha /\!/ \beta$
effect	Prove that two planes are parallel

【Micro Dial】

1. To prove that two planes are parallel, you need to find two intersecting straight lines in one of the planes that are parallel to the other plane. Note that the word "intersect" cannot be lost.

2. You can prove that surfaces are parallel by proving that lines are parallel.

Mind Mapping
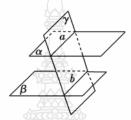
(4) The property theorem of parallel lines and planes

4.1 Natural language: If a straight line is parallel to a plane, then the intersection of any plane passing through the straight line and the plane is parallel to the straight line.

4.2 Graphic language: As shown in the figure.

4.3 Mathematical symbolic language：$a /\!/ \alpha, a \subset \beta, \alpha \cap \beta = b \Rightarrow a /\!/ b$

4.4 The role of the property theorem of parallel lines and planes

①As a basis to prove that the lines are parallel. When proving that lines are parallel, it can be proved that one of the straight lines is parallel to a plane, and the other straight

line is the intersection of the plane passing through the first straight line and the known plane, thus obtaining that the two straight lines are parallel.

②As a basis for drawing a straight line parallel to the known straight line. If a straight line is parallel to a plane, and you want to draw a straight line in the plane that is parallel to a known straight line, you can use the known straight line to draw a plane that intersects the known plane, and the intersection line is the straight line you want to draw.

(5) Theorem of properties of planes and planes parallel to each other

5.1 Natural language: If two parallel planes intersect a third plane at the same time, then their intersection lines are parallel.

5.2 Graphic language: As shown in the figure.

5.3 Mathematical symbolic language：$\alpha // \beta, \alpha \cap \gamma = a, \beta \cap \gamma = b \Rightarrow a // b.$

【Micro Dial】

1. It is known that two planes are parallel. Although any straight line in one plane is parallel to the other plane, all straight lines in the two planes are not necessarily parallel to each other. They may be parallel straight lines or out-of-plane straight lines. But it cannot be intersecting straight lines.

2. Use this theorem to prove that lines are parallel.

(6) Other properties of two planes being parallel

6.1 Two planes are parallel, and any straight line in one plane is parallel to the other plane.

6.2 Parallel line segments sandwiched between two parallel planes are equal.

6.3 There is and is only one plane parallel to the known plane passing through a point outside the plane.

6.4 Two straight lines are intercepted by three parallel planes, and the corresponding line segments intercepted are proportional.

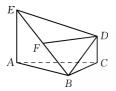6.5 If two planes are parallel to a third plane, then the two planes are parallel to each other.

【Example practice】

【Practice 1】In the space quadrilateral ABCD, E and F are points on AB and AD respectively, and $AE:EB = AF:FD = 1:4$, H and G are the midpoints of BC and CD respectively, then (   )
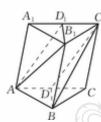
A．$BD //$ plane EFG, and quadrilateral EFGH is a parallelogram

B．$EF //$ plane BCD, and quadrilateral EFGH is a trapezoid

C．*HG //* plane ABD, and the quadrilateral EFGH is a parallelogram

D.*EH //* plane ADC, and the quadrilateral EFGH is a trapezoid

【Practice 2】In the space figure as shown in the figure, △ABC is an arbitrary triangle, AE‖CD, and AE=2a, CD=a, and F is the midpoint of BE. Prove：DF‖plane ABC.
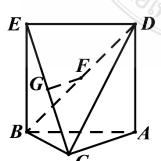

【Practice 3】As shown in the figure, in the oblique triangular prism $ABC\text{-}A_1B_1C_1$, points D，D_1 are on AC，A_1C_1 respectively. Then what position of the point D makes plane BC_1D‖plane AB_1D_1

【Practice 4】As shown in the figure, in a quadrangular pyramid $C-ABED$, the quadrilateral $ABED$ is square and the points G, F are the midpoints of the line segments EC, BD.
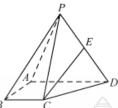
(1) Prove $GF //$ 平面ABC :;

(2) Is there a point H on the line segment BC that makes the plane $GFH //$ plane ACD? If it exists, please find the point H and prove it; if it does not exist, please explain the reason.

【Practice 5】As shown in the figure, in the square pyramid P-ABCD,
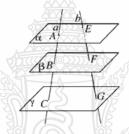
BC//plane PAD, $BC = \frac{1}{2}AD$,and E is the midpoint of PD.

(1) Prove: BC//AD;

(2) Prove: CE//Plane PAB

【Practice 6】 It is known that the three planes α, β, and γ satisfy α‖β‖γ, the straight line a intersects these three planes at points A, B, and C, and the straight line b intersects these three planes at points E, F, and G in turn. . Prove: $\frac{AB}{BC} = \frac{EF}{FG}$.

【Homework】

Manual
Initiate live broadcast
①**: Pin PC main interface>>Click on the left menu bar>>Click on 【...】 >>Select live streaming**
Click to initiate live streaming>>Customize settings for live streaming title>>After setting, click to enter the live streaming room
②**: Pin PC group chat interface>>Click below>>Click on the chat box to initiate live streaming icon>>Click on immediate live streaming>>Customize live streaming titles, etc.>>After setting, click to enter the live streaming room**

Shared screen
①**Enter the PC side DingTalk live streaming interface>>Click on the upper left menu bar to share>>When selecting window sharing, you can set it according to the pop-up window as needed>>Click OK to proceed**
②**Enter the PC end DingTalk live streaming interface>>Share on the toolbar above>>Select the option to share computer audio, and then click on Share to select the shared screen**

Playback

①**Before starting the broadcast: Pin the live streaming PC to initiate the live streaming interface>>Click on Settings and enable live playback before starting the broadcast, allowing viewers to connect.**

②**After the start of the broadcast: Pin the live streaming PC interface>>Click on the settings above>>Click on the general/screen watermark to complete the relevant settings**

③**Nail PC Live Interface>>Playback Management>>Click on the live playback you want to view**

- Online Classroom Login Method
Online Classroom Login Method
By Chengyang Yu

Thesis Title: **The Digital Technology on The online and offline classroom of High School Mathematics**
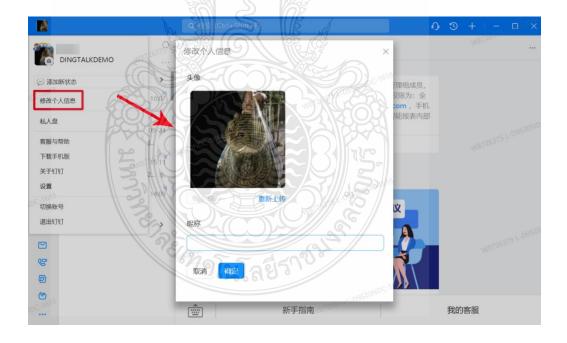
1. Course URL:https://www.dingtalk.com
2. Login steps：
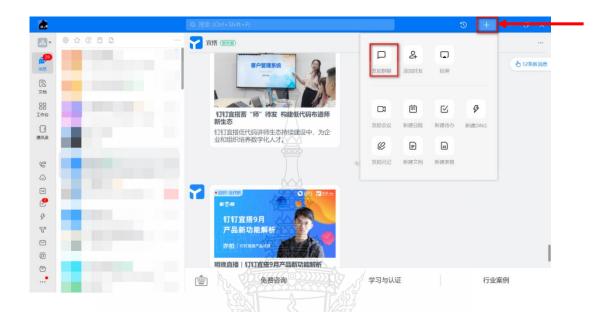　2.1 Enter the DingTalk official website to download and install

2.2 Register Account: Click on the guide page to register an account. After opening it, you can directly enter your phone number and verification code, and click Register.

2.3 Click on the avatar - modify personal information

2.4 Click on the top right corner **+** -> Initiate group chat.

Digital Technology

The digital technology of this thesis is an application which is named DingTalk**.** DingTalk is an enterprise-level intelligent mobile office platform created by Alibaba Group. It will lead a new generation of working methods in the future and will accompany the growth of every enterprise. It is a collaborative office and application development platform for enterprise organizations in the digital economy era and a new productivity tool. The following sentences are the steps to ues Dingtalk for an online class:
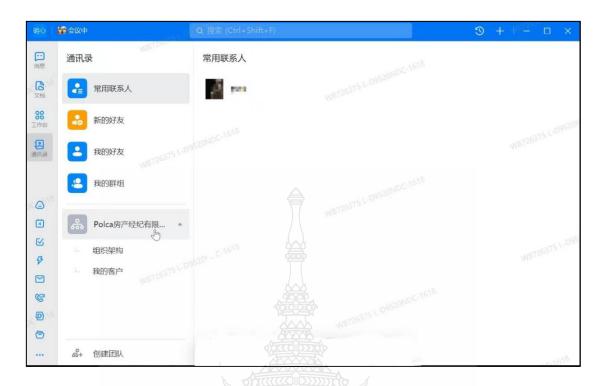
Figure 2.1 Home page of Dingtalk program

First, we use DingTalk's group live broadcast function. In-group live broadcast is safe and controllable, and it can easily open up new ways of online teaching, corporate training, large-scale conferences, annual conferences and exhibitions, and video marketing. Before the formal class begins, the teacher will create a new group and bring all students and teachers into the group.

Step 1. Preparation for live broadcast

Only adults who have completed personal real-name authentication and are over 18 years old can initiate live broadcasts.

Send a live broadcast preview: In order to allow everyone to participate on time
- select the meeting DING
- notify the participants in time.

Figure 2.2 Preparation for live broadcast

Figure 2.3 Preparation for live broadcast

Figure 2.4 Preparation for live broadcast

Step 2. Initiate a group live broadcast

In online classes, teachers usually initiate group live broadcasts on the computer. The live broadcast path is: DingTalk on the computer - DingTalk Group - Toolbar - Initiate group live broadcast.

Figure 2.5 Initiate a group live broadcast

Figure 2.6 Initiate a group live broadcast
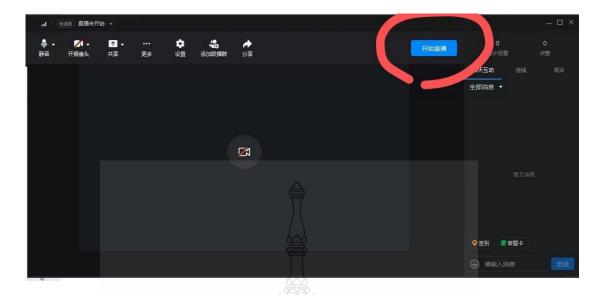

Figure 2.7 Initiate a group live broadcast

Figure 2.8 Initiate a group live broadcast

By selecting the screen sharing mode, you can share content such as PPT courseware open on the desktop, or some kind of operation demonstration directly to the audience, and you can choose to show your face. Display the camera footage in a certain area of the live broadcast to achieve a picture-in-picture effect. This is also the most commonly used live broadcast mode for teachers. Teachers can directly open the teaching files on the computer to show and teach students.
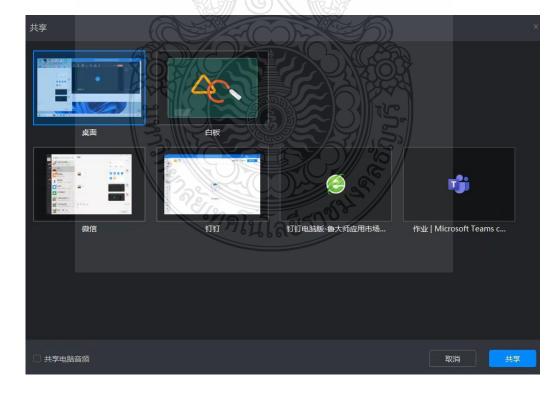

Figure 2.9 Select the screen sharing mode

Figure 2.10 Select the screen sharing mode

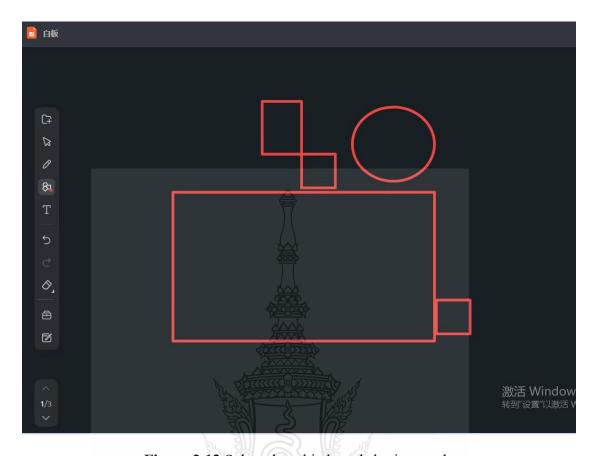

Figure 2.11 Select the whiteboard sharing mode

Figure 2.12 Select the whiteboard sharing mode

Step 3. After-class work

Teachers can upload homework files in the group chat, and students can download and print them out in the group chat, and then complete the homework. If students are not proficient enough in the content learned in class, they can choose the live broadcast playback function and view the playback video in "Group Files - Live Playback". The detailed path is as follows: DingTalk on PC--Group File--Live Playback.

Note: Live broadcasts lasting less than 1 minute cannot be saved and played back. Only live video replays within the past 3 months will be saved in the playback list.

Figure 2.13 The live broadcast playback function

Figure 2.14 The live broadcast playback function

103

Figure 2.15 The live broadcast playback function

Biography

Name-Surname	Chengyang Yu
Date of Birth	1995-01-25
Address	Jiaxin Garden, Xianghe Road,Shunde,Foshan,Guangdong Province, China
Educatio	Master Degree
Work Experience	Assets valuer for 1 year
	Senior high mathematics teacher for 6 years
Present -2023	Senior high mathematics teacher
Telephone	86-13138251913
e-mails	871274877@qq.com

วิทยานิพนธ์ฉบับนี้เป็นงานวิจัยที่เกิดจากการค้นคว้าและวิจัย ขณะที่ข้าพเจ้าศึกษาอยู่ใน คณะครุศาสตร์อุตสาหกรรม มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี ดังนั้น งานวิจัยในวิทยานิพนธ์ ฉบับนี้ถือเป็นลิขสิทธิ์ของมหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี และข้อความต่าง ๆ ในวิทยานิพนธ์ ฉบับนี้ ข้าพเจ้าขอรับรองว่าไม่มีการคัดลอกหรือนำงานวิจัยของผู้อื่นมานำเสนอในชื่อของข้าพเจ้า

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.