EXPLORING CHINESE LANGUAGE LEARNING OF STUDENTS IN MATH CLASS AT A THAI PRIVATE SCHOOL: A CASE STUDY OF USING CHINESE AS A MEDIUM OF INSTRUCTION

BY

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Abstract

This study aimed 1) to investigate the effects of Chinese as a medium of instruction (CMI) on the Chinese math score, 2) to find out the level of Chinese knowledge of Thai first-graders, and 3) to identify the factors affecting Chinese language learning of the students in Chinese math class when using CMI. The study adopted mix-methods research approach to obtain both quantitative and qualitative data from a class of 21 Thai first graders selected with the convenience sampling method. Pre/post-tests of Chinese math and YCT Level 1 were given to the students to compare the scores of Chinese math and Chinese language knowledge at the beginning and at the end of the course using CMI. The findings of the study revealed that the mean scores of the post-test of the students in Chinese math ($\bar{x}$=95.95/S.D.=7.19) and Chinese language knowledge ($\bar{x}$=196.68/S.D.=5.83) were higher than those of the pre-tests ($\bar{x}$=16.14/S.D.=7.28; $\bar{x}$=96.28/S.D.=22.56) sequentially at a significant value of P=.001. The teacher/researcher's journal revealed that the enhancement of Chinese language learning of the students was notably influenced by eight key factors: 1) students' behavior, 2) classroom management strategies, 3) teacher-student interaction, 4) teaching aids, 5) teacher's support, 6) classroom atmosphere, 7) students' learning outcomes and 8) Chinese ability.

(Total 179 pages)

Keywords: Chinese Language Learning, Chinese Math, CMI, First-Grade Thai Student

Student's Signature …..... Thesis Advisor's Signature .....

Table of Contents

Table of Contents (Cont.)

Table of Contents (Cont.)

List of Tables

List of Figures

Chapter 1

Introduction

This chapter presents the background of the study, statement of the problem, research objectives, research questions, research scope, conceptual framework, limitations of the study, significance of the study, and definitions of terms.

1.1 Background of the Study

With China's reform and opening-up, the growth of China's economic influence, and the increasing number of Chinese tourists and residents, Chinese language teaching and learning in Thailand is becoming very popular (Sae-thung, 2022).

China's economy has risen significantly in the 40 years since its reform and opening- up, and its foreign influence has constantly increased, recruiting partners from all over the world (Lu et al., 2019). “Over the years, Chinese has had substantial influence on the world’s economy and it is expected the world’s largest economy before 2030” (Tambunlertchai, S., & Tambunlertchai, K., 2015, p. 27). Thailand, as a friendly neighbor of China, is geographically, genetically, and culturally near to China, and it is an important region for political, economic, commercial, and educational contacts (Chummee, 2022), making it an excellent partner for China. The two nations signed the Joint Statement on the 21st Century Cooperation Plan in 1999, which further reinforced the two sides' comprehensive cooperation, and the China-ASEAN Free Trade Area was established in 2002, which further boosted China-Thailand investment and trade relations (Bi, 2021). In 2013, China presented the "One Belt and One Road" initiative, and Thailand has actively cooperated with China (Rochelle & Ho, 2022). From the data

reported by the Ministry of Commerce of the People's Republic of China, Bilateral commerce between China and Thailand was only US$24.62 million when the two countries first established diplomatic ties in 1975; in September of 2022, bilateral import and export of products has topped US$81 billion, a more than 3,000-fold increase. The active cooperation between Thailand and China has provided a general environment for the development of Chinese language education in Thailand.

The rising Chinese economy has prompted a considerable number of tourists to Thailand (Ewe & Min, 2021). A large number of Chinese tourists has led to the development of related service industries (Liu, & Zhang, 2022), and the local Chinese language services in Thailand will undoubtedly increase the sales of the local tourism industry in Thailand. According to the official data provided by the Ministry of Tourism and Sports of Thailand, over 9.8 million Chinese visitors visited Thailand in 2017, and reaching 10.98 million Chinese tourists traveled to Thailand in 2019 before the COVID-19 pandemic. With the large opportunities in the business landscape, there is a growing demand for a workforce that can speak Chinese (Silarak, 2021).

In response to the high demand for Chinese language talents, lots of Thai government, private and international schools have developed and applied Mandarin curricula, covering kindergarten, primary, secondary, and university levels of education (Sae-thung, Boonsuk & Section, 2022). Nowadays, Chinese in Thailand has become the second most-spoken foreign language after English (Sae-thung et al., 2022).

Regarding the second or foreign language teaching, numerous studies have shown that using target language as the medium of instruction can not only greatly enhance learners' foreign language competency but also academic subjects, this teaching technique has been greatly developed in many countries around the world (e.g. Snow, Met & Genesee, 1989; Leaver & Stryker, 1989; Grabe & Stoller,1997; Cammarata & Tedick, 2012). Using target language as a medium of instruction is a type

of teaching method in bilingual education (Johnson & Swain, 1997). Students learn over time in a target language class that focuses on various subjects such as mathematics, science, and art, where the target language is the language tool used to teach these subjects. As the internationalization of Chinese continues to spread and deepen (Henderson, Appelbaum & Ho, 2013), the application of the Chinese as a medium of instruction (CMI) approach is becoming more and more widespread.

According to the review of the literature, the majority of the studies on using Chinese as a Medium of Instruction (CMI) tool took place with young children in the United States. For example, Cao (2013) explored several educational strategies and obstacles associated with Chinese Mandarin as a medium of instruction for kindergarten students at an American private school; Chen, Y., Yang and Chen, H., (2017) stated five key problems that Chinese as a medium of instruction (CMI) approach encounter in the lessons for preschool level students in the US. They are challenging in finding professional teachers, underdeveloped professional potential, the issue of balancing content and language pedagogy, inadequate usage of Chinese, and lack of outside assistance resources; Lü (2020) reviewed 35 research articles and books that were published in the last few years on Chinese as a medium of instruction (CMI) approach in the United States revealed that researchers are looking into a variety of topics related to language and literacy development in Chinese as a medium of instruction (CMI) approach, such as academic success in English, Chinese language and literacy acquisition, pedagogical approaches and classroom interactions, changes in learners' language use, and their sociolinguistics.

The adoption of Chinese as a medium of instruction in many schools for young children is rooted in the recognition of the distinct advantages that these young learners possess in the realm of language acquisition. Young children, owing to their early developmental stage, exhibit a remarkable advantage in language learning due to their heightened brain plasticity (Festman, 2021). Within the cohort of young language

learners, educators have the unique opportunity to capitalize on this critical phase of language acquisition by employing Chinese as a teaching tool. This method creates an environment where students can naturally and consistently engage with the target language (Abdullaev, 2021), rendering it an ideal period for the acquisition of a second language. Immersive classroom environments are designed to create engaging and captivating learning experiences (Chamboko & Manditereza, 2023), especially for young children. These environments incorporate various characteristics that align with the learning preferences and inclinations of young language learners. This engaging environment serves to heighten the motivation of young learners, making the process of language acquisition not only effective but also enjoyable. Interactive activities, educational games, and real-life experiences integrated into the curriculum not only make learning enjoyable but also alleviate the fear and apprehension often associated with language learning. Therefore, creating immersive language learning environments for young learners is necessary because it takes full advantage of their natural ability to acquire language, lays the foundation for lifelong language skills, and provides numerous cognitive, cultural, and practical advantages.

However, Zhao (2013) indicated that the teaching model of Chinese as a medium of instruction (CMI) is less used in Thailand. Furthermore, Qin (2021) only found seven research articles through CNKI (China National Knowledge Infrastructure) platform when she typed in "Immersion Education in Thailand" in Mandarin as the object of the search. Therefore, it is not difficult to conclude that there are few relevant studies about using Chinese Mandarin as a medium of instruction in Thailand.

To add to more body of knowledge in using Chinese as a medium of instruction in teaching other subjects in particular mathematics, this study aimed to evaluate the effectiveness of using Chinese as a Medium of Instruction (CMI) in the subject of Chinese Mandarin mathematics among Thai young learners, especially first-grade students. Findings from this study could be used to support the teachers and students in

the field of Chinese language teaching and learning with a focus on the bilingual or multilingual context.

1.2 Statement of the Problem

When educators deliver the course content through the medium of the target language, the method of instruction is called the using target language as a medium of instruction (Johnson & Swain, 1997). With the application of this teaching method in mathematics, there are also certain challenges that teachers and students face (Fleckenstein, Gebauer & Möller, 2019).

When students are not good or proficient in the target language, they prefer to use their L1. Cohen (1994) pointed out that in the United States, Primary 3 to Primary 5 students in the lessons of using Spanish as a medium of instruction chose English which is their native language to process math problems presented in Spanish. Canadian eighth graders who are in French immersion classes utilize their first language to carry out the tasks (Swain & Lapkin, 2000). Moreover, based on research, elementary teachers who employed the target language as a medium of instruction have reported that due to the lack of target language knowledge, students are unable to comprehend complex academic materials (Walker & Tedick, 2000). These instances underscore the importance of commencing this teaching method from an early age, as it allows for the gradual development of knowledge in the target language, ensuring that students can effectively engage with more complex academic material as they progress through their education. Starting at an early age lays a strong foundation for language knowledge, which is essential for successful language immersion programs, especially in subjects like mathematics

For educators, the difficulty of integrating discipline and language has been demonstrated by bilingual teachers (Cammarata & Tedick, 2012). In the study of Ó

Ceallaigh, Hourigan and Leavy (2021), the researcher reveals the challenge faced by teachers who use target language as a medium of instruction in finding the appropriate balance between language and subject content when teaching.

Narrowing down to this study, as the teacher in the school who teaches math through the use of Chinese, the researcher has found similar problems when using Chinese as the Medium of Instruction (CMI) in Chinese Mandarin math classes. For Thai first-grade students whose mother tongue is not Chinese, it is difficult for them to understand the content of mathematical knowledge in an all-Chinese teaching and learning context, and to choose the appropriate Chinese language for solving and answering questions. Aunio and Kuzu (2021) stated that understanding of basic concepts is one of the challenges of teaching math to first-grade children. They may not yet have developed a strong understanding of basic concepts in mathematics. A first grader's language skills may still be developing, students' proficiency in the language taught determines the effectiveness of their classes. (Aunio, 2021; Kuzu, 2021). This phenomenon is manifested in the fact that these students have difficulty completing class assignments and homework on their own, and have difficulty understanding what the teacher conveys. Sometimes they may grasp some content but lack the confidence or vocabulary to express it in Chinese, causing them to remain silent or respond in their native language. The following excerpt from the Minutes of the Meeting of the school showed a recorded remark of how the students performed in their math classes and their learning achievement in Chinese classes.

Language barriers are significantly impacting students' abilities to engage effectively in the classroom (Alsahafi, 2019). Their mixed use of Thai and Chinese during responses reflects their struggle with inadequate Chinese vocabulary and expression skills. This struggle leads some students to opt for silence due to their inability to fully articulate themselves in Chinese. Even those eager to participate may provide incorrect answers or struggle to comprehend the teacher's questions due to

language comprehension difficulties. The challenge extends to assignments and exercises, where the inability to read entirely Chinese questions presents a significant hurdle. Overcoming this hurdle might necessitate additional teacher support and guidance to ensure students comprehend the question requirements. While most students can handle arithmetic questions once they understand them, assessing their mathematical abilities tied to written Chinese responses requires considering their knowledge in the language.

Over time, students with these characteristics may find it increasingly challenging to understand and engage effectively in an all-Chinese language course.

In order to help students in their subsequent learning of Chinese language and mathematical knowledge, educators need to provide support to help students overcome language barriers while acquiring mathematical academic content. Therefore, it is very necessary to study the effectiveness of employing Chinese as a teaching language in low-age mathematics classes.

1.3 Research Objectives

The three research objectives of the study are:

1) To investigate the effects of CMI on the Chinese math score of 21 Thai first graders by comparing the pre- and post- Chinese math tests at a private school in Chachoengsao.

2) To explore the effects of CMI on the level of Chinese knowledge of 21 Thai first graders by comparing the pre- and post- Chinese knowledge tests at a private school in Chachoengsao.

3) To identify the factors affecting learners' Chinese language learning in math class when using CMI.

1.4 Research Questions

The three main research questions are as follows:

1) What are the effects of CMI on the Chinese math score of 21 Thai first graders by comparing the pre- and post- Chinese math tests at a private school in Chachoengsao?

2) What are the effects of CMI on the level of Chinese knowledge of 21 Thai first graders by comparing the pre- and post- Chinese knowledge tests at a private school in Chachoengsao?

3) What are the factors can affect students' Chinese language learning in math class when using CMI?

1.5 Research Scope

1.5.1 Location

The research site of this study is at a private school located in Chachoengsao, Thailand which is the workplace of the researcher. This school provide Chinese education from nursery to secondary level and it has adopted the same math textbook as China for first-year Chinese math class in primary school. Therefore, the math content taught by the research in the Chinese math class of first grade is based on the mathematics textbook edited by People's Education Press (PEP).

1.5.2 Population

In this research, the population refers to all of the Thai first-grade students, about 45 who were studying at this Thai private school in Chachoengsao. These 45 students were divided into two classes according to their student ID. Due to the maximum class size first 24 students were in one class, the remaining 21 learners were in the other class.

1.5.3 Samples

A whole class with 21 first grade Thai students participating in this study were all native Thai speakers, indicating that Chinese was not their primary language. Besides, because they all graduated from the research site school's kindergarten, they may have acquired different levels of basic Chinese language and math capabilities but the input of the Chinese language knowledge was assumed to be the same.

1.5.4 The Use of Purposive Sampling

Since this is a classroom-based study of the researcher's class and it is also considered a case study, access is readily available. The obvious sampling technique adopted is convenience sampling. This technique is appropriate as a one group Pre/Post test experimental study (Creswell, Hanson, Clark Plano, & Morales, 2007). The researcher is working in this private school and teaches Chinese math as the only Chinese homeroom teacher.

1.6 Conceptual Framework

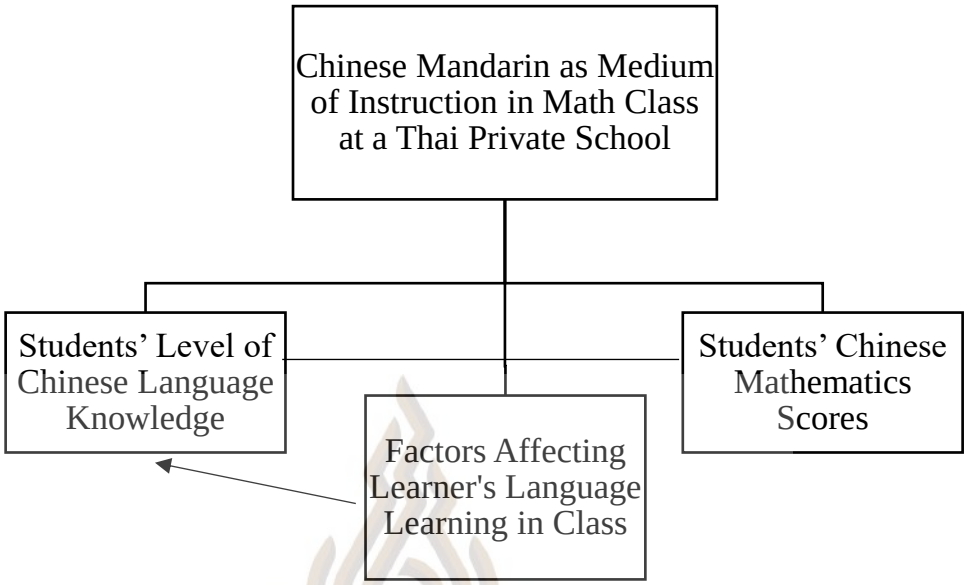

Figure 1.1 The Conceptual Framework

1.7 Limitations of the Study

Since this is a case study, it may not be typical of a wider population or generalizable to other circumstances. Thus, the findings from this study can only be applied to similar contexts

1.8 Significance of the Study

The study is beneficial to the following groups:

1) The teacher of the class and other teachers will learn from the findings how using Chinese as a medium of instruction in teaching math can be effectively applied.

2) The students will also benefit from learning math through applying Chinese as a teaching tool. They may be able to improve and enhance both Math and Chinese capabilities.

3) The school can make use of the findings to improve how employing Chinese Mandarin as a medium of instruction will yield better students' learning engagement and performance.

1.9 Definitions of Terms

Chinese Language Leaning: In this study, Chinese language learning for participants occurs in Chinese math class. Educator teaches Chinese math content through Chinese, a medium of instruction, to cultivate students' Chinese literacy ability.

Math Class: In this research, students use the same full Chinese mathematical textbook as Chinese curriculum which is edited by People's Education Press (PEP) and the subject teacher applies Chinese to deliver the lessons in math class. The Chinese language used in the investigated math class for the teacher and students is not daily-life language, it is more related to math academic language. For example, greater than, less than and number positions in Chinses Mandarin.

Thai Students: The samples of this study are six or seven-year-old Thai first graders, who were born and raised in Thailand and whose parents are also Thai.

Thai Private School: The Thai private school which is the research site is located in the middle region of Thailand and it is not owned by the government. This means school can select teaching materials based on their school needs and situations and the curriculum is more flexible.

Using Chinese as a Medium of Instruction: Chinese in this study refers to Mandarin and it is the medium of instruction for teacher. The subject teacher applies Chinese Mandarin to deliver the lessons in math class.

Chapter2

Literature Review

This chapter covers seven major topics of the focus of the study. The topics discussed are a medium of instruction, theories of using target language as a medium of instruction, learning math through using target language as a medium of instruction, Chinese as a medium of instruction in Thailand, factors affecting students' language learning in the target language teaching medium classroom, tools for measuring Chinse language knowledge of foreigners and related studies.

2.1 A Medium of Instruction

A medium of instruction or media of instruction is a language used in teaching. This teaching model commonly employed in bilingual schools or multilingual program.

According to Pokrivþáková (2013), bilingual education encompasses both formal and informal educational settings and involves instruction in at least two languages. However, the topic of bilingual education is complex and can have varying interpretations depending on the context. The definition of bilingual education can differ among different individuals and can also take on different meanings in different countries (Hurajová, 2015). Among them, Cohen's definition of bilingual education is widely accepted (Anna, 2015), stating that bilingual education refers to the use of two languages as the medium of instruction for learners in either a portion or all of a school's program (Cohen, 1975). In addition, the multilingual programs utilize more than two languages in teaching (García, 2008). And the goal of using of a medium of instruction

aims to facilitate learning of both the language and the subject matter being taught.

In this study, the medium of instruction is Chinese Mandarin which is not learners' first language and the subject matter is basic mathematics. Thus, this study will explore the participants' Chinese language knowledge level and Chinese math scores by implementing this mode of teaching.

2.1.1 Significance of Applying the Target Language as a Medium of Instruction

Nowadays, there are many methods introduced by educators to learn a new language. However, when comparing different approaches, using the target language as a teaching tool is often considered to be more effective than other methods.

Comparing with traditional method, Cook (2016) indicated that students who have passed four years of high school French have gone to Paris and been unable to talk to people on the street because they have not learned enough French through the traditional methods of foreign language teaching focusing on grammar translation from language one to language two. Swain (1996) has shown that bilingual students tend to develop greater knowledge in the target language compared to students who learn through traditional classroom instruction.

Comparing with audio-lingual approach, the audio-lingual approach does incorporate some emphasis on reading and writing, but it primarily focused on oral communication skills (Mei, 2018) . The main goal of the approach is to train students to produce and comprehend language through repetition and drills, with a heavy emphasis on accuracy and grammatical correctness. This approach has been criticized for producing students who can produce correct sentences but may not be able to use the language in real-life situations.

In response to these criticisms, various communicative methods were introduced from the 1970s (McCarthy & Carter, 2006). These methods aimed to develop students' ability to use language in meaningful and authentic ways, with a focus on communication rather than accuracy. However, in moving from an extreme emphasis in grammar to no emphasis on grammar, students were able to carry out conversations but their speech was full of grammatical errors.

On the other hand, using target language as a medium instruction involves immersing students in a language-rich environment class and provides students with opportunities to use the language in real-life situations, which can improve their ability to communicate and understand the language.

2.1.2 Effective and Ineffective Target Language Medium of Instruction

Effective target language medium of instruction refers to a language education approach that entails immersing students in the target language and culture, with opportunities to engage with native speakers and use the language in meaningful ways.(Goldoni, 2013). Effective programs have been found to be highly effective in promoting language acquisition (Genesee, 1985), cultural understanding (Supriyono, Saputra & Dewi, 2020), and academic achievement (Christian, 1994). In an effective education, learners are typically provided with explicit instruction in grammar and vocabulary as well as opportunities for practice and interaction with native speakers (Swain, 1997).

Based on the literature research, some characteristics of effective target language medium of instruction programs include:

1) A focus on communication: Effective target language medium of instruction programs prioritize the development of communicative competence, providing learners with opportunities to use the language in meaningful ways.

2) Explicit instruction: Effective target language medium of instruction programs provide learners with explicit instruction in grammar and vocabulary, helping them to develop a solid foundation in the language.

3) Cultural integration: Effective target language medium of instruction programs promote cultural integration by providing learners with opportunities to interact with native speakers and learn about the target culture.

4) Supportive environment: Effective target language medium of instruction programs create a supportive learning environment that fosters engagement, motivation, and success.

On the contrary, ineffective target language medium of instruction is teaching methods that have been found to be ineffective or less effective in achieving their intended outcomes (Steers, 1976). Ineffective target language medium of instruction can be manifested in several ways:

1) Target language medium of instruction programs that fail to promote true bilingualism and biculturalism.

2) The teaching approach of using target language as a medium of instruction that do not provide learners with explicit instruction in grammar and vocabulary, leading to gaps in knowledge and hindering their ability to communicate effectively.

3) The learning class of using target language as a medium of instruction that are not adequately supported with resources, such as trained teachers, appropriate curriculum, and materials, resulting in suboptimal outcomes for learners.

4) The teaching approach of using target language as a medium of instruction that are not well-designed or implemented, resulting in low student engagement, high attrition rates, and limited success in achieving the intended outcomes.

Bull (1965) provided a more detailed distinction between effective and ineffective teaching method of using target language as a medium of instruction.

Effective target language medium of instruction involves a teacher using easily comprehensible language and speaking slowly and clearly, while utilizing hand gestures, visual aids, and other techniques such as “acting out” to enhance understanding. In contrast, ineffective target language medium of instruction occurs when the teacher speaks too quickly or at a natural speed, as if the student were already fluent in the language, resulting in the student becoming quickly overwhelmed and unable to comprehend the language being used. This can create a sense of distance between the student and the material, ultimately leading to a loss of attention and comprehension.

Lambert (1974) distinguished between effective and ineffective approaches by categorizing them as 'additive' and 'subtractive'. The additive approach suggests that a student does not lose their first language or associated culture while learning a second language, while the subtractive approach implies that an individual is expected to abandon their first language and culture, leading to a general loss of academic performance.

The understanding of both the success and ineffectiveness of target language medium of instruction can be highly beneficial for bilingual and multilingual teachers or the educators who use of a medium of instruction other than the student's first language. By comparing, the researcher designs curricula and lesson plans that better engage and support their students in language acquisition. They can focus on using clear, comprehensible language, incorporating visual aids and modeling techniques, and speaking at an appropriate pace to facilitate student understanding.

2.2 Theories of Using Target Language as a Medium of Instruction

In the area of target language as a medium of instruction, many theories point out how to make the class effective and interesting to help students not only improve

their target language skills but also the academic performance. The following sections indicate the theories that are part of the theoretical framework of this study.

2.2.1 Content-Based Instruction

Brinton, Snow and Wesche (1989) described content-based instruction (CBI) as “the integration of content learning with language teaching aims. More specifically, it refers to the concurrent study of language and subject matter, with the form and sequence of language presentation dictated by content”. In this context, content typically refers to academic areas (such as mathematics, physics, or social studies) and the language is employed as the medium to teaching subject knowledge (Mohan, 1986). The language objectives for learning are met through subject learning, thus, the target language plays an important role in teaching and learning.

According to Brinton, Snow, and Wesche (1989), There are three CBI teaching approaches that educators might use:

1) Theme-based Language Instruction

In this model, A language curriculum is developed by selecting specific themes or subjects from the content. Typically, themes-based language education utilizes materials crafted by educators or adapted from external sources. There is often a deliberate effort to integrate the chosen subject across all instructional areas (Brinton et al., 1989). The goal is to assist students in acquiring comprehensive academic language skills by presenting them with captivating and relevant information. Among the three content-based methods, theme-based language education stands out as the most favored, as it can seamlessly integrate into nearly any existing institutional setting, and the chosen theme or topic can be tailored to align with the students' interests.

2) Sheltered content instruction

This methodology makes use of a curriculum that is specifically designed to

accommodate the pupils' poor ability in language education. As such, sheltered courses are closely related to the primary and secondary immersion education tradition, which separates or “sheltered” second language (L2) learners from pupils who speak the language natively. By putting all L2 learners in the same level of linguistic, this approach lowers anxiety levels and protects them from the modifications and simplifications made by native speakers while interacting with L2 learners (Krashen, 1981). Typically, sheltered courses require special adjustments for L2 students. Teachers frequently select texts for second language learners that are at an acceptable level of difficulty and modify the course requirements to meet their language proficiency (Brinton, Snow & Wesche, 1989).

3) Adjunct language instruction

Under this approach, students are enrolled in two related courses, one of which focuses on language and the other on content. Although the teaching emphasis of the two courses is different, they both cover the same material. While subject instructors focus on academic topics, language teachers place more emphasis on language proficiency. A curriculum like this requires close collaboration between the language and topic teachers, with language teachers frequently going above and beyond to become well-versed in the subject matter. In order to guarantee the smooth integration of the two curricula, adjustments can be required for each course. The essential premise of this paradigm is that students will benefit from the interconnected courses by gaining cross-disciplinary cognitive skills and academic coping methods (Brinton et al., 1989).

Based on these models, language objectives may be classified into two types:

1) Content-obligatory language

Content-obligatory language refers to the language that students are required to master for given academic topic. For example, students should learn and master mathematical vocabularies and sentences like feet and inches in a measurement lesson.

2) Content-compatible language objectives

Although suitable language can be taught in the context of a certain material, it is not needed for successful content mastering.

Snow et al. (1989) gave a guidance on how teachers who use target language as a medium of instruction can use this framework. The effective teachers could design a clear teaching plan to teach and develop students' content-obligatory and content-compatible language competences. They could integrate the subject lesson and content-obligatory language while creating and seeking opportunities for students to practice their second/foreign language skills whenever possible.

As the goal of the research school is to help students become proficient in academic Chinese through sustained exposure to Chinese in a mathematical context. This purpose is consistent with the themes-based language instruction model in CBI. Therefore, the intervention lessons were designed based on the framework of content-based language theory. The teaching content adopts two themes from the school's regular curriculum - the first-grade Chinese mathematics textbook edited by the People's Education Press (PEP). This means that students practice and learn more Chinese knowledge in class rather than math skills.

2.2.2 Content and Language Integrated Learning

Coyle, Hood and Marsh (2010) stated that content and language integrated learning (CLIL) is acknowledged as an instructional approach that promotes the learning of additional language as well as content. It permits education to be given in a language other than the student's primary language (Coyle, 2007; Dalton-Puffer, 2011; Lorenzo, Casal & Moore, 2010; Nikula, Dalton-Puffer & Garcia, 2013). To make sure that students understand the material, it is essential to take into account their language skills. It is difficult to teach pupils in a foreign language if you do not include their home tongue. According to Lin (2015), the employment of both primary and

second languages at different phases of classroom activities is permitted when implementing CLIL.

Moreover, it's critical to think about building a balance between using native language and second language. According to Thomas-Sunesson, Hakuta and Bialystok (2018), teachers can assist students in understanding difficult material by using code-switching or trans-language. However, to prevent using the first language excessively, caution should be exercised. In a similar vein, Lin (2015) claims that difficulties with a second or foreign language may lead to an overreliance on the students' native language.

Therefore, it is not difficult to see that CLIL focuses more on understanding and learning of subject content rather than target language (Borsetto and Schug 2016). This paradigm enables the creation of a bilingual program in which both languages are employed as the medium of teaching, as well as the focus on subject learning.

In this case research, school has implemented a policy wherein both students and teachers are restricted from using languages other than Chinese during class time related to Chinese learning, specifically in the context of Chinese language learning. This policy aims to establish a language immersion learning environment for the students. Therefore, it was a challenge for the teacher to deliver the class.

2.2.3 English as a Medium of Instruction

Macaro (2018) defined English Medium Instruction (EMI) is the use of the English language to teach academic topics other than English in nations or areas where English is not the majority's first language (L1), which is usually a student's second or foreign language. In contrast to CBL and CLIL, which emphasizes language acquisition through a topic in particular, the EMI classroom primarily centers on the content or

topic with minimal to no specific emphasis on language learning (Rogier, 2012).

Many educational administrators worldwide are drawn to the idea of implementing EMI policies. The prevalence of English as a lingua franca in academia, as highlighted by Dearden (2014), underscores its pivotal role in facilitating effective communication. The impact of initiatives promoting staff mobility and student exchange, exemplified by programs like Erasmus (Çankaya, 2017), underscores the significance of English proficiency in fostering international academic interactions. Furthermore, the perceived advantageous outcomes of EMI, associated with the prestige of English (Hu et al., 2014), align with the overarching objective of internationalization in domestic educational settings (Macaro et al., 2018). The potential to attract a more diverse student body, including international students. Other factors, such as the perceived influence of English on employability (Shudooh, 2017) and the lack of resources in the first language (Kim et al., 2014), contribute to the multifaceted arguments supporting the implementation of EMI programs in higher education.

2.2.4 Chinese as a Medium of Teaching

Nowadays, most of the Chinese as a medium of instruction (CMI) research papers and articles available are studied in the context of the young learners (Chen, Yang, & Chen, 2017; Wang, Harvey, Wong, & Peyton, 2022). The role of CMI among these studies was to promote the development of target language. Based on the theories of second language acquisition, younger children have natural strengths in language acquisition. Youngsters are in a critical stage of natural language acquisition (Festman, 2021). They acquire language through mirroring, communication, and immersion, just as they learn their native language (Abdullaev,2021). However, with age, the brain's adaptability decreases, posing potential challenges for students learning new languages

(Pliatsikas, Deluca & Voits, 2020).

Furthermore, in an immersion setting, learners are surrounded by the target language, creating an environment where they engage with and absorb the language in various contexts (Madrid, 2001). This approach often involves instruction, communication, and exposure to the language in real-life situations, fostering natural language acquisition. Immersion language learning is based on the belief that constant exposure and active participation in authentic language use contribute significantly to language proficiency development (Cummins, 2000). This theory is commonly applied in educational settings where learners are immersed in the language through content-based instruction or language immersion programs.

Therefore, this is reason why many teachers try to using target language as a medium of instruction in their classroom for young foreign learners (Cao, 2013; Chen et al., 2017).

In this study, the participants were first-grade Thai students, indicating that they are in the critical period for learning a new language. Furthermore, the primary focus of this study is on the participants' Chinese language acquisition. Therefore, this teaching model, using Chinese as the teaching tool is considered suitable for them.

2.3 Learning Mathematics Through Using Target Language as a Medium of Instruction

2.3.1 Teaching Chinese to Foreigners

Language acquisition normally means first language acquisition, learning with

no instruction required and before school starts (Miesel, 2011). Thus, teaching Chinese to foreigners, on the other hand, falls under the category of second or foreign language acquisition. In this context, individuals are learning a language that is not their native language, and instruction is typically involved.

In today's globalized world, teaching Chinese to foreign young learners may face a unique set of challenges. These challenges stem from differences in language and culture and require special teaching methods to promote students to better understand and use Chinese （Wang, 2019）.

Here is a discussion of some of the main challenges and how to deal with them.

1) Language Differences

Foreign children usually use different language structures and phonological systems, which are quite different from Chinese. This may cause them to have difficulty understanding and mastering Chinese grammar and pronunciation. To address this challenge, teachers should use concise and clear language to help students understand the unique features of the Chinese language through examples and interactions. We attach great importance to oral training and provide audio materials to help students better adapt to the Chinese phonetic system.

2) Cultural Difference

Chinese is not just a language, it also reflects Chinese culture and values. When teaching Chinese, these cultural differences need to be explained and communicated to help students better understand the meaning behind the language. Teachers can combine language and culture through stories, traditional songs, festivals, etc., so that students can have a more comprehensive understanding of the background and connotation of Chinese.

3) Chinese Character Learning

Chinese uses Chinese characters, which can be an unfamiliar and complex challenge for students of non-Chinese language languages. Mastering Chinese characters requires patience and systematic study. The use of interesting games, associations and practical applications can help stimulate students' interest in learning Chinese characters and allow them to cope with this challenge more easily.

4) Integration of Listening, Speaking, Reading and Writing

The four basic skills of Chinese listening, speaking, reading and writing are interrelated, but for foreign children, the integration of these skills may require more time and effort. Through multimedia teaching, role-playing and practical applications, teachers can help students better integrate these skills and improve their confidence in using Chinese.

5) Learning Motivation

Learning a new language may require extra motivation and interest. Foreign children may need a way to stimulate interest so that they can have fun learning Chinese and become more motivated to study. Introducing interesting learning activities, Chinese movies or music, and topics related to Chinese culture can help stimulate students' enthusiasm for learning Chinese.

In order to meet these challenges, teaching methods need to be flexibly adjusted, taking into account the individual differences of students, and focusing on fun and interactivity to ensure that students have fun while learning Chinese and effectively master language skills

2.3.2 Teaching Math

Mathematics commonly referred to as "math", is a field of study that deals with the properties, relationships, and operations of numbers, quantities, and shapes (Ojose, 2011). It is a fundamental subject that is essential for scientific, technological, and economic progress (Popkewitz, Diaz & Kirchgasler, 2017). Math includes a wide range of topics, such as arithmetic, algebra, geometry, calculus, probability, and statistics. The study of math involves numerical reasoning, critical thinking, problem-solving, and mathematical fluency, which are transferable skills that are valuable in many areas of life (Bransford, Sherwood, Vye & Rieser, 1986).

As elementary students progress through their education, their math skills develop and become more sophisticated. In the early grades, students learn basic arithmetic, such as addition, subtraction, multiplication, and division, as well as simple concepts of geometry and measurement (Mulligan & Mitchelmore, 2009). As they move up in grade levels, students begin to learn algebraic concepts, including equations and variables. They also learn more advanced geometry and measurement, including concepts of angles, area, and volume (Powell, Fuchs,L., & Fuchs, D., 2013). Additionally, students begin to learn about statistics and probability, which are important skills for interpreting data and making informed decisions. The development of math skills in elementary school is critical because it provides the foundation for success in more advanced math classes later in their education (Ramirez, Gunderson, Levine & Beilock, 2013).

Teaching math to first-grade children can present some challenges (Aunio, 2021; Kuzu, 2021).

Frist is understanding of basic concepts. First graders may not yet have developed a strong understanding of basic concepts in mathematics. Teachers need to use clear, simple language and concrete examples to ensure students understand

numbers, quantities and basic mathematical relationships.

Second is concentration and concentration. First-year students often have limited ability to focus and focus on subject matter. In order to teach effectively, interesting teaching methods need to be used to make learning mathematics interesting and easy to understand.

Third is language barrier. A first grader's language skills may still be developing, and language barriers may be a challenge for abstract math concepts. Teachers need to use intuitive methods, such as diagrams and physical objects, to help students understand better.

Fourth is availability of teaching resources and tools. Some schools or classrooms may lack adequate teaching resources and tools, which may limit the variety of practical teaching. In this case, teachers need to make creative use of existing resources to promote students' mathematics learning.

Last is subject connection. Teachers need to work hard to connect mathematics with students' real lives so that they can see the application of mathematics in daily life, thereby increasing students' interest in the subject of mathematics.

In overcoming these challenges, teachers can use personalized teaching methods, pay attention to students' individual differences, encourage active participation, and provide encouragement and support.

2.3.3 Benefits of Learning Math Through Using Target Language as a Medium Instruction

When students learn math in a language that is not their native language, they are immersed in that language in the whole lessons, which can help them improve their language knowledge, develop critical thinking skills, enhance cultural awareness and strength academic performance (Lindholm-Leary & Howard, 2008).

Firstly, learning math through implement target language as a medium instruction can help students improve their target language knowledge (Genesee & Lambert, 1991). This is because they are exposed to the language in a context that is meaningful to them and they are required to use the language to solve problems and communicate with their friends and teachers.

Secondly, math is a subject that requires students to think critically and solve problems using logical reasoning (Aizikovitsh & Amit, 2010), thus, it can lead to develop students cognitive abilities (Lazaruk, 2007). Studying math through implement target language as a medium instruction might help students develop these abilities since the language barrier forces them to think in new and diverse ways.

Thirdly, learning mathematics through implement target language as a medium instruction may introduce people to other cultures and ways of thinking. This can help them develop a greater appreciation for diversity and a deeper understanding of different perspectives.

In addition, according to studies, people who study math through implement target language as a medium instruction outperform their counterparts who learn arithmetic in their original language (Watzinger-Tharp, Swenson & Mayne, 2018). This may be due to the fact that they are forced to think more deeply and critically about the material, which can lead to better retention and understanding.

Lastly, learning math through using target language as a medium instruction can provide learners with additional chances in the future. For example, prepare students for occupations requiring bilingual or multilingual abilities, such as international business, diplomacy, or scientific research.

2.3.4 Challenges of Learning Math Through Using Target Language as a Medium of Instruction

With the widespread use of language medium instruction, many issues and challenges have been identified. Two of these topics that frequently appear in research articles are whether to use the first language in the classroom due to deficiencies in the target language skills acquired by students and how to balance course content and target language for teachers who use target language as a medium of instruction (Cammarata & Tedick, 2012).

2.3.4.1 Whether the First Language Should Be Chosen as an Aid

According to numerous researchers, inadequate knowledge in the language used for instruction is a major contributing factor to the subpar academic performance of numerous students in mathematics, particularly those who are bilingual or multilingual (Secada, 1992; Salekhova & Danilov, 2016). Language ability is crucial for understanding mathematical concepts. (Salekhova, 2020). Bilingual students who are deficient in the language of instruction do poorly in terms of comprehension and involvement in classroom discussions (Setati, 2005). Consequently, they are unable to achieve their academic goals owing to a lack of communication skills.

Several scholars suggest that using L1 in full target language instruction may be useful. It could address subject content missed due to students' lack of language

knowledge. Behan and Turnbull (1997) observed that Grade 7 children in Canada engaged in bilingual programs used their first language (L1) for tasks such as task management, information exchange, and vocabulary search. In 2000, Lapkin discovered that students utilized their first language (L1) to facilitate task progression, such as sequencing, comprehension, and task management, concentrate their attention, such as searching for vocabulary, retrieving grammatical information, and explaining, and engage in interpersonal interactions. Their findings all indicated that using L1 might help to promote and improve the development of L2 while also functioning as an effective technique for handling cognitively demanding topics. However, they cautioned against aggressively encouraging the use of L1 since it may function as a replacement for, rather than a help to, second language learning.

The school in this study firmly believes in the benefits of using target language as a medium of instruction, and as a result, has mandated the use of Chinese as the sole language of instruction. Consequently, the Chinese language knowledge of students plays a critical role in their ability to learn mathematics in Chinese.

2.3.4.2 Balancing Subject Content and Language in Teaching

Bilingual education, according to studies, frequently concentrates on subject content at the expense of language learning, which is damaging to language learning (Cammarata & Tedick, 2012). While instructors using the target language as a medium instruction feel they "teach language all the time," they do not balance language and content consistently or effectively (Fortune, Tedick & Walker, 2008).

The teachers who use target language as a medium of instruction already claim that their students' inadequate competency in the target language has stopped them from enrolling in higher-level courses (Fortune et al., 2008; Walker & Tedick, 2000). To

avoid interfering with the natural speed of subject content teaching, they prefer to explain using the learners' native language （Hoare, Kong, & Bell, 2008）. Because the field overlooks the relevance of language development while teaching subject matter, the linguistic results of using target language as a medium of instruction are insignificant.

Based on this Content-based learning, Snow, Met and Genesee (1989) gave a guidance on how teacher plays two roles in their teaching, one is subject teacher teaching academic content and another one is the target language teacher. Based on this framework, teachers can design clear teaching plans to teach and develop students' content-compulsory and content-compatible language abilities.

2.4 Chinese as a Medium of Instruction in Thailand

Today, most Chinese as a language of instruction (CMI) research takes place in the United States (Chen et al., 2017). However, there are relatively few studies related to the use of this teaching method to teach language and other subjects in Thailand (Qin, 2021). In the research survey of Zhao (2013), he found that only the majority of Confucius Institutes and some Chinese schools use Chinese as a medium of instruction (CMI). However, most other schools still use other traditional teaching methods, and even some schools have Chinese language programs where Thai teachers use Thai to teach Chinese.

2.4.1 Factors that Influence the Implement of Chinese as a Medium of Instruction (CMI) in Thailand

Based on the study of Zhao (2013), here are four main factors that influence the use of Chinese as a medium of instruction (CMI) in Thailand.

2.4.1.1 Learners

Not all students are suitable for the CMI method. Students need to meet a number of criteria as the subject of instruction in order to have a positive outcome in the classroom with this method.

At a technical university, many Thai students from other majors were asked to study Chinese, such as medical school, engineering school, etc. The interviews revealed that they were studying Chinese with the clear purpose that is passing the exams and getting credits. So, they don't have much interest and want to spend more time on learning Chinese (Zhao, 2013). Therefore, it is obvious that the CMI method is not suitable for this group of students.

According the Zhao's result of questionnaire on Chinese native and Thai local teachers who teach Chinese in Thailand, forty-two percent of teachers think CMI method is suitable for students with zero foundation of Chinese language, fifty-two percent think it is suitable for students with beginner level, and fifty-four percent think it is suitable for higher level students. However, CMI's teachers in the U.S. believe that this approach is 100% best for students with zero Chinese language foundation. Moreover, second language acquisition theory already demonstrated early bilingual education is the most effective way to acquire a new language naturally.

Thus, when zero-based students learn Chinese in this method class, learners need to be interested in Chinese, think more and actively participate in teaching activities. In addition, Zhao (2013) listed the characteristics of students for whom the CMI method is appropriate in Thailand as well. They are:

1) Students should have some basic Chinese language knowledge.
2) Need to start using the method with younger children.

3) Students are interested in Chinese language and culture.

4) Actively participate in learning activities.

Therefore, if students lack of these characters, it is difficult for CMI pedagogy to make a positive impact, and it will affect the use of faculty.

2.4.1.2 Qualities of the CMI's Teacher

Zhao (2013) summarized the characteristics needed for CMI teachers to have:

1) Could use rich body language in combination with teaching content, teaching methods should be diverse and interesting.

2) Knowledgeable about Chinese culture and able to incorporate cultural elements into their teaching to create an immersive and authentic learning environment.

3) Knowledgeable about education theory and able to apply it effectively in the classroom to enhance student learning.

4) To understand and respect Thai culture and students' characteristics, Skilled in using a variety of teaching strategies to cater to the needs of diverse learners.

5) Very familiar with the knowledge and material being taught.

According to the effective using target medium of instruction program that researcher mentioned in the last part, I do believe that CMI teachers should have two more features.

Firstly, CMI teachers should proficient in Chinese language skills, with a standard accent and a good command of vocabulary and grammar. The quality of Chinese teachers in Thailand varies and this can have a significant impact on students' language learning outcomes. For example, in one of private school in Bangkok where the research worked before, Chinese teachers who are not majoring in education

accounted for about 50% of all Chinese teachers in that school. And even several Chinese native language teachers have strong Chinese dialect accent. This will inevitably affect students' Chinese pronunciation, especially in an CMI lesson. Once students develop a less than standard Mandarin pronunciation, it can ultimately affect their ability to communicate effectively in Mandarin and will be difficult and painful for them to correct later on in their studies.

Second is teachers need to be passionate about teaching Chinese and committed to creating a positive and supportive learning environment for students. Passion for teaching Chinese and a commitment to creating a positive and supportive learning environment for students are particularly important in CMI class because this approach to language learning requires students to spend a lot of time learning and using the language in a natural setting (Savage & Hughes, 2014). In this teaching model, students are expected to communicate primarily in the target language, which can be challenging and intimidating, especially for those who are just starting to learn the language. A teacher who is passionate about teaching Chinese and committed to creating a positive and supportive learning environment can help to ease these challenges and create a more conducive learning environment for students. When teachers are passionate about teaching Chinese, they are more likely to be enthusiastic and engaging in their teaching methods, which can help to inspire and motivate students. A positive and supportive learning environment, where students feel comfortable and supported, can also help to build students' confidence and encourage them to take risks with their language learning (Stroupe & Kimura, 2013, p. 73).

The CMI method places various demands on teachers and is the reason why many teachers do not use this method in their classes as well.

2.4.1.3 Teaching Environment

Language acquisition is inextricably linked to the environment (Asa, 2020). A wide variety of facilities, teaching aids and classroom environments are available to promote bilingual learning (Sykes, Oskoz & Thorne, 2013).

As a CMI model, the primary concern is the full Chinese teaching environment, which makes students feel like they are in China. However, based on researcher teaching experience and investigate other Chinese language teacher in Thailand, the limited teaching budget does not allow Chinese teachers to have enough teaching aids and various teaching equipment such as projectors, stereos and computers to support their teaching. It would limit teachers' teaching activities and discourage them from CMI. Thence, the school policy and faculty support are crucial as well.

2.4.1.4 Teaching Resources

Professor Lin (2012), vice dean of Capital Normal University's Department of Foreign Culture, brought out the odd dearth of Chinese teaching resources appropriate for the CMI method of teaching the language abroad.

According to research of Qin (2021) of Shanxi University of Technology students teaching Chinese in Thailand. 10.43% of Chinese teachers do not have teaching textbooks, 27.59% develop and compose their own teaching materials, and 53.45% have unique Chinese teaching materials.

Among the Chinese educational resources offered by Thai schools, the timeliness and applicability of CMI techniques are elements that influence CMI approach implementation in Thai.

To sum up, the CMI method is not commonly used in Thailand due to the

characteristics of Thai students, qualities of Chinese teachers, poor teaching support and lack of appropriate teaching resources.

In this study, the participants are first graders that means they have the age advantage of acquiring a new language. The research, who is the teacher of students has obtained a certificate of Mandarin, indicating that the researcher's Chinese Mandarin has reached a standard level. And to better facilitate student learning, aside teaching materials each classroom is equipped with computers, projectors, electronic pens, audio and other technological teaching aids.

2.4.2 Studies of CMI Implementation in Thailand

The study of Chinese language teaching in Thailand focuses on the present state of teaching, as well as instructional materials, techniques (Qin, 2021), and strategies (Chen, 2009).

Among the relatively few studies on the using Chinese Mandarin as a medium instruction in Thailand, the following research findings on the use of the CMI model in Thailand for students at all levels show the positive impact.

Zhang (2018) indicated that the effectiveness of CMI classes in the Confucius Institute for Chinese Medicine at Queen's University in Thailand by implementing a questionnaire, fieldwork, classroom observation and comparison with student performance in non-CMI Chinese courses as data collection tools. Han (2018) analyzed the characteristics of CMI in kindergarten of Nakhon Pathom in Thailand. Zhao (2013) and Wang (2019) outlined the requirements and concepts for employing Chinese language as a medium instruction in Thailand. Yu (2019) revealed that the Chinese language environment in secondary school has contributed positively to the spread of

Chinese culture in Thailand.

These studies, however, have limitations and cannot be generalized to analyze situation of employed Chinese Mandarin as a medium instruction in Thailand as a whole. Thus, the finding of this study could facilitate discussions on the using of Chinese Mandarin as a teaching tool in Thailand.

2.5 Factors Affecting Students' Language Learning in the Target Language as Teaching Medium Classroom

In this research, target language for students is Chinese Mandarin, the participants obtained and practiced Chinese language knowledge when they learning Chinese math content. However, it is worth noting that the role of CMI in this study is to improve students' Chinese proficiency by immersing them in the target language learning environment so that they can participate and absorb language knowledge in different contexts.

To achieve a positive Chinese language learning outcome, factors that may affect students' language learning need to be identified in the target language as teaching medium classroom.

Several factors significantly influence students' language learning when the teacher employs the target language as the medium of instruction in the classroom. Firstly, the proficiency of the teacher in the target language is paramount (Brevil, 2020). A teacher who is fluent and skilled can effectively convey information, provide clear explanations, and serve as a linguistic model for students. Clarity of instruction is equally essential (Bull, 1965), as clear and well-structured explanations aid students in

grasping new concepts and language elements more effectively. Student motivation plays a crucial role (Jiang, Zhang & May, 2019), with engaged students more likely to actively participate and learn. Classroom interaction (Jiang et al., 2019), and opportunities for students to communicate, ask questions, and engage in discussions. They can get timely and constructive feedback when interact with teacher actively, along with error correction contribute significantly to language proficiency. Employing a variety of teaching strategies, recognizing individual learning styles, giving them a positive and supportive learning environment encourages students to take risks, fostering language development (Lou & Noels, 2019). Visual aids can help students comprehend and enhance target language learning (Pateşan, Balagiu & Alibec, 2018).

In summary, from previous studies, target language proficiency of the teacher, clarity of instruction, student motivation, classroom interaction, teaching strategies, supportive learning environment, visual aids and other things will influence students' language learning in the target language as teaching medium classroom.

2.6 Tools for Measuring Chinese Knowledge of Foreigners

HSK (Hanyu Shuiping Kaoshi), YCT (Youth Chinese Test) and BCT (Business Chinese Test) are currently the mainstream tests for foreign Chinese learners to assess their Chinese language ability (Peng, Yan & Cheng, 2021).

According to the official website of Chinese Test, HSK is an internationally recognized test that assesses applicants' ability to utilize Mandarin for communication in everyday life, study, and work. The YCT is an international standardized Chinese language knowledge exam that assesses primary and secondary school students whose first language is not Chinese's ability to utilize Chinese in their everyday lives and studies. The BCT is an international standardized exam of Chinese language

competence that focuses on applicants' ability to utilize Mandarin to communicate in realistic business or general work settings.

Due to the participants in this study are first graders, so the YCT exam is the appropriate language assessment to assess their Chinese language knowledge.

The YCT test is separated into two parts: written and oral, and they are independent of one another. The written exam covers YCT (Level 1), YCT (Level 2), YCT (Level 3) and YCT (Level 4), whereas the oral exam covers YCT (Elementary) and YCT (Level 4). (Intermediate).

In one word, the researcher used the YCT level 1 exam to test samples language knowledge of Chinese, and for the validity of the test results, participants have not used and seen this test before in school.

2.7 Related Researches

This section covers relevant studies that are attempts to enhance students' both academic performance and level of target language knowledge.

Kasimova (2023) explored the implementation of Content and Language Integrated Learning (CLIL) with college freshmen, particularly in mathematics and IT. However, this approach has shown challenges, with some students struggling to concentrate and facing difficulties in mathematical tasks. Critics suggest that language learning, especially in its initial stages, should solely emphasize language, fearing it could hinder language acquisition. Nonetheless, students willing to engage actively have found value in this method, particularly in collaborative group work. Integrating math skills into language learning promotes critical thinking, reduces sentence

repetition, enriches vocabulary, and bolsters comprehension across various language domains. Successful integration necessitates both language instructors and content teachers to understand the fundamentals of the combined subjects and the theories underpinning CLIL.

Van (2020) aimed to scrutinize the background differences between students in English and Dutch CLIL (Content and Language Integrated Learning) programs and those in non-CLIL programs in Francophone Belgium. This study is conducted for students in grades 5 or 11. The findings revealed significant distinctions between these groups, indicating that CLIL students generally come from higher socio-economic backgrounds and experience smoother academic paths. Because they seek a favorable educational environment and language advantage.

Salimovich (2022) discussed the application of content-based instruction (CBI) in English for Specific Purposes (ESP), with a focus on legal English learning. ESP, especially Legal English, requires an understanding of the complexities of language within a specific scientific field, not just the terminology. Studies have shown mixed results regarding the effects of CBI on language learning, with some suggesting a positive impact on academic performance. Learning Legal English requires a solid foundation in general English, familiarity with Uzbek law, and an understanding of the complexity of legal vocabulary and the differences between legal systems. Legal English teaching focuses on language skills (grammar, syntax, etc.) rather than jurisprudence, and advocates the integration of legal and language expertise in teaching. Finally, the importance of professional competence and motivation for students who wish to excel in Legal English is emphasized.

Amrani's (2019) qualitative study delved into the impact of content-based instruction (CBI) on enhancing comprehension and vocabulary within an English for

Specific Purposes (ESP) course at an engineering school in Morocco. The study involved 40 students split into two groups, undergoing a 15-hour legal English course across six weeks. The course emphasized reading comprehension and vocabulary acquisition through an interactive approach aimed at active learner engagement. Pre-tests and post-tests were administered to gauge progress, comparing results between the two groups initially and then within each group. The findings indicated overall progress in legal English comprehension and vocabulary skills for both groups. Specifically, the experimental group displayed significant improvement in post-test scores compared to their pre-test scores, while the control group maintained higher pre-test scores.The study concludes that content-based instruction positively influences ESP comprehension and vocabulary enhancement. It affirms that focusing on subject matter content indeed contributes to language learning, showcasing how CBI can effectively bolster language skills within a specialized context.

Lai (2018) investigated the attitudes and motivations of EFL students in learning English through content-based instruction (CBI) at a Thai university. Seventy-one college sophomores completed 6-point Likert scale questionnaires about attitudes and motivation, and researchers conducted classroom observations and collected midterm and final exam scores. According to statistical analysis, the students had a generally good opinion of the CBI-based course, and their interest in learning English was at a moderate level. There were substantial differences in attitudes between nursing and medical students, although motivations for the two programs did not differ significantly. It is recommended that professors of CBI courses adopt motivational strategies to enhance students' instrumental motivation and comprehensive motivation.

Bellés-Calvera (2018) studied a Spanish-speaking bilingual community in a high school that taught music in English using a CLIL approach. The aim was to assess students' perceptions of these music lessons and evaluate the suitability of teaching

music in English. The study involved tailored materials and a final questionnaire. Results showed that students found these music lessons in English to be easier compared to regular classes. They not only enjoyed the exposure to English but also expressed interest in participating in CLIL programs in the future. The pedagogical implications suggested the development of learner autonomy, utilization of audio-visual aids, and the need for further research in bilingual and multilingual regions.

The usage of virtual reality (VR) in the classroom has gained in popularity in recent years. Its presence and immersive design open up new learning opportunities. For example, Putra (2022) reviewed eight experimental papers published between 2010 and 2021, and the findings showed that, VR enhances student learning more than the control condition. Moreover, immersive VR has a notably stronger effect compared to semi-immersive and non-immersive systems. This effect remains consistent across different educational levels and most subject areas. Peixoto (2021) indicated the link between immersive Virtual Reality (VR) and learning a foreign language is notably positive, especially when contrasted with traditional teaching methods. Additionally, the correlation between immersive VR and the user's motivation and satisfaction is also strongly positive. Lan (2020) found that students' learning motivation and autonomy were stimulated by observing the learning process and analyzing primary school students' answers to interview questions. Their attitudes towards the learning content or activities were positive and they expressed enjoyment of the virtual environment.

Content-Based Instruction (CBI), also known as “immersion and Content-and -Language- Integrated Learning (CLIL),” evolved as a teaching method that blends curricular subject matter with target language skills (Bellés-Calvera, 2018). They are not pedagogically different from one another (Cenoz, 2015).

In conclusion, these studies focus on teaching academic content through a second or foreign language, which is consistent with the approach of this study.

Furthermore, incorporating immersive elements into virtual reality, such as images, sound, and other engaging stimuli, creates a captivating interesting and understandable learning environment.

Chapter 3

Research Methodology

This chapter describes research design, research site, population and samples, research instruments, validity, data collection processes, data analysis and research ethical considerations.

3.1 Research Design

This research aimed to study the effects of CMI on Chinese mathematic scores and Chinese knowledge level of the 21 Thai first graders by comparing Chinese math and knowledge test scores before and after ten math courses and identify the factors affecting learner's Chinese language learning in classroom. The researcher used a mixed methods research approach and employed 1) the pre/post-test of Chinese math, 2) the pre/post- YCT level 1 test as Chinese language knowledge test, and 3) the teacher's journal as data collection tools. The lesson plans that were designed to teach math were adopted as an intervention instrument.

According to Mander (2017), mixed-method research offers three significant advantages over other research approaches. Firstly, it provides more flexibility and can be utilized in various research designs. Secondly, the integration of both qualitative and quantitative data enables the researcher to gather extensive and comprehensive data from diverse sources. Finally, quantitative data is presented in numerical form, while qualitative data is presented in descriptive language that captures emotions, feelings, and opinions that are difficult to quantify. In this study, quantitative data came from the Pre/Post math test and the students' Chinese knowledge test results, while the teacher's

journal provided qualitative data.

This study had three objectives as follows:

1) To investigate the effects of CMI on the Chinese math score of 21 Thai first graders by comparing the pre- and post- Chinese math tests at a private school in Chachoengsao.

2) To explore the effects of CMI on the level of Chinese knowledge of 21 Thai first graders by comparing the pre- and post- Chinese knowledge tests at a private school in Chachoengsao.

3) To identify the factors affecting learner's Chinese language learning in math class when using CMI.

To find out the answer to the first objective, the scores of the pre- Chinese math test and the post-Chinese math test were compared, while the answer to the second research objective was found in the students' scores of the pre and post- Chinese knowledge test results. This test is a standardized Chinese knowledge test, YCT (Youth Chinese Test) level 1. Lastly, teacher's journal gave the answer to third research objective.

3.1.1 Research Procedures

The following steps explained how this research was conducted. The research design process is shown below:

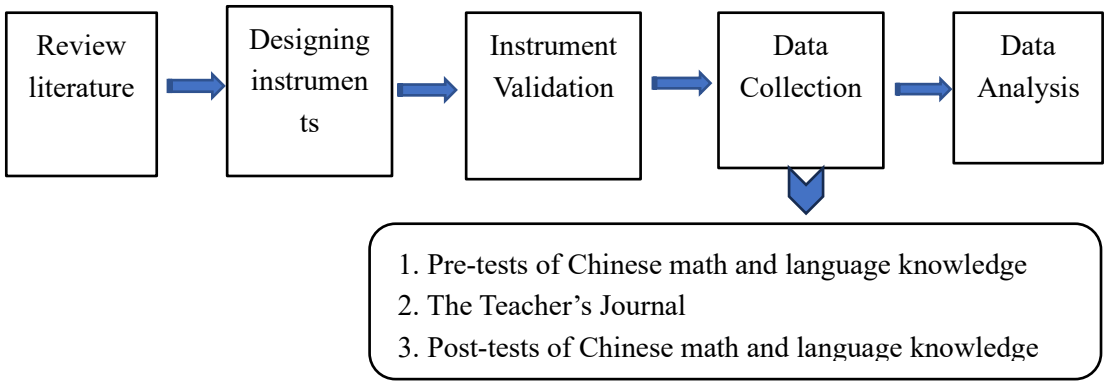

Figure 3.1 The Steps of the Research Process

3.2 Research Site

This study was conducted in a private school in Chachoengsao Province, Thailand. All educational programs at the school are based on the Basic Education Core Curriculum, with a strong focus on providing students with knowledge to promote their personal growth. The school provides diversified trilingual education for students from preschool to secondary school, they are Thai, English and Chinese. However, the teaching time and subjects of the three languages are not completely consistent, except for language and mathematics courses. At the primary level, students are required to study three Chinese-related courses: Chinese language, Chinese mathematics, YCT (Youth Chinese Test) at lower grade or HSK (Hanyu Shuiping Kaoshi) at upper grade. Teaching materials in Chinese language and mathematics courses use the same Chinese and math textbooks edited by the People's Education Press and YCT or HSK course use the exam's official textbooks. Regarding Chinese learning period, learners need to attend 9 periods to learn Chinese including math and YCT per week from Monday to Friday in primary one level, 60 minutes per period. The school formulates that 5 of the 9 Chinese classes are in Chinese language learning, and 2 of the 9 are in Chinese math and YCT content learning respectively.

Moreover, this school follows a language immersion approach, where is used the target language as a medium of instruction to create an environment that fosters language acquisition and application. This method is known for its effectiveness in helping students become proficient in the target language by exposing them to it consistently in various contexts. Therefore, the school has a very important policy for teachers. All teachers are mandated to conduct their lessons exclusively in the target language, irrespective of the subject matter. This policy underscores the school's commitment to creating a comprehensive language-learning atmosphere for its students.

In conclusion, teachers will strictly abide by the school's policy and use Chinese as the medium when teaching Chinese mathematics.

3.3 Population and Samples

This study has a population of approximately 45 Thai first-grade students who were studying Chinese math at a private school in Chachoengsao, Thailand. These 45 students were randomly divided into two classes. Due to the maximum class size first 24 students are in one class and the other one with 21 learners. The focus of the research is on 21 Thai first-grade students who are all native Thai speakers and have previously attended the school's kindergarten. Although the students may have had varying levels of knowledge in Chinese language, it is assumed that they have received the same Chinese instruction. Since this is a classroom-based study of the researcher’s class and it is also considered a case study, access is readily available. The obvious sampling technique adopted is convenience sampling. The researcher is employed at this private school and instructs Chinese math in the research class.

3.4 Research Instruments

The researcher employs three instruments in this study to obtain significant data for the research aims. At the beginning of the study, the teacher of grade 1 gave students pre-tests of Chinese math and YCT level 1 test to evaluate students' Chinese math and Chinese language knowledge level. Then during ten Chinese math lessons study in CMI, the researcher gave two themes Chinese math learning content based on Chinese mathematical textbook edited by People's Education Press (PEP), Comparing How Many and Position. To better promote Chinese mathematical knowledge and Chinese language development, based on the guidance of Snow, Met, & Genesee (1989) to teachers who using a medium of instruction, the subject matter of these two themes were divided into two parts, one content-obligatory language and one content-compatible language. For content-obligatory language, it includes 19 words, 15 sentences. And about content-compatible languages, they are common items in life, such as fruits and animals, students practiced this type of language to the maximum extent possible. For instance, in a math class where students are learning numbers 1-10 in their first lesson, these numbers (1-10) represent content-obligatory language, and any item that signifies a quantity is considered content-compatible languages. After finishing each lesson, teacher should write journal to record what happened in classroom to identify the factors affecting learner's Chinese language learning in math class when using CMI. After all the teaching periods, students again took the post-tests of Chinese math and the Chinese knowledge test (YCT 1) to see the difference in student scores before and after the course.

In conclusion, this research consisted of three research instruments and one intervention instrument to collect data.

3.4.1 The Pre/ Post-Test of Chinese Math

Pre/post-test was used as a tool to compare students' math scores before and after the study to find out the effects of CMI on the Chinese math score.

The content of Chinese math pre/post-test was adapted two themes from the teaching textbook, Comparing How Many and Position, would teach in class. This test included two parts:

1) Listening and Speaking

In this part, students are required to give oral responses in Chinese to the three questions. For the first question, students need to read 10 numbers, and these 10 numbers are randomly ordered from one to ten. Each number values 0.5 mark, so the total mark of first speaking question is 5 marks. The second problem is to please correctly state the three relationships in sentences between the quantities of the following items asked by teacher and five marks per relationship, the total mark of second question is 15 marks. Three relationships asked by teacher as follow:

(1) Xiao Ming has 8 apples and Xiao Hua has 2 apples, who has more apples than who? Answer: Xiao Ming has more apples than Xiao Hua.

(2) Rabbit has 6 bottles of milk and Kitten has 3 bottles of milk, who has less milk than who? Answer: Kittens have less milk than rabbits.

(3) The dog ate 10 pieces of cake and the turtle ate 10 pieces of cake. Do they eat the same amount of cake? Answer: Dog and turtle eat the same amount of cake.

The third question is to please using sentence structures of … is on/below/in front of/ behind the …, above/Under/In front of/Behind of the…is…, …is on the right/left of… and on the right/left of the…is… to describe six pictures of the following items in the correct way and five marks per picture, the total mark of third question is 30 marks.

2) Reading and Writing

In this section, students need to read the questions themselves and write the correct answers in Chinese within 25 minutes. In this part Pinyin can help them to read and understand the questions.

This part includes three questions as well. The first question asks students to write from one to ten, and this question is worth 5 marks. The second question is for students to understand and write the correct Chinese characters to describe the relationship between objects based on the information in the picture, and this question is worth 15 marks. And the last question is to write the correct position Chinese words based on the giving content, and this question is worth 30 marks.

Therefore, the testing content of pre-test and post-test are same, testing student's applications of 19 words and 15 sentences as listing in lesson plans and the test divides into two parts, listening speaking and reading writing, each section has 50 points, so the total score for the pre/post-test is 100 marks. In addition, due to the unique nature of speaking and listening tests, speaking and listening tests will be administered one-on-one. Participants could take reading and writing test together for 20 minutes.

3.4.2 The Teacher's Journal

A teaching journal is a continuous written documentation of teaching observations, reflections, and various thoughts, typically kept in the form of a notebook, book, or electronic format. It functions as a resource for discussion, reflection, or evaluation (Richards & Farrell, 2010). However, in this study, the researcher acted as a classroom teacher and recorded what happened in the classroom based on her observations. Researcher wrote every journal after each lesson. Thus, there was ten teachers journal at the end of study. These records can be used to analyze the factors affecting learner's Chinese language learning in math class when using CMI. This gave a deeper understand on CMI as well.

Numerous factors can impact students' language learning when using target language as a teaching tool, and I strongly believe that distinct elements may manifest in each lesson. As a result, within in this journal, teacher refrained from establishing a predetermined theme for analysis; instead, adopting a directional approach in writing. This flexible method enables researcher to comprehensively observe and document the distinctive dynamics of each lesson, capturing the various factors influencing language learning.

3.4.3 The Pre/post-test of Chinese Language Knowledge

Chinese language knowledge test was used as a tool to compare students' Chinese language scores before and after the study to find out effects of CMI on the level of Chinese knowledge.

To achieve this, the study utilized the Youth Chinese Test (YCT) level 1. YCT is a globally standardized knowledge exam for the Chinese language, specifically designed to assess the language knowledge of primary and secondary school students whose native language is not Chinese. It aims to evaluate their ability to use the language effectively in both daily activities and academic endeavors.

Before administering the YCT Level 1 Test to the participants, the test items were thoroughly tested with potential test-takers. Experts were involved in constructing the questions, ensuring that each question aligned with the objectives of the test items, and they were carefully reviewed one by one. YCT Level 1 test consists of 35 questions and added Pinyin, divided into two parts: listening (100 marks) and reading (100 marks).

1) Listening (10 minutes)

Section 1 has 5 questions. Listen to each question twice. Each question is one word, and a picture is provided on the test paper. The test taker determines what is right or wrong based on what they hear.

Section 2, 5 questions. Each question is listened to twice. Each question is a phrase and 3 pictures are provided on the test paper. The test taker selects the corresponding picture according to what he or she hears.

Section 3, 5 questions. Each question is listened to twice. Each question is a sentence and a picture is provided on the test paper. The test taker determines what is right or wrong based on what he or she hears.

Section 4, 5 questions. Each question is listened to twice. Each question is a dialogue and 3 pictures are provided on the test paper. The test taker selects the corresponding picture based on what he or she hears.

5) Reading (17 minutes)

Part 1, there are 5 questions. Each question provides a picture and a word, and the candidate has to determine whether it is consistent or not.

Part 2, 5 questions in total. Each question provides a sentence, and there are several pictures on the paper, and the candidate has to determine whether the sentence The candidate has to choose the corresponding picture according to the content of the sentence.

Part 3, 5 questions. Each question provides a picture and an incomplete dialogue, and there are 6 options on the paper. There are 6 options on the paper, and candidates are asked to choose their answers.

Regarding the test content, to promote both mathematical content and Chinese language development, the researcher followed the guidance of Snow, Met and Genesee (1989) in utilizing the target language as the medium of instruction for subject teaching. The content for these two themes was divided into two parts: content-obligatory language and content-compatible language. The former consisted of 19 words and 15

sentences as presented in the lesson plans, while the latter included common items used in daily life. It just so happens that the YCT 1 exam covers numbers and common items and expressions used in everyday life! For instance, in a math class where students are learning numbers 1-10 in their first lesson, these numbers (1-10) represent content-obligatory language, and any item that signifies a quantity, such as apples and birds, is considered content-compatible languages. Students were encouraged to practice this type of language as much as possible in class. Thus, the content-compatible language used in this study is consistent with the content of YCT level 1. These daily and common vocabulary words are needed in math class to help students practice mastering the Chinese math concepts, specifically when educators use target language as a medium of instruction.

3.4.4 Intervention Instrument

3.4.4.1 Lesson Plans

The study lasted ten lessons on basic Chinese math, with each lesson lasting 60 minutes. The researcher focused on two themes adopted from Chinese mathematical textbook edited by People's Education Press (PEP). The first teaching theme is Comparing How Many and it consists of 13 words and 3 sentences, including numbers 1-10 (one to ten), 多（many），少（less），一样多（as much），“…比…多。”（…more than…），“…比…少。”（... less than…），“…和…一样多。”（…as much…）. The second theme is Position, it consists of 6 words and 12 sentences, including 上（on），下（below），前 （in front of），后（behind），“…在…的上面/下面/前面/后面。” （… is on/below/in front of/ behind the …），“…的上面/下面/前面/后面是…。”（Above/Under/In front of/Behind of the…is…），左（left），右（right），“…在…的左边/右边。”（…is on the right/left of…），“…的左边/右边是…。”（On the right/left of the…is…）.

To enhance both mathematical content and Chinese language development, the researcher followed the guidance of Snow, Met, & Genesee (1989) on employing target language as a medium of instruction in subject teaching, and divided the content for these two themes into two parts: content-obligatory language and content-compatible language. The former included 19 words and 15 sentences as showing last paragraph, while the latter involved common items in daily life, such as fruits and animals, and students were encouraged to practice this type of language as much as possible in class. Details of the lesson plans are shown below:

Table 3.1 Ten Succinct Teaching Plans

Lessons	**Activities**
1	**Introduction** 1) Introduce the course and teaching goals 2) Explain rules of doing pre-test and YCT 1 test 3) Conduct pre-test firstly, and then YCT 1 test
2	**Teaching Content: Number 1-10** 1) warm up: Chinese number song 2) Master numbers 1-10 through counting matching and tracing number 3) Doing the classroom exercise related to this lesson

Table 3.1 Ten Succinct Teaching Plans (Cont.)

Lessons	Activities
3	**Teaching Content: Many，Less，as much** 1) warm up: Chinese song “Compare How Many” 2) Count through the items that students are familiar with and use many, few and as much to compare 3) Doing the classroom exercise related to this lesson
4	**Teaching Content: …more than…, ...less than…, …as much…** 1) warm up: Chinese cartoon “How much do you know?” 2) Practice through drills and activity：Putting and Drawing. 3) Doing the classroom exercise related to this lesson
5	**Teaching Content: on, below, in front of, behind** 1) warm up: Game: Fingers above, fingers below, fingers in front, fingers behind 2) Practice through the game “where is Xiaoming?”. 3) Doing the classroom exercise related to this lesson

Table 3.1 Ten Succinct Teaching Plans (Cont.)

Lessons	Activities
6	**Teaching Content: … is on/below/in front of/ behind the …** 1) warm up: Chinese song “Direction Song” 2) Practice through drills and activity：Hide and seek. 3) Doing the classroom exercise related to this lesson
7	**Teaching Content: In front of/Behind of/Above/Under the…**is… 1) warm up: Game: Listen to the command and do the action 2) Practice through activity：Look at picture and talk about it. 3) Doing the classroom exercise related to this lesson
8	**Teaching Content: Left, Right** 1) warm up: Quizzes-Make a guess 2) Practice through role play and activity：You tell, I do 3) Doing the classroom exercise related to this lesson

Table 3.1 Ten Succinct Teaching Plans (Cont.)

Lessons	Activities
9	**Teaching Content: …is on the right/left of…, on the right/left of the…is…** 1) warm up: Chinese song "Left Right Up Down" 2) Practice through game and activity：Changing seat and putting 3) Doing the classroom exercise related to this lesson
10	**Summary** 1) The teacher briefly summarizes the course 2) Students do post-test and YCT 1 test 3) Students give feedbacks through Semantic Differential Scale

3.5 Validity

The assessment of validity in this study pertains to the extent to which the tools accurately measure the intended constructs. To ensure content validity at the item development stage, the researchers used the Index of Item-Objective Congruence (IOC) developed by Rovinelli and Hambleton (1977). The IOC is a procedure commonly used in instrument development for evaluating content validity, and it will be employed to

assess the pre/post- Chinese math test and the teacher's log in this study. To conduct this evaluation, three experts will be invited to review and provide feedback on the items.

The IOC points in calculations provided into three scales of rating for consistency and congruencies of the items. Three experts will choose only one answer as the given mark from these three alternatives of choices as follows:

+1 = Congruent with clear understanding,

0 = Uncertain or not sure whether item related to the study,

-1 = Not Understand or not congruent or related to this study.

According to Rovinelli and Hambleton (1977), each item in the assessment must exhibit consistency with a value of 0.67 or higher to be considered valid. The IOC marks are calculated by below equation:

$$IOC = N \sum R \quad (3\text{-}1)$$

R = Point given by experts

ΣR = Total points of each expert

N = Numbers of experts

In this study, IOC results of the four instruments were assessed at above 0.67. The IOC results of the Pre/Post-test of Chinese math was 0.945, and the IOC result of lesson plan was 1. Thus, these two instruments used in the study showed high validity

high scores.

3.6 Data Collection

The study spanned five weeks, comprising two Chinese mathematics classes per week, each lasting 60 minutes. Therefore, the students took a total of ten mathematics courses and accumulated ten hours of instructional time teaching mathematics through CMI throughout the study.

3.6.1 Pre-Tests of Chinese Math and Chinese Language Knowledge

The data of pre-tests of Chinese math and Chinese language knowledge were obtained from participants taking the exam before the teaching lessons given.

3.6.2 Teacher's journal

The researchers recorded in detail what happened in the classroom in teacher journals after each class. Therefore, in the end, ten teacher logs can be obtained as visual data, which can provide valuable data for research to determine the factors that affect learners' Chinese learning in mathematics classes when using CMI.

3.6.3 Post-Tests of Chinese Math and Chinese Language Knowledge

The content of pre-tests and post-tests are same. The data of post-tests of Chinese math and Chinese language knowledge were obtained from participants taking the exam after all the teaching lessons given.

3.7 Data Analysis

In this study, two types of data were collected. Different data types require different data analysis tools

3.7.1 The Pre/post-Tests of Chinese Math and Chinese Language Knowledge

The pre/post-tests of Chinese math and language knowledge test data is quantitative data. To analyze the data of this type, SPSS software was employed. To begin with, the total scores for each subskill in both the pre-test and post-test, as well as the Chinese language knowledge test, were calculated. Next, the scores were entered into SPSS and got the t-test, mean, and standard deviation. The pre-test scores were then compared to the post-test scores.

3.7.2 Teacher's journal Data Analysis

The data from the teacher's journal as the qualitative data were analyzed by content analysis. The three analysis steps were adopted from Three Cs (Coding-Category-Concept) Process of Lichtman (2013). The following figure displays how the qualitative data will be analyzed.

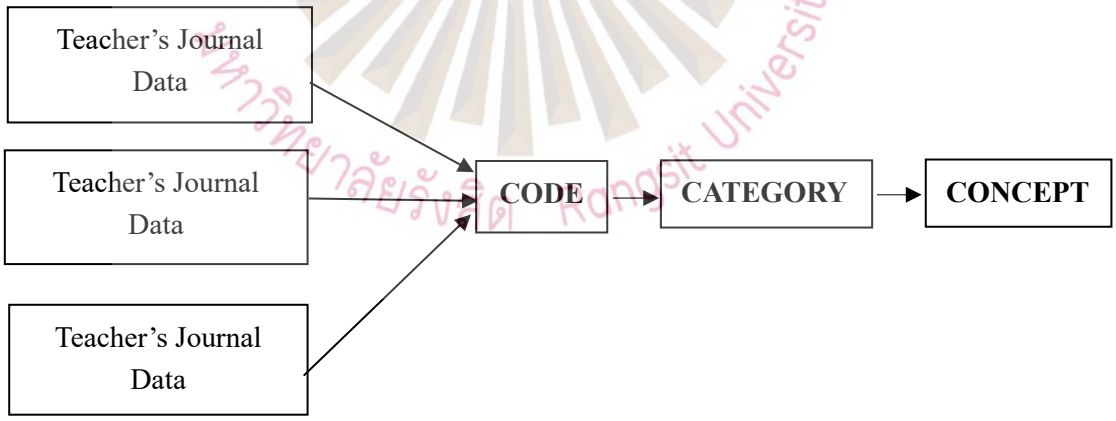

Figure 3.2 Data Analysis Process based on Litchman's Three Cs process

3.8 Ethical Considerations

To ensure ethical conduct of the study, the researcher will take the following

measures:

1) The researcher will obtain informed consent from the participants prior to conducting the study.

2) The personal information and responses of the participants will be collected and stored securely.

3) The researcher rigorously adhered to the principles of participant anonymity and opinion confidentiality. To ensure the privacy of research participants, only numerical identifiers, such as “student 1”, “student 2”, and “student 3”, were employed to refer to individuals involved in the study.

4) In order to protect the confidentiality of participant information, the collected data will be deleted within one year of the publication of this study.

To ensure the confidentiality of participants' personal information and identity, all samples and director of research school were required to sign an informed consent form. The form used for this study are Participant Information Sheet with Consent Form (For legal guardian of 6 - 7 years old) and Legal Guardian Informed Consent Form (For legal guardians of children/minors under 12 years to sign), which has been adapted from the RSU Ethical Review Board (ERB).

In accordance with the RSU Ethical Review Board (ERB), the researcher conducted an informed consent process to ensure that potential participants were provided with adequate information and ample opportunity to consider whether to participate in the study without any pressure or undue influence. As a result, participants had the freedom to withdraw from the survey process at any time without being subject to any questioning or experiencing any negative impacts on their personal or professional lives.

To ensure compliance with the RSU Ethical Review Board (ERB) regulations, the researchers will maintain the confidentiality of the sample's personal information and identity, and will only utilize the information gathered for the purposes of this study.

Chapter 4

Data Analysis

This chapter analyzes the data collected from 21 Thai first grade students who study math using Chinese Mandarin as the Medium of Instruction (CMI) to explore the effects of CMI on the level of Chinese knowledge and Chinese math score by comparing the pre- and post-treatment and identify the factors affecting learner's Chinese language learning in class.

The Pre/Post-Tests of Chinese math and Chinese language knowledge and teacher's journal were designed to get the data for the three researcher questions:

1) What are the effects of CMI on the Chinese math score of 21 Thai first graders by comparing the pre- and post- Chinese math tests at a private school in Chachoengsao?

2) What are the effects of CMI on the level of Chinese knowledge of 21 Thai first graders by comparing the pre- and post- Chinese knowledge tests at a private school in Chachoengsao?

3) What are the factors can affect students' Chinese language learning in math class when using CMI?

The Pre/Post-test of Chinese math and Chinese language knowledge were used to compare the student's mathematics score and the levels of Chinese language knowledge at the beginning and at the end of the course to explore the effects of CMI on the Chinese math score and Chinese language. The third tool used an approved qualitative study, using teacher journals to record what is the lesson like in Chinese math

for identifying the factors affecting learner's Chinese language learning.

The findings from the three instruments are show below:

4.1 The Data Analysis of the Students' Results of Pre-Tests and Post-Tests

Pre/post-tests of Chinese math and Chinese language knowledge were used as tools to compare the results of Chinese Math Test and Chinese Language Knowlege Test before and after the study. Therefore, Paired T-test was used to analyze the Pre-test and Post-test scores.

4.1.1 Paired T-test

The outcomes of the scores entered into SPSS for examination are depicted in two type tables. Table 4.1 and 4.3 presents fundamental statistical details regarding the performance of students before and after the treatment. In Table 4.2 and 4.4, the findings of the statistical test are displayed.

Table 4.1 Paired Samples Statistics of Chinese Math Test

Chinese Math Test	Mean	N	Std. Deviation	Std. Error Mean
Pre-Test	16.14	21	7.28	1.59
Post-Test	95.95	21	7.19	1.57

Table 4.2 Paired Samples Test of Chinese Math Test

Chinese Math Test	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pre-test - Post-test	-79.81	7.67	1.67	-83.30	-76.32	-47.71	20	0.00

In the Chinese Math Test, the mean of the Pre-test is 16.14, while the mean of the Post-test is 95.95 (95.95 > 16.14), and the mean in t-test is -79.81, which means the Post-test score is 79.81 higher than that of the Pre-test. From what is shown, the S.D in the Pre-test is 7.28, while it is 7.19 in the Post-test. This indicates that not only students' scores were higher in the Post-test, but the gap among students shrank after the treatment. The second table reveals a significant difference, with a Sig. value of P-0.00 < 0.05. This implies a significant distinction between before and after the intervention.

Table 4.3 Paired Samples Statistics of Chinese Language Knowledge Test

Chinese Language Test	Mean	N	Std. Deviation	Std. Error Mean
Pre-Test	96.28	21	22.56	4.92
Post-Test	196.68	21	5.83	1.27

Table 4.4 Paired Samples Test of Chinese Language Knowledge Test

Chinese Language Test	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pre-test - Post-test	-100.40	19.37	4.22	-109.21	-91.58	-23.75	20	0.00

In the Chinese Language knowledge Test, the mean of the Pre-test is 96.28, while the mean of the Post-test is 196.68 (196.68 > 96.28), and the mean in t-test is -100.40, which means the Post-test score is 100.40 higher than that of the Pre-test. Based on the presented data, the S.D in the Pre-test is 22.56, while it is 5.83 in the Post-test. This suggests that not only did students' scores increase in the Post-test, but also the disparity among students narrowed after the study. From the Table 4.2, the value of Sig. is P-0.00 < 0.05. It means that there is a significantly difference between before and after the study.

4.1.2 The Comparison of the Test Scores of Chinese Math and Chinese Language Knowledge

This section shows the students' mean scores in each part of the Chinese math and Chinese language knowledge tests. All the results displayed their improvement in the Post-test. Figures 4.1 and 4.2 distinctly illustrate the enhancement in scores of Chinese mathematics and Chinese language knowledge based on the mean scores from each section of tests.

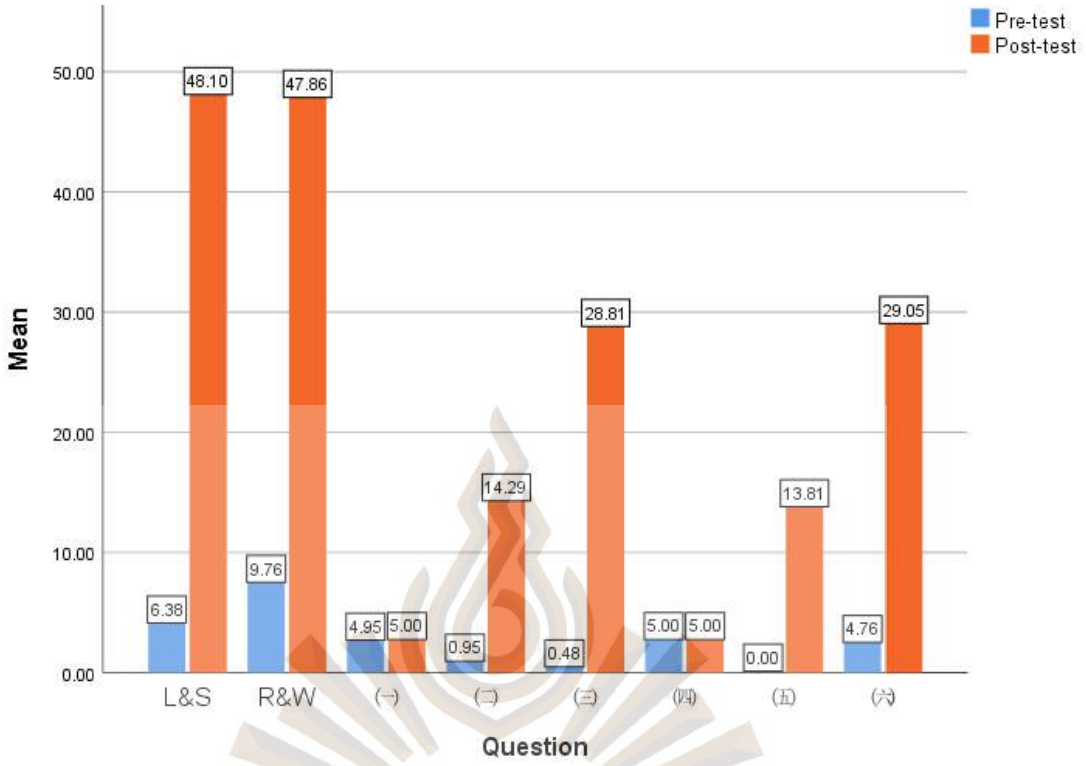

Figure 4.1 The Mean Scores of Each Question in the Chinese Math Test

Figure 4.1 above shows the mean scores of each question in the Chinese math test before and after the study. The Chinese Mathematics test includes two parts, six questions. The first part is listening and speaking, including question one (一) to question three (三). The second part is reading and writing, including question four (四) to question six (六). The initial set of category data, denoted as L&S in Figure 4.1, represents the average scores of students on questions 1(一) to 3(三) of the listening and speaking part in both the pre-test and post-test. The second category R&W is the mean score of the students on questions 4(四) to 6(六) of the reading and writing section in the pre-test and post-test. According to the comparison of students' mean scores in the first two categories, it is evident that there was a big progress in learner's listening, speaking, reading, and writing capabilities in Chinese math after studying the course, especially the listening and speaking skills.

The following six categories of means labeled from （一） to （六） correspondingly represent the six questions in the Chinese math test paper. Based on the

comparison of the average scores of the pre-test and post-test of the six questions in the Chinese Mathematics Test, the most substantial improvement occurred in the third question (三), with the score increasing from 0.48 in the Pre-test to 28.81 in the Post-test. There was a marginal improvement of 0.05 scores in the first question (一), rising from 4.95 to 5.00 in both the pre-test and post-test. The second question (二) demonstrated improvement from the score of 0.95 to 14.29 and fifth question(五) improved 13.81 scores. Improvements in sixth question(六) was 24.29 scores. It's noteworthy that the mean values for the fourth question(四) remained unchanged between the pre-test and post-test. This is attributed to the fact that the maximum score for this question is 5 marks, so there is no room for improvement.

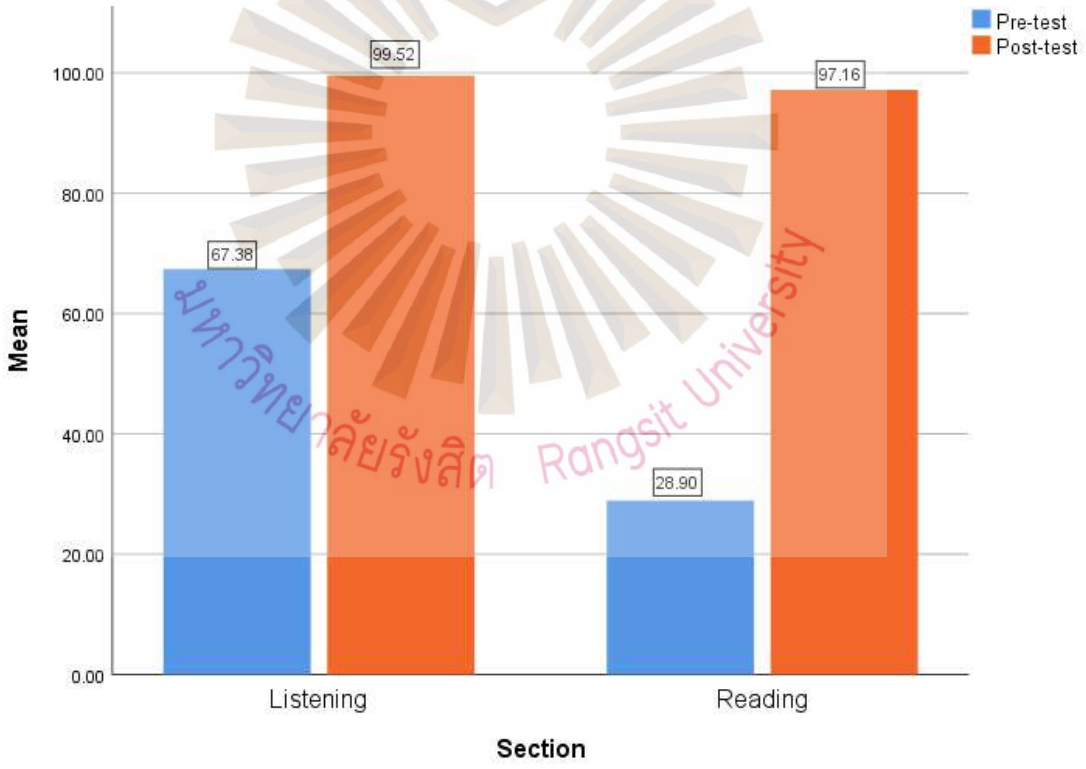

Figure 4.2 The Mean Scores of Each Section in the Chinese Language Knowledge Test

Figure 4.2 above displays the mean scores of each section in the Chinese language knowledge test before and after the treatment. The Chinese language

knowledge test involve into two parts, listening and reading. In the listening section, students improved by 32.14 scores, progressing from the mean score of 67.38 in the pre-test to 99.52 in the post-test. Improvements in reading section was 68.26 scores from the mean score of 28.90 in the pre-test to 97.16 in the post-test. In short, Figure 4.2 clearly indicates that the students' listening and reading scores at the Chinese language knowledge level have been greatly enhanced after studying.

4.2 The Data Analysis of Teacher's Journal

The main purpose for this teacher's log was to record what happened in the Chinese math classes when using CMI in order to discover what are the factors affecting learner's Chinese language learning.

The researcher is the instructor of this course. Therefore, the teacher's journal of this study was written by the researcher. Since this study included ten classes, thus, the researcher wrote a total of ten journals based on the observations of each class. Table 4.5 below shows the details of the records of the teacher's journal.

Table 4.5 The Analysis of Teacher's Journal

Lesson	Record Details	Analysis	Category
1	1）Students were very excited Children were very noisy and had difficulty concentrating	Students were excited and keep talking with their classmates.	Noisy classroom atmosphere
	2）The students calmed down after the teacher used	Teaching with using an slogans	Useful classroom management strategy

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
1	classroom slogans to regulate discipline		
	3）Students who do not understand the introduction or know what the exam questions were be take the initiative to raise their hands and ask questions	Rasing their hands when they need	Students' behavior
	4）After seeing the test papers, they would discuss in Thai with the classmates next to them	Talking with their friends when they see something new	Students' behavior
	5）Students are not yet able to ask and answer questions in accurate Chinese	Poor listening and speaking skills in Chinese	Weak Chinese ability
	6）Their test papers are basically blank	Poor reading and writing skills in Chinese	Weak Chinese ability

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
2	1）When the teacher shouts the class slogan: Stand up for class, the students quickly return to their seats, sit quietly, and wait for the teacher to start class	Students were noisy before teacher uses classroom slogan.	Useful classroom management strategy
	2）Everyone raised their hands and answered the questions	The students were very active in class	Active Classroom atmosphere
	3）Students keep their eyes on the teacher and the pictures, and can carefully observe the pictures to discover the number of items inside	Students were interested in teaching aids	Interesting teaching aids
	4）Students can use correct quantitative relationships to answer the teacher's questions	The teacher asks questions and students answer	Teacher- student's interaction

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
2	5）Almost all students were able to reading the questions and use the correct Chinese numbers to write the classroom assignment	Students' level of Chinese knowledge	Students' learning outcomes
3	1) Most of students do sit quietly and pay close attention to the class	Sit quietly and focus on class	Students' behavior
	2) A significant number of students were raising their hands to answer questions	Positive trend in terms of student participation	Teacher- student's interaction
	3) The majority of the class responded positively to the aids, such as story asking	Students responded positively to the teaching aids	Interesting teaching aids
	4) Students can always use correct Chinese to answer questions	The teacher asks questions and students answer	Teacher- student's interaction

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
3	5) Students with weak receptive abilities need one or two attempts or teacher reminders to express themselves correctly	Students with weak receptive abilities learning process	Teacher's support
	6）Most of students can understand the questions themselves and choose the correct Chinese characters	Students' level of Chinese knowledge	Students' learning outcomes
4	1) While a majority of students were sitting quietly, and paying attention to the lesson	Students sit quietly and focus on lesson	Students' behavior
	2) During the practice activities, students actively raised their hands and took their own things to express on the stage	The teacher gave student opportunity to practice	Teacher- student's interaction
	3) Students are very interested in mathematics-themed cartoons and stories	Students are interested in teaching aids	Interesting teaching aids

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
4	4) The students can use complete sentences to express quantitative relationships themselves after practicing the second and third times	Teachers constantly guide learner's learning	Teacher's support
	5) Most students can write more 多 and less 少 according to the meaning of the question. Only a few students can write the same 同样多	Students' level of Chinese knowledge	Students' learning outcomes
5	1）The teacher reminded the students through class instructions to sit up straight and watch the teacher	Teacher uses class instruction to remind them	Useful classroom management strategy
	2）The students were very brave and active	Students are active	Active classroom atmosphere

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
5	3）The students were very interested in today's teaching pictures and games, they stay very positive in class	Students are interested in teaching aids	Interesting teaching aids
	4）Most students can understand the teacher's questions and use the correct words to answer the questions	The teacher asks questions and students answer	Teacher- student's interaction
	5）The teacher provides one-on-one tutoring and focus on asking these students during review in the next class	Giving personal tutoring	Teacher's support
	6）Most of students can read the questions themselves and choose the correct Chinese characters to fill in the blanks according to the meaning of the questions	Students' level of Chinese knowledge	Students' learning outcomes

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
6	1) Teachers used group discipline competition mechanisms to motivate students to comply with activity rules and maintain attention	Teacher uses group discipline competition mechanisms to motivate them	Useful classroom management strategy
	2) Number of students were active to raised their hands increased significantly	Students are active	Active classroom atmosphere
	3) Students pay very close attention to the teaching aids	Students are interested in teaching aids	Interesting teaching aids
	4) Most students can answer questions asked by teacher correctly using sentences in Chinese	The teacher asks questions and students answer	Teacher- student's interaction

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
6	5) Students can understand the meaning of the question themselves and choose the correct Chinese characters to fill in the blanks	Students' level of Chinese knowledge	Students' learning outcomes
	6) Teachers provide one-on-one tutoring for students who cannot write	Giving personal tutoring	Teacher's support
7	1) Students were not always be sitting quietly but could be actively engaged in discussions	Students are not quietly but actively engaged	Students' behavior
	2) Teacher reminds the students through different sounds and slogans to keep quiet and attention	Teachers use strategies to maintain classroom discipline	Useful classroom management strategy
	3) Most of learners were raising their hands with smile to ask and answer the questions	The teacher asks questions and students answer	Teacher- student's interaction

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
7	4) PowerPoint and various school supplies made the lesson more interactive and engaging for students	Students are interested in teaching aids	Interesting teaching aids
	5) After the teacher's reminder, the students immediately realized that they should use the knowledge they learned in this lesson to answer and write	Giving students' reminders when they are doing their own tasks	Teacher's support
8	1) Students set well and kelp watching and listening to teacher	Students focus on class	Students' behavior
	2) Students raised their hands to participate activities actively	Students are positive to engage the class	Teacher- student's interaction
	3) The teaching aids aroused students' interest	Students are interested in teaching aids	Interesting teaching aids

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
8	4) Students are prompted to use the correct Chinese expressions (such as left, right), and students are prompted to perform actions related to left and right	Students' level of Chinese knowledge	Students' learning outcomes
	5) All of them can use proper Chinese to respond the questions and tsks in reading and writing	Students' level of Chinese knowledge	Students' learning outcomes
9	1) Teacher needs to use class instructions drag their concentration back to lesson	Teacher uses group discipline	Useful classroom management strategy
	2) Every student raised their hands to engage the learning	Students are positive to engage the class	Teacher- student's interaction
	3) Students sang loudly along with the music and kelp following the teaching	Students are interested in teaching aids	Interesting teaching aids

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
9	4) Students generally demonstrated knowledge in using proper Chinese expressions when responding to oral questions	Students' level of Chinese knowledge	Students' learning outcomes
	5) Students can write answers using the content learned in this lesson in today's assignments	Students' level of Chinese knowledge	Students' learning outcomes
10	1）Students are very excited, so the concentration and classroom discipline were good	Students sit quietly and focus on class	Students' behavior
	2）During the exam, the students were very quiet	Students are quietly	Quiet Classroom atmosphere

Table 4.5 The Analysis of Teacher's Journal (Cont.)

Lesson	Record Details	Analysis	Category
10	3) Through listening and speaking tests of today, most students can communicate effectively with teachers, understand the teacher's questions and answer questions using complete and correct words and sentences	Students' level of Chinese knowledge	Students' learning outcomes
	4) Most students can read and write correct Chinese to answer questions quietly by themselves	Students' level of Chinese knowledge	Students' learning outcomes

Based on the recorded information it can be coded into different categories and what emerge in each lesson are summarized below:

Lesson 1: Noisy classroom atmosphere, Useful classroom management strategy, Students' behavior, Students' behavior, Weak Chinese ability, Weak Chinese ability

Lesson 2: Useful classroom management strategy, Active Classroom atmosphere, Interesting teaching aids, Teacher- student's interaction, Students' learning outcomes

Lesson 3: Students' behavior, Teacher- student's interaction, Interesting

teaching aids, Teacher- student's interaction, Teacher's support, Students' learning outcomes

Lesson 4: Students' behavior, Teacher- student's interaction, Interesting teaching aids, Teacher's support, Students' learning outcomes

Lesson 5: Useful classroom management strategy, Active classroom atmosphere, Interesting teaching aids, Teacher- student's interaction, Teacher's support, Students' learning outcomes

Lesson 6: Useful classroom management strategy, Active classroom atmosphere, Interesting teaching aids, Teacher- student's interaction, Students' learning outcomes, Teacher's support

Lesson 7: Students' behavior, Useful classroom management strategy, Teacher- student's interaction, Interesting teaching aids, Teacher's support

Lesson 8: Students' behavior, Teacher- student's interaction, Interesting teaching aids, Students' learning outcomes, Students' learning outcomes

Lesson 9: Useful classroom management strategy, Teacher- student's interaction, Interesting teaching aids, Students' learning outcomes, Students' learning outcomes

Lesson 10: Students' behavior, Quiet Classroom atmosphere, Students' learning outcomes, Students' learning outcomes

In ten teacher journals, here are a total of eight categories, and the frequency of

the eight important categories in 10 lessons is indicated in the table below.

Table 4.6 Frequencies of the Five Key Categories in Each Lesson

Category	Frequency
Students' behavior	7
Useful classroom management strategy	6
Teacher- student's interaction	8
Interesting teaching aids	8
Teacher's support	5
Classroom atmosphere	5
Students' learning outcomes	11
Weak Chinese ability	2

In ten teacher journals, here are a total of eight categories, and the frequency of the eight important categories in 10 lessons is indicated in the table below.

The following keywords are indicated by the journal's real expressions.

1) Student's behavior

Student's behavior in this part refers to the actions, conduct, and demeanor exhibited by a student in classroom. For example, in the journal, students sat nicely and after seeing the test papers, they would discuss in Thai with the classmates next to them. Students' behavior was sometimes good and sometimes bad during the learning process. Students' behavior always needs the teacher's intervention to maintain it well.

2) Useful classroom management strategy

Teacher used classroom instructions, clear slogans, and competition mechanisms to help students sit quietly and focus on class. The reason of why it is useful is because students' behavior has changed after using it.

3) Teacher- student's interaction

In this study, teacher- student's interaction occurred when students engaged class such as answering and ask teacher's question.

4) Interesting teaching aids

The teacher opted to use the music, picture, cartoon, story, game well in both preparing students for the classes and delivering the lessons. In one word, students were very interested in the teaching tools prepared by the teacher.

5) Teacher's support

According to the recorded course details, the teacher was in charge of ensuring that every student learned as much as possible and assisting them in finishing their tasks, providing one-one tutoring.

6) Classroom atmosphere

In this theme, it can be clearly seen that the students' learning attitude and learning environment. The classroom environment was a bit noisy at the beginning of the course, but after the teacher's intervention, the classroom environment became quiet and positive.

7) Students' learning outcomes

From the records of each lesson, it is not difficult to see that students were able to express themselves in Chinese and write answers using the content learned after learning.

8) Weak Chinese ability

This category appears only twice, both before students formally enter the learning content. At that time students were not yet able to ask and answer questions and responded exams in accurate Chinese.

In summary, the themes that emerged included eight categories: 1) Students' behavior 2) Useful classroom management strategy 3) Teacher- student's interaction 4) Interesting teaching aids 5) Teacher's support 6) Classroom atmosphere 7）Students' learning outcomes and 8）Weak Chinese ability . The real words of these eight aspects from teacher journal revealed that there are the factors affecting learner's Chinese language learning.

4.3 Summary

This study's findings led to the following conclusions.

When the results from the Pre-tests and Post-tests of Chinese math and Chinese knowledge exams were compared, the students in the study had both higher overall scores in the Post-tests. Furthermore, the rubric scores of subskills of Chinese math and Chinese language knowledge were also higher in the Post-test than in the Pre-test.

By analyzing what happened in class recorded in teachers' journals, the factors that can affect students' Chinese language learning can be classified into eight aspects: students' behavior, classroom management strategy, teacher- student's interaction, teaching aids, teacher's support, classroom atmosphere, students' learning outcomes and Chinese ability.

Chapter 5

Conclusion, Discussion and Recommendation

This chapter consists of three sections. The first is the study's conclusion based on the data analysis findings, the second is a discussion of the findings of this research based on previous scholars' research to show the similarities and differences in relation to the theories, and the third is recommendations for using the study's findings and directions for future research.

5.1 Conclusion

Three main research questions of this study are as follows:

1) What are the effects of CMI on the Chinese math score of 21 Thai first graders by comparing the pre- and post- Chinese math tests at a private school in Chachoengsao?

2) What are the effects of CMI on the level of Chinese knowledge of 21 Thai first graders by comparing the pre- and post- Chinese knowledge tests at a private school in Chachoengsao?

3) What are the factors can affect students' Chinese language learning in math class when using CMI?

Three instruments of this study provide responses to these three research questions: 1) the Pre/Post-test of Chinese math score results, 2) the Pre/Post-test of Chinese language knowledge score results and 3) records from the teacher's journal.

This section will summarize the findings of the study based on each research question as follows:

5.1.1 Research Question 1

What is the effect of CMI on the Chinese math score of 21 Thai first graders by comparing the pre- and post- Chinese math tests at a private school in Chachoengsao?

In the pre-Chinese math test, the mean score of the 21 Thai first graders who study mathematics through using Chinese Mandarin as a medium of instruction was 16.14. After learning the course, the mean score changed to 95.95, meaning in the final test the mean of the Post-test was 79.81 points more than that of the Pre-test. It indicated that students obtained higher scores after the study. It also validated that first hypothesis, students' Chinese mathematic scores are higher in the post-test than in the pre-test, is established. And the S.D (7.28) in the Pre-test was bigger than the S.D. (7.19) in the Post-test. This showed in the Post-test that the students' scores were clustered closer to the mean than those in the Pre-test. In other words, group performance was better in the Post-test. Based on these findings, it's reasonable to conclude that using Chinese Mandarin as a medium of instruction in mathematics class can improve students' math scores.

Comparing the scores of the Pre-test with those of the Post-test showed Chinese math enhancement. However, subskills should also be studied to understand or to identify in which sub- skills students could really improve. So, students were assessed in two parts, listening speaking and reading writing, and each part included three questions. It was found that among the six questions on the post-Chinese mathematics test, students' average scores per question increased. It can be seen that after studying this course, learners' Chinese listening, speaking, reading and writing abilities have made great progress in math.

In summary, this teaching techniques, employing Chinese Mandarin as a medium of instruction positively affected the students' math score.

5.1.2 Research Question 2

What are the effects of CMI on the level of Chinese knowledge of 21 Thai first graders by comparing the pre- and post- Chinese knowledge tests at a private school in Chachoengsao?

To answer this question, a standardized knowledge test, YCT (Youth Chinese Test) level 1, that is expected of the students' Chinese level was used.

The mean score of the 21 Thai first-graders who learn mathematics using Chinese Mandarin as their medium of instruction was 96.28 on the pre-Chinese language competency exam. The mean score increased to 196.68 after completing the course. Indicating that at the end of the exam, the mean of the Post-test was 100.40 points higher than the mean of the Pre-test. It showed that following the research, learners' Chinese ability had increased. Additionally, it validated that second hypothesis, students' Chinese language knowledge scores are higher in the post-test than in the pre-test, is established. And the S.D (22.56) in the Pre-test was bigger than the S.D. (5.38) in the Post-test. The results of the students were found to be more closely grouped around the mean in the Post-test than they were in the Pre-test. Stated otherwise, the group's performance on the post-test was superior. Thus, it can be concluded that using Chinese Mandarin as a medium of instruction in mathematics class can enhance students' level of Chinese language knowledge.

Chinese language competence improved when the Pre-test and Post-test results were compared. To comprehend or determine which subskills students might actually progress in, subskills should also be researched. The 35 questions in the listening and reading parts make up the two sections of the Chinese language knowledge test.

Students increased their listening scores by 32.14 points, going from a pre-test mean score of 67.38 to a post-test mean score of 99.52. The mean score in the reading part improved by 68.26 points from the pre-test's 28.90 to the post-test's 97.16. It showed that after learning, the students' reading and listening skills at the Chinese language competency level had significantly improved.

Therefore, students' levels of Chinese language knowledge can be increased by using Chinese Mandarin as a teaching tool in math class.

5.1.3 Research Question 3

What are the factors can affect students' Chinese language learning in math class when using CMI?

The researcher acted as a classroom teacher and recorded what happened in the classroom based on her observations. Researcher wrote every journal after each lesson. Thus, there was ten teachers journal data at the end of study.

The themes that emerged included eight categories:

1) Student's behavior

Students sat nicely and after seeing the test papers, they would discuss in Thai with the classmates next to them. Students' behavior was sometimes good and sometimes bad during the learning process. Students' behavior always needs the teacher's intervention to maintain it well. Students' behavior plays a crucial role in shaping the learning experience. Positive behavior supports motivation, engagement, and a positive classroom atmosphere, all of which contribute to effective language acquisition.

2) Useful classroom management strategy

For participants as younger students, staying focused can be a challenge, and teachers used a variety of clear slogans, and competition mechanisms to help students improve their concentration and engagement in class. Ensuring that everyone can keep up with the course content.

3) Teacher- student's interaction

Pupils were very brave and positive during lessons. Students raised their hands to ask and answer questions regardless of whether they know. Positive teacher-student interactions are foundational to a successful learning experience. It contributes to a supportive and motivating atmosphere, foster effective communication, and create a classroom environment where students feel encouraged to explore and develop their language skills.

4) Interesting teaching aids

Students were very interested in the teaching aids prepared by teachers. Students' classroom participation has also been greatly improved through various teaching aids such as songs, stories, pictures, games, etc. Fun teaching aids made the learning process more vivid and interesting for students, thereby enhancing students' memory and understanding of the course content.

5) Teacher's support

Ensuring that everyone can keep up with the course content, the teacher provided additional support and one-on-one teaching to students who were slow to adopt and cannot do the assignments. When students are supported by their teacher, they are more likely to take risks in using the language, knowing that mistakes are viewed as opportunities for learning.

6) Classroom atmosphere

In this theme, it can be clearly seen that the students' learning attitude and learning environment. The classroom environment was a bit noisy at the beginning of the course, but after the teacher's intervention, the classroom environment became quiet and positive. This positive classroom atmosphere is very beneficial to the exchange of knowledge and learning results. It may also mean that teachers are doing a good job of creating an atmosphere that encourages participation and open communication.

7) Students' learning outcomes

From the records of each lesson, it is not difficult to see that students were able to express themselves in Chinese and write answers using the content learned after learning. Once they acquire the learning content, their Chinese language knowledge would increase as well.

8) Weak Chinese ability

At the beginning of the study, students had a weak Chinese ability, they were not yet able to ask and answer questions and responded exams in Chinese. This could may affect their pace of learning.

In conclusion, within a Chinese math class utilizing Mandarin as its instructional language, the enhancement of students' Chinese language learning outcomes is notably influenced by key factors. These include students' behavior, classroom management strategy, teacher- student's interaction, teaching aids, teacher's support, classroom atmosphere, students' learning outcomes and Chinese ability. These elements collectively contribute to the improvement of Chinese language learning.

5.2 Discussion

This section discusses results of using CMI in Chinese math class and achieving positive learning outcomes when using target language as a medium of instruction in class.

5.2.1 Results of using CMI in Chinese math class

In this research, when the results of the Chinese math and Chinese knowledge exams' Pre-tests and Post-tests were compared, first graders had better overall scores in the Post-tests, and children made considerable progress in the final examinations. Additionally, the assessment scores of Chinese math and Chinese language knowledge subskills were higher in the Post-test than in the Pre-test, demonstrating that teaching math using CMI (Chinese as a medium of instruction) is incredibly enhanced students' level of Chinese language knowledge and Chinese math understanding. Therefore, the results of this study once again proved that using target language as a medium of instruction not only improves students' academic performance but also improves their language skills (e.g. Snow et al., 1989; Leaver & Stryker, 1989; Grabe & Stoller,1997; Cammarata & Tedick, 2012). In addition, math is a subject that requires students to think critically and solve problems using logical reasoning (Aizikovitsh & Amit, 2010). As this study demonstrated, learners could count to compare amounts and describe the locations of items in different way after learning. This established a strong basis in logical thinking, setting the stage for their later, more intricate Chinese mathematics studies (Ramirez et al., 2013).

5.2.2 Achieving Positive Learning Outcomes When Using Target Language as a Medium of Instruction in Class

The teacher used Chinese Mandarin as a medium of teaching to instruct the students in the Chinses math class, and the students followed what the teacher guide them. Hiring a native speaker of the target language for learners is an effective way to

create an immersive language environment, provide clear explanations, and serve as a linguistic model for students (Brevil, 2020; Zhao, 2013). This study demonstrates this point. The Chinese math teacher of participants is Chinese native speaker. She had the Mandarin certificate and had studied major of elementary education. These qualities of teachers in line with CMI (Zhao, 2013): knowledge in Chinese language skills, a standard accent, a good vocabulary and grammar, understanding of educational theories. Increasing classroom interaction (Jiang et al., 2019), and opportunities for students to communicate, ask questions, and engage in discussions are the other useful methods to promote the language learning when using target language as a teaching tool in classroom (Swain, 1997). Positive classroom interactions are foundational to a successful learning experience. It contributes to a supportive and motivating learning environment (Stroupe & Kimura, 2013, p. 73), foster effective communication, and create a classroom environment where students feel encouraged to explore and develop their language skills (Goldoni, 2013; Lou & Noels, 2019). For example, students can get timely and constructive feedback when interact with teacher actively, along with error correction contribute significantly to language proficiency. Visual aids can help students comprehend and enhance target language learning (Sykes et al., 2013; Pateşan et al., 2018). The school in this study provided rich teaching aids and equipment for Chinese teaching, for example there are computers, speakers, multi-function projectors, electronic pens and Chinese environmental creation areas in the classroom. These teaching aids are all can create an enjoyable and understandable immersive learning environment for students. Lastly, teaching class utilized appropriate teaching materials for using CMI, it is a Chinese mathematical textbook edited by People's Education Press (PEP) in China. This textbook meets the timeliness and applicability of CMI technology (Zhao, 2013).

5.3 Implications of the Findings of the Study

The findings of the study had led us to believe that using Chinese as a medium of instruction in math classes enable students to improve their Chinese Language knowledge. Thus, the results of this study may recommend that Chinese teachers use CMI in subject-content classes.

5.4 Recommendations

This section describes how the study's findings may be applied and makes suggestions for further research.

5.4.1 The Findings Will Be Helpful in Contexts Similar to This Study

This study explored participants' Chinese language learning in math class and it is a case study of using Chinese as a medium of instruction. Thus, the findings will not be generalized to explain other contexts.

Based on results and findings of this research, the following suggestions are put forward for the teaching of Chinese mathematics to young foreign students.

5.4.1.1 Adopting CMI in Class

In the process of teaching Chinese mathematics in lower grades, teachers must effectively use Chinese as the teaching language to create an enjoyable immersive classroom for students. So that students can quickly and naturally acquire and use the target language, thereby improving students' Chinese knowledge and academic performance.

5.4.1.2 Creating A Relaxed and Enjoyable Learning Atmosphere

Teachers should use a variety of teaching materials and learning activities to try best to create a relaxed and interesting learning environment for students. This will make the class fun and lively while reducing students' fear of using Chinese in class.

5.4.2 Other Levels of Chinese Math Lessons Should Be Studied in The Future

Students at various stages of development often display distinct levels of learning, critical thinking, and communication skills. Younger learners might tackle fundamental mathematical problems in the target language, whereas older, more advanced students face intricate mathematical and linguistic challenges, which are genuine language and subject integration exercises.

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APPENDICES

APPENDIX A
LESSON PLANS

Lesson: 1
Course: Introduction the course to students
Duration: 60 minutes
Teaching materials: Test paper of Pre-test and YCT Level 1
Learning Objectives: 1. Students need to know what they will learn in this study, how long this study lasts and how they need to present in the final class. 2. Doing Pre-test to know students' math ability in Chinese before study 3. Doing YCT Level 1 Test to know students' level of Chinese language knowledge before study
Teaching and Learning Steps: **1. Introduction, 5 minutes** --Teacher introduces herself --Telling to students they will learn Chinese Math --Introduce the study to students, the study will last 10 lessons and they need to take Post-test and YCT Level 1 Test again after study --Helping Students know the instruction of two tests **2. Pre-test (Reading-Writing), 20 minutes** --Give students examination papers, students start answering questions --Listening and Speaking part will conduct one-on-one during the lesson break on the pre-test day **3.YCT Level 1 Test, 35 minutes** --Give students examination papers, the teacher starts to play the listening audio --Students start answering reading questions themselves after finishing the listening

Lesson: 2

Course: Number 1-10

Duration: 60 minutes

Teaching materials: PowerPoint, music

Learning Objectives:

1. Through counting activities, we will get a preliminary understanding of students' counting situation and make them learn how to count initially.
2. Help students understand school life, stimulate students' interest in learning mathematics, and infiltrate ideological and moral education.

Teaching and Learning Steps:

1. Warm up 5 minutes

Sing and dance: Chinese Number Song

2. Teaching 30 minutes

Counting with the picture "beautiful school".

Guide students to observe the illustrations on pages 2 to 3 of the textbook. By looking at the picture and arousing students' interest in observation, the teacher can express it like this: This is a beautiful country elementary school, and today is the first day of school. What do you see here?

Let students observe by themselves first, and then name what is in the picture. On the basis of observation, the teacher will guide students to count the number of people and numbers from 1 to 10 one by one. You can count them in a certain order, counting the smaller ones first (such as flags, single shoulders, stone benches, etc.) and then the larger ones (such as garbage cans, buildings, flowers, etc.). After each type of object is counted, the teacher can follow the example of pages 3-4 of the textbook and add the collection circle to such objects and write the corresponding number. The same number of objects can be grouped together. For example, if a student says "1 flag, 1 teacher", the teacher can show a picture of 1 flag and 1 teacher on a slide or multimedia, and tell the students that 1 flag and 1 teacher can be represented by the number "l", which is shown on the left side of the picture during the week. "1". After all 10 numbers are shown, have students read them to find out how many students know the 10 numbers.

3. Practice 20 minutes

1) Practice numbers 1-10 through counting matching of real items and tracing number

2) Doing the classroom exercise related to this lesson

4. Conclusion and homework 5 minutes

Teacher stresses the key points and concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 3

Course: Comparing in words “多”、“少”、“同样多”

Duration: 60 minutes

Teaching materials: Pencil, eraser, pictures of pears, apples and flowers, slides

Learning Objectives:

1. Students are able to know the meaning of "as much", "more" and "less" through manipulation, and will compare the number of objects in a corresponding way.
2. Develop students' spirit of mutual cooperation and awareness of using mathematics.

Teaching and Learning Steps:

1. Warm up 5 minutes

Chinese song: “Compare How Many”

2. Teaching 35 minutes

Listen to the story 《Three Little Pigs》 and answer the questions.

After the story is finished, the teacher will ask a few questions

1) How many bunnies are there on the diagram? How many bricks does each bunny carry? While students are answering, the teacher will paste pictures of the rabbits' heads and bricks.

2) If one rabbit carries one brick, are there any extra bricks? Are there any extra bunnies?

After the students answer, the teacher explains that there is no extra bunny and no extra brick when a bunny is against a brick. Let's say: There are as many bunnies as bricks.

3) How many little pigs are there on the diagram? How many pieces of wood are there in total?

While students are answering, the teacher will paste the pictures of the piggy heads and the wood.

4) One little piggy head is compared to one piece of wood, is there any extra piggy head at the end? Are there any extra logs? Are there more piglets or more logs? Who has more and who has less?

Ask the group leader to answer after the students share. Teacher's notes: more, less.

Teacher's note: There is more wood and less piglets, we can also say that there is more wood than piglets and less piglets than wood.

3. Practice 15 minutes

The whole class will work on the relationship between more, less and the same amount.

4. Conclusion and homework 5 minutes

Teacher comments “more, less and as much” and concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 4

Course: Comparing in sentences“…比…多”、“...比…少”、“...比…同样多”

Duration: 60 minutes

Teaching materials: Pencil, eraser, pictures of pears, apples and flowers

Learning Objectives:

1. Students can understand the meaning of "more, less and as much" by comparing items; and they can express it in sentences.

2. Students are able to dictate 比，多，少，同样多

3. Enable students to stimulate their interest in learning mathematics through manipulation and observation.

Teaching and Learning Steps:

1. Warm up 5 minutes

Chinese cartoon: “How much do you know?”

2. Teaching 30 minutes

Review and continue to introduce the story from the previous lesson, *the three little pigs*.

Teacher extension note: When there is more wood and fewer piglets, we can say that there is more wood than piglets and fewer piglets than wood.

Students imitate to say who has more and who has less, who has more and who has less than who.

3. Practice 20 minutes

1) After the teacher arranges the six erasers, ask students to arrange the pencils against the erasers, asking them to arrange as many pencils as erasers, and use sentences to say their quantity relationship.

2) The teacher lays out the number of items in relation to each other and the students use sentences to describe them. Then students lay out the corresponding quantity relationships based on the teacher's descriptions.

3) Doing the classroom exercise related to this lesson

4. Conclusion and homework 5 minutes

Teacher concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 5

Course: Position “上”、“下”、“前”、“后”

Duration: 60 minutes

Teaching materials: PowerPoint and “Xiaoming” name card

Learning Objectives:

1. Understand the basic meaning of up and down and front and back, feel the relativity of up and down, front and back, and be able to use up and down and front and back to describe the position of the object.
2. In the learning activities, with the help of students' original knowledge base and life experience, abstract the four orientation words, so that students can use "up, down" "front, back" to describe the relative position of objects.
3. To make students feel the close connection between mathematics and real life, and appreciate the value of orientation in life

Teaching and Learning Steps:

1. Warm up 5 minutes

Game: Fingers above, fingers below, fingers in front, fingers behind

2. Teaching 30 minutes

Observe and describe a picture of a bridge over a river by using the teacher's questions.

1) What do you see when you look at this picture?
2) Can you use words like "up and down" to tell us where these vehicles are located?
3) People say that the train is on top and the train is on the bottom at the same time, what is going on?
4) How can we make it clear?

And then, teacher shows the animated car picture, students observe, exchange and discuss the questions below:

1) What do you see again?
2) Can you use words like "front, back" to say where these cars are? The direction of the front of the car is "front".
3) How can you say it clearly?

Look at who is in front of whom and who is behind, and then say who is in front of whom and who is behind

3. Practice 20 minutes

1) Game: Who's in front of you? Who is behind you?

Please ask the students sitting in front of Xiaoming to stand up.

Ask the students sitting behind Xiaoming to raise their hands.

2) Doing the classroom exercise related to this lesson

4. Conclusion and homework 5 minutes

Teacher concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 6

Course: Using "...在…的上面/下面/前面/后面" to describe the position

Duration: 60 minutes

Teaching materials: Practice paper, various school supplies, slides

Learning Objectives:

1. Use sentences to describe the relative positions of objects above, below, in front and behind.
2. Develop students' observation skills and language skills.

Teaching and Learning Steps:

1. Warm up 5 minutes

Chinese song: "Direction Song"

2. Teaching 30 minutes

Teaching slides:

1) On Sunday, the children in class two (1) wanted to visit the exhibition hall. Look, they are lining up to get on the bus! How many children are going?

Who is in front of Li Lin? Who is behind Wang Ying?

Where is Zhang Ning in line with Li Lin? Where is Wang Ying in line with Zhang Ning?

From the library, how many stops do you think the children will have to make to the exhibition hall according to the stop sign? What is the next stop?

What is the fourth stop after the library? What is the previous stop in the park? (Show the textbook)

2) As you pass by the gymnasium, the puppies are having a fierce swimming competition: (text)

What do you see? And complete the related questions

If they continue to swim, how might their order before and after change?

3) Discuss in small groups.

4) Summary: We have to say whether a person or object is in front or behind depends on what time it is. The time is different, and the position before and after is different, which is the relative nature of position in time.

3. Practice 20 minutes

1) Use the sentences to say: What is on top of the desk? What is underneath the desk? Who is in front of you? Who is behind you? Say it to each other at the same table.

2) Doing the classroom exercise related to this lesson

4. Conclusion and homework 5 minutes

Teacher concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 7

Course: Using "...的上面/下面/前面/后面是…" to describe the position

Duration: 60 minutes

Teaching materials: PowerPoint, various school supplies

Learning Objectives:

1. Use different expressions to describe the relative positions of objects above, below, in front and behind.

2. Students are able to dictate 上，下，前，后

3. Develop students' multiple-thinking skills

Teaching and Learning Steps:

1. Warm up 5 minutes

Game: Listen to the command and do the action

2. Teaching 30 minutes

1) Find a few students and have them each say what they have on top, and then find a few more and have them give a few examples of what is on top and what is on the bottom compared to what. The teacher then guides the students to say the opposite, expressing the position relationship in a different way.

2) The teacher asks another 3 students to come up to the stage (facing north). Who is in front and who is behind. The student in the middle is in the front and the student in the back.

3) Who is at the front of the line? Who is at the end of the line? (Turn backwards)

4) Four students line up and change direction as required. What did you find? What is the difference from the original? Why is there this change?

(When facing north, No. 1 is at the front and No. 3 is at the end; when facing south, No. 1 is at the end and No. 3 is at the front.)

5) Question: Why is No. 1 in the front at one time and at the end at another?

Group discussion.

6) Summary: We have to say whether a person or object is in front or behind depends on who it is compared with, and the front and back positions are different when compared with different people or objects. The direction is different, and the position relationship referred to is also different.

3. Practice 20 minutes

1) Look at the bedroom picture and ask students to use different sentences to describe the position of objects in the bedroom.

2) Doing the classroom exercise related to this lesson

4. Conclusion and homework 5 minutes

Teacher concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 8

Course: Position “左”、“右”

Duration: 60 minutes

Teaching materials: PowerPoint, various school supplies

Learning Objectives:

1. Be able to determine the left and right position and order of objects, and be able to describe the position of objects in terms of left and right, and be able to express them in their own language.
2. Be able to initially use the knowledge learned to solve problems and initially develop the concept of space.

Teaching and Learning Steps:

1. Warm up 5 minutes

Quizzes: Raise your hand if you guessed correctly. Raise your hand and don't put it down. Can you tell us which hand you are raising? Then the other hand is the left hand, and today we will learn about left and right together. (Write on the Board: left and right)

2. Teaching 30 minutes

Contact yourself, experience left and right.

Teacher: For us, our hands can do a lot of work! Students think about what we usually do with our left and right hands in life?

(Usually, we often use our right hand to write, hold chopsticks when we eat, raise our hand with our right hand when the teacher asks a question ..... press the book with our left hand, and hold the bowl when we eat .....)

Teacher: Yes, the left hand and the right hand are a pair of good friends, they can do a lot of things together, is there such a pair of good friends in our body?

(Students answer: left eye, right eye, left ear, right ear, left foot, right foot, left leg, right leg .....)

Summary: The one on the same side as our right hand is our right side, and the one on the same side as our left hand is our left side.

3. Practice 20 minutes

1) Activity: You tell, I do

Hold out your left hand and hold out your right hand.

Pat your left shoulder with your left hand and pat your right shoulder with your right hand.

Feel your left ear with your left hand and your right ear with your right hand.

Pat your right hand with your left hand, pat your left hand with your right hand.

2) Doing the classroom exercise related to this lesson

4. Conclusion and homework 5 minutes

Teacher concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 9

Course: Using "...的左边/右边是…"、"…在…的左边/右边" to describe the position

Duration: 60 minutes

Teaching materials: Small chairs, foods, music

Learning Objectives:

1. Use different expressions to describe the relative positions of objects left and right in sentences.

2. Students are able to dictate 左，右

3. Develop students' multiple-thinking skills

Teaching and Learning Steps:

1. Warm up 5 minutes

Chinese song: "Left Right Up Down"

2. Teaching 30 minutes

Contact life, we know the left and right, you are so smart, please help the teacher to put the food in the right place, okay?

1) Please ask the students to gently go to the table to take a kind of food.

2) What are the students holding in their hands, report it.

4) Listen to the command and put them on the table.

In the middle of the table is a plate of apples. On the left of the apples is cake, on the right is Coke, on the top is banana, on the bottom is ice cream, on the left of banana is orange, on the left is strawberry, peach is on the left of the ice cream, on the right is pear.

After each food is placed, students repeat the sentences of the position described by the teacher.

3. Practice 20 minutes

1) Game: "changing seat" game.

The music starts, students listen to the music around the chair to do free movement, learners listen carefully, the music stops to find a chair. Music stops, students quickly go to find the small chair and sit down. Ask the learners to say: Who is on my left and who is on my right? (Or say: My left is whom and My right is whom?) Tell their fellows: Who is on my left? Who is on my right?

2) Doing the classroom exercise related to this lesson

4. Conclusion and homework 5 minutes

Teacher concludes the class.

Give students the related worksheet and ask them review and finish it at home.

Lesson: 10
Course: Post-test, YCT Level 1 test and summary the study
Duration: 65 minutes
Teaching materials: Post-test and YCT Level 1 test
Learning Objectives: 1. Teacher briefly summarizes the course 2. Students do Post-test in order to know students' math ability in Chinese after study 3. Students do YCT Level 1 Test again in order to know students' level of Chinese language knowledge after study 4. Getting to know student's feeling through doing Semantic Differential Scale by participants.
Teaching and Learning Steps: **1. Summarize, 5 minutes** --Teacher briefly summarizes the whole study -- Introduce the purposes of Post-test and YCT Level 1 Test --Helping Students know the instruction of two tests **2. Post-test (Reading-Writing), 20 minutes** --Give students examination papers, students start answering questions --Listening and Speaking part will conduct one-on-one during the lesson break on the post-test day. **3.YCT Level 1 Test, 35 minutes** --Give students examination papers, the teacher starts to play the listening audio --Students start answering reading questions themselves after finishing the listening **4. Doing Semantic Differential Scale, 5 minutes** After class, the semantic differential scale was distributed to each of the 21 participants. They were asked to tick " √ "at the number 1-7 that most corresponded their true feelings.

APPENDIX B
TWO PAIRS OF PRE-TEST AND POST-TEST
CHINESE MATH
AND
ACHINESE LANGUAGE KNOWLEDGE

Pre/Post-test of Chinese Math (Listening & Speaking)

姓名：_____ 班级：_____ 分数：_____

一. 请读出下面的数字。(5 marks)

3	2	7	1	9	4	6	8	5	10

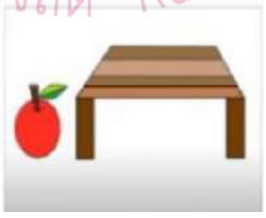
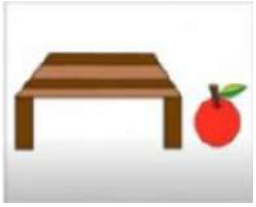
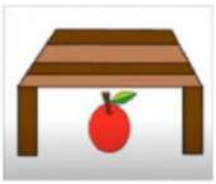
二. 请正确说出下面物品的数量关系。(15 marks)

1. 小明有 8 个苹果，小花有 2 个苹果，谁比谁的苹果多？

2. 兔子有 6 瓶牛奶，小猫有 3 瓶牛奶，谁比谁的苹果少？

3. 小狗吃了 10 块蛋糕，乌龟也吃了 10 块蛋糕，他们吃的蛋糕数量一样吗？

三. 请用正确的方式描述下面物品的位置。(30 marks)

		 In front of
	 Behind	

Pre/Post-test of Chinese Math (Reading & Writing)

姓名： _____ **班级：** _____ **分数：** _____

xiě chū xià miàn diū shī de shù zì

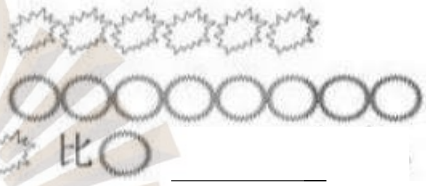
一. 写出下面丢失的数字。(5 marks)

1									10

qǐng xiě chū zhèng què de hàn zì miáo shù tā men de guān xì

二. 请写出正确的汉字描述他们的关系。(15 marks)

比 _____



比 _____

☆ 和 ♡ _____

gēn jù tú piàn nèi róng xiě chū zhèng què de wèi zhi guān xì

三. 根据图片内容写出正确的位置关系。(30 marks)

píng guǒ zài zhuō zi de
苹果在桌子的（ ）biān 边。

píng guǒ zài zhuō zi de
苹果在桌子的（ ）biān 边。

māo zài xiāng zi de
猫在箱子的（ ）miàn 面。

píng guǒ zài zhuō zi de
苹果在桌子的（ ）biān 边。

píng guǒ zài zhuō zi de
苹果在桌子的（ ）miàn 面。

māo zài xiāng zi de
猫在箱子的（ ）miàn 面。

Pre/Post-test of Chinese Language Knowledge

国家汉办/孔子学院总部
Hanban/Confucius Institute Headquarters

新中小学生汉语考试

YCT（一级）

Y11003

注　意

一、YCT（一级）分两部分：

1. 听力（20 题，约 10 分钟）
2. 阅读（15 题，17 分钟）

二、听力结束后，有 3 分钟填写答题卡。

三、全部考试约 35 分钟（含考生填写个人信息时间 5 分钟）。

中国　北京　　国家汉办/孔子学院总部　编制

一、听 力

第一部分

第 1-5 题

例如：		√
		×
1.		
2.		
3.		
4.		
5.		

第二部分

第 6-10 题

例如：	 A √	 B	 C
6.	 A	 B	 C
7.	 A	 B	 C
8.	 A	 B	 C

9.	 A	 B	 C
10.	 A	 B	 C

第三部分

第 11-15 题

例如：		√
		×
11.		
12.		
13.		
14.		
15.		

第四部分

第 16-20 题

例如：	 A	 B	 C √
16.	 A	 B	 C
17.	 A	 B	 C
18.	 A	 B	 C

19.	 A	 B	 C
20.	 A	 B	 C

二、阅 读

第一部分

第 21-25 题

例如：		gǒu 狗	×
		mǐfàn 米饭	√
21.		èr 二	
22.		tā 她	
23.		shǒu 手	
24.		niúnǎi 牛奶	
25.		tóufa 头发	

第二部分

第 26–30 题

A 

B 

C 

D 

E 

F 

例如：Wǒ de bízi cháng .
我 的 鼻子 长 。 E

26. Wǒ de yú zài zhèr .
我 的 鱼 在 这儿 。 ☐

27. Bàba , wǒmen xiànzài qù nǎr ?
爸爸 ， 我们 现在 去 哪儿 ？ ☐

28. Xiǎogǒu , nǐ bù rènshi wǒ ma ?
小狗 ， 你 不 认识 我 吗 ？ ☐

29. Tā de gèzi bù gāo .
他 的 个子 不 高 。 ☐

30. Nǐmen kàn , niǎo zài nàr .
你们 看 ， 鸟 在 那儿 。 ☐

第三部分

第 31–35 题

A	miàntiáor 面条儿	B	nǎ 哪	C	hé 和
D	sān 三	E	gēge 哥哥	F	yuè 月

例如1：A：Zhèr yǒu jǐ ge rén?
这儿 有 几 个 人 ？

B：Zhèr yǒu (D) ge rén.
这儿 有 （ D ）个 人 。

31．A：Jīntiān shì hào?
今天 是 5（ ）7 号 ？

B：Bú, jīntiān shì 8 hào.
不 ， 今天 是 8 号 。

32．A：Shéi zài jiā?
谁 在 家 ？

B：Wǒ ( ) māma zài jiā.
我 （ ） 妈妈 在 家 。

33．A：Zhè shì nǐ de ( ).
这 是 你 的（ ）。

B：Hǎo de, xièxie.
好 的 ， 谢谢 。

34．A：Nǐ ( ) jǐ suì?
你（ ）几 岁 ？

B：Tā 11 suì.
他 11 岁 。

35．A：Nǐ shì ( ) guó rén?
你 是（ ） 国 人 ？

B：Wǒ shì Zhōngguórén.
我 是 中国人 。

APPENDIX C
TEACHER'S JOURNAL

Teacher's Journal
Lesson 1: Introduction the course to students and doing Pre-tests of Chinese math and Chinese language knowledge **Date**: 23 October 2023 **Writer**: Ruirui Li
Today is the first day of learning and the students were very excited. When I first started attending class, the children were very noisy and had difficulty concentrating. The students calmed down after the teacher used classroom slogans to regulate discipline and students kept looking at the teacher. Teacher introduces the course and students take the exams, students who do not understand or know what the exam questions are will take the initiative to raise their hands and ask questions, and the teacher will answer them. Students were surprised to see many papers today. After seeing the papers, they would discuss them in Thai with the classmates next to them. Students are not yet able to ask and answer questions in accurate Chinese. In the listening and speaking tests, they could not understand and answer the questions asked by the teacher. It is not difficult to see from the invigilation that the learners do not know how to do it, and their test papers are basically blank. It shows that the students' current reading and writing skills in Chinese are very poor.

Teacher's Journal
Lesson 2: Number 1-10 **Date:** 26 October 2023 **Writer:** Ruirui Li
When the teacher shouts the class slogan: Stand up for class, the students quickly return to their seats, sit quietly, and wait for the teacher to start class. Most students can look up at the teacher for long periods of time. The students were very active in class today. Everyone raised their hands and answered the questions. The students are very interested in the pictures and music in the slides, keep their eyes on the teacher and the pictures, and can carefully observe the pictures to discover the number of items inside. This lesson mainly uses items with Chinese names that students already know to learn and practice counting. The content is relatively simple. Students can all use correct quantitative relationships to answer the teacher's questions. Today's class exercise was well done. Almost all students were able to reading the questions and use the correct Chinese numbers to write the answers.

Teacher's Journal
Lesson 3: Comparing in words "多"、"少"、"同样多" **Date:** 30 October 2023 **Writer:** Ruirui Li
Most of students do sit quietly and pay close attention to the class. The classroom dynamic showed a positive trend in terms of student participation. A significant number of students were raising their hands to answer questions. The majority of the class responded positively to the aids, such as story asking, demonstrating increased engagement and understanding. Students with strong receptive abilities can always use correct Chinese to answer questions, while students with weak receptive abilities need one or two attempts or teacher reminders to express themselves correctly. Through learning, students understand the meaning of more, less, and the same amount. Most of students can understand the questions themselves and choose the correct Chinese characters to fill in the blanks according to the meaning of the questions.

Teacher's Journal
Lesson 4: Comparing in sentences"…比…多"、"...比…少"、"...比…同样多" **Date:** 2 November 2023 **Writer:** Ruirui Li
While a majority of students were actively engaged, sitting quietly, and paying attention to the lesson. But a few seemed to disengaged, they need the teacher to remind them by name. During the practice activities, students actively raised their hands and took their own things to express on the stage. Students are very interested in mathematics-themed cartoons and stories, and can answer the teacher's questions after watching them. The students can use complete sentences to express quantitative relationships themselves after practicing the second and third times. Most students can write more 多 and less 少 according to the meaning of the question. Only a few students can write the same 同样多，this vocabulary needs more practice.

Teacher's Journal
Lesson 5: Position "上"、"下"、"前"、"后" **Date:** 6 November 2023 **Writer:** Ruirui Li

A small number of students were not very focused today. The teacher reminded the students through class instructions to sit up straight and watch the teacher. After being reminded, the students' attention improved significantly。

The students were very brave and active. Most of the students could raise their hands and express themselves bravely to answer the teacher's questions.

The students were very interested in today's teaching pictures and games, they stay very positive in class.

Most students can understand the teacher's questions and use the correct positional words to answer the questions. For students who do not understand the questions and use incorrect Chinese to answer, the teacher provides one-on-one tutoring and focus on asking these students during review in the next class.

Through learning, students understand the meaning of up and down and front and back. Most of students can read the questions themselves and choose the correct Chinese characters to fill in the blanks according to the meaning of the questions. For students who don't know how to do it, teachers will provide one-on-one tutoring in class.

Teacher's Journal
Lesson 6: Using "...在…的上面/下面/前面/后面" to describe the position **Date**: 9 November 2023 **Writer**: Ruirui Li
Students' discipline was a bit disordered when doing classroom exercises. Teachers used group discipline competition mechanisms to motivate students to comply with activity rules and maintain attention. When students gained a deeper understanding of mathematical concepts the number of students raised their hands increased significantly. Students are also interested in this teaching aids. The teaching aids used in this class are similar to those used in the previous class. Therefore, compared with the last class, students were not as excited about the teaching aids this time. Through many demonstration exercises and discussions, by the end of get out of class, students' expressions have been greatly improved. Most students can answer questions asked by teacher correctly using sentences in Chinese. After correctly understanding the positional relationship, students can understand the meaning of the question based on the pictures and Chinese characters themselves and choose the correct Chinese characters to fill in the blanks according to the meaning of the questions. Teachers provide one-on-one tutoring for students who cannot write.

Teacher's Journal
Lesson 7: Using "...的上面/下面/前面/后面是…" to describe the position **Date:** 13 November 2023 **Writer:** Ruirui Li
During these activities, students might not always be sitting quietly but could be actively engaged in discussions, moving around for various exercises, or participating. Teacher reminds the students through different sounds and slogans. The teaching actives of this lesson's encourage students to actively raise their hands and engage verbally during learning, so most learners were raising their hands to ask and answer the questions. PowerPoint and various school supplies made the lesson more interactive and engaging for students. Through the activities involving listening and speaking and describing positions, students were likely practicing and using these expressions in Chinese. The teacher made more corrections at first, but the more students practice, the fewer mistakes they make. Many students confused the content of this class with the content of the previous class and used the expressions in the previous class to answer questions. After the teacher's reminder, the students immediately realized that they should use the knowledge they learned in this lesson to answer and write.

Teacher's Journal
Lesson 8: Position "左"、"右" **Date:** 16 November 2023 **Writer:** Ruirui Li
Students set well and kelp watching and listening to teacher. Students raised their hands to participate activities actively, like raising specific hands or performing tasks with their left and right sides. The teaching aids aroused students' interest, and students actively participated in the activities. Most students can express themselves correctly in Chinese, but for students who cannot express themselves independently，students are prompted to use the correct Chinese expressions (such as left, right), and students are prompted to perform actions related to left and right. Students did a very good job in writing. All of them can use proper Chinese to respond the questions and tsks in reading and writing.

Teacher's Journal
Lesson 9: Using "...的左边/右边是…"、"…在…的左边/右边" to describe the position **Date:** 20 November 2023 **Writer:** Ruirui Li
Students set well themselves for a while and then teacher need to use class instruction drag their concentration back to lesson. Students were very positive in this lesson, every student raised their hands to engage the learning, even some of them not very good. Students sang loudly along with the music and kelp following the teaching. Students generally demonstrated knowledge in using proper Chinese expressions when responding to oral questions. Students have good reading comprehension in today's assignments, they can write answers using the content learned in this lesson.

Teacher's Journal
Lesson 10: Post-test, YCT Level 1 test and summary the study **Date:** 23 November 2023 **Writer:** Ruirui Li

Today is the last class and the students are very excited, so the concentration and classroom discipline were good.

Most of the time in this class was spent on exams. During the exam, the students were very quiet. There were very few people who raised their hands to ask questions. When filling out the Semantic Differential Scale, the students were very serious and kept asking the teacher questions.

The students were very excited about the test papers and felt novel about the Semantic Differential Scale, they kept asking the teacher what it was.

Through listening and speaking tests of today, it is concluded that most students can communicate effectively with teachers, understand the teacher's questions and answer questions using complete and correct words and sentences.

Through reading and writing tests of today，Most students can read and answer questions quietly by themselves, and can also choose and write correct Chinese writing to answer questions.

APPENDIX D

EVIDENCE OF ITEM OBJECTIVE CONGRUENCE

LESSON PLAN

PRE-TEST AND POST-TEST OF CHINESE MATH

Item Objective Congruence (IOC) for Lesson Plans

NO.	Content	Experts Review		
		+1	0	-1
1.	**Lesson 1: Introduction the course to students** **Duration: 60 minutes** **●Learning Objectives:** 1. Students need to know what they will learn in this study, how long this study lasts and how they need to present in the final class. 2. Doing Pre-test to know students' math ability in Chinese before study 3. Doing YCT Level 1 Test to know students' level of Chinese language knowledge before study **●Teaching and Learning Steps:** **1. Introduction, 5 minutes** --Teacher introduces herself --Telling to students they will learn Chinese Math --Introduce the study to students, the study will last 10 lessons and they need to take Post-test and YCT Level 1 Test again after study --Helping Students know the instruction of two tests **2. Pre-test (Reading-Writing), 20 minutes** --Give students examination papers, students start answering questions --Listening and Speaking part will conduct one-on-one during the lesson break on the pre-test day			

	3.YCT Level 1 Test, 35 minutes --Give students examination papers, the teacher starts to play the listening audio --Students start answering reading questions themselves after finishing the listening			
2.	**Lesson 2: Number 1-10** **Duration: 60 minutes** **●Learning Objectives:** 1. Through counting activities, we will get a preliminary understanding of students' counting situation and make them learn how to count initially. 2. Help students understand school life, stimulate students' interest in learning mathematics, and infiltrate ideological and moral education. **●Teaching and Learning Steps:** **1. Warm up 5 minutes** Sing and dance: Chinese Number Song **2. Teaching 30 minutes** Counting with the picture "beautiful school". Guide students to observe the illustrations on pages 2 to 3 of the textbook. By looking at the picture and arousing students' interest in observation, the teacher can express it like this: This is a beautiful country elementary school, and today is the first day of school. What do you see here? Let students observe by themselves first, and then name what is in the picture. On the basis of observation, the teacher will guide students to count the number of people and numbers			

	from 1 to 10 one by one. You can count them in a certain order, counting the smaller ones first (such as flags, single shoulders, stone benches, etc.) and then the larger ones (such as garbage cans, buildings, flowers, etc.). After each type of object is counted, the teacher can follow the example of pages 3-4 of the textbook and add the collection circle to such objects and write the corresponding number. The same number of objects can be grouped together. For example, if a student says "1 flag, 1 teacher", the teacher can show a picture of 1 flag and 1 teacher on a slide or multimedia, and tell the students that 1 flag and 1 teacher can be represented by the number "l", which is shown on the left side of the picture during the week. "1". After all 10 numbers are shown, have students read them to find out how many students know the 10 numbers. **3. Practice 20 minutes** 1) Practice numbers 1-10 through counting matching of real items and tracing number 2) Doing the classroom exercise related to this lesson **4. Conclusion and homework 5 minutes** Teacher stresses the key points and concludes the class. Give students the related worksheet and ask them review and finish it at home.			
3.	**Lesson 3: Comparing in words “多”、“少”、“同样多”** **Duration: 60 minutes** **●Learning Objectives:** 1. Students are able to know the meaning of "as much", "more" and "less" through manipulation, and will compare the number			

	of objects in a corresponding way. 2. Develop students' spirit of mutual cooperation and awareness of using mathematics. **●Teaching and Learning Steps:** **1. Warm up 5 minutes** Chinese song: “Compare How Many” **2. Teaching 35 minutes** Listen to the story 《Three Little Pigs》 and answer the questions. After the story is finished, the teacher will ask a few questions 1) How many bunnies are there on the diagram? How many bricks does each bunny carry? While students are answering, the teacher will paste pictures of the rabbits' heads and bricks. 2) If one rabbit carries one brick, are there any extra bricks? Are there any extra bunnies? After the students answer, the teacher explains that there is no extra bunny and no extra brick when a bunny is against a brick. Let's say: There are as many bunnies as bricks. 3) How many little pigs are there on the diagram? How many pieces of wood are there in total? While students are answering, the teacher will paste the pictures of the piggy heads and the wood. 4) One little piggy head is compared to one piece of wood, is there any extra piggy head at the end? Are there any extra logs? Are there more piglets or more logs? Who has more and who has less? Ask the group leader to answer after the students share. Teacher's notes: more, less.			

	Teacher's note: There is more wood and less piglets, we can also say that there is more wood than piglets and less piglets than wood. **3. Practice 15 minutes** The whole class will work on the relationship between more, less and the same amount. **4. Conclusion and homework 5 minutes** Teacher comments “more, less and as much” and concludes the class. Give students the related worksheet and ask them review and finish it at home.			
4.	**Lesson 4: Comparing in sentences “…比…多”, “...比…少”, “...比…同样多** **Duration: 60 minutes** **●Learning Objectives:** 1. Students can understand the meaning of "more, less and as much" by comparing items; and they can express it in sentences. 2. Students are able to dictate 比，多，少，同样多 3. Enable students to stimulate their interest in learning mathematics through manipulation and observation. **●Teaching and Learning Steps:** **1. Warm up 5 minutes** Chinese cartoon: “How much do you know?” **2. Teaching 30 minutes** Review and continue to introduce the story from the previous			

	lesson, *the three little pigs*. Teacher extension note: When there is more wood and fewer piglets, we can say that there is more wood than piglets and fewer piglets than wood. Students imitate to say who has more and who has less, who has more and who has less than who. **3. Practice 20 minutes** 1) After the teacher arranges the six erasers, ask students to arrange the pencils against the erasers, asking them to arrange as many pencils as erasers, and use sentences to say their quantity relationship. 2) The teacher lays out the number of items in relation to each other and the students use sentences to describe them. Then students lay out the corresponding quantity relationships based on the teacher's descriptions. 3) Doing the classroom exercise related to this lesson **4. Conclusion and homework 5 minutes** Teacher concludes the class. Give students the related worksheet and ask them review and finish it at home.			
5.	**Lesson 5: Position “上”、“下”、“前”、“后”** **Duration: 60 minutes** **●Learning Objectives:** 1. Understand the basic meaning of up and down and front and back, feel the relativity of up and down, front and back, and be able to use up and down and front and back to describe the position of the object.			

	2. In the learning activities, with the help of students' original knowledge base and life experience, abstract the four orientation words, so that students can use "up, down" "front, back" to describe the relative position of objects. 3. To make students feel the close connection between mathematics and real life, and appreciate the value of orientation in life ●**Teaching and Learning Steps:** **1. Warm up 5 minutes** Game: Fingers above, fingers below, fingers in front, fingers behind **2. Teaching 30 minutes** Observe and describe a picture of a bridge over a river by using the teacher's questions. 1) What do you see when you look at this picture? 2) Can you use words like "up and down" to tell us where these vehicles are located? 3) People say that the train is on top and the train is on the bottom at the same time, what is going on? 4) How can we make it clear? And then, teacher shows the animated car picture, students observe, exchange and discuss the questions below: 1) What do you see again? 2) Can you use words like "front, back" to say where these cars are? The direction of the front of the car is "front". 3) How can you say it clearly? Look at who is in front of whom and who is behind, and then say who is in front of whom and who is behind			

	3. Practice 20 minutes 1) Game: Who's in front of you? Who is behind you? Please ask the students sitting in front of Xiaoming to stand up. Ask the students sitting behind Xiaoming to raise their hands. 2) Doing the classroom exercise related to this lesson **4. Conclusion and homework 5 minutes** Teacher concludes the class. Give students the related worksheet and ask them review and finish it at home.			
6.	**Lesson 6: Using "...在…的上面/下面/前面/后面" to describe the position** **Duration: 60 minutes** **●Learning Objectives:** 1. Use sentences to describe the relative positions of objects above, below, in front and behind. 2. Develop students' observation skills and language skills. **●Teaching and Learning Steps:** **1. Warm up 5 minutes** Chinese song: "Direction Song" **2. Teaching 30 minutes** Teaching slides: 1) On Sunday, the children in class two (1) wanted to visit the exhibition hall. Look, they are lining up to get on the bus! How many children are going? Who is in front of Li Lin? Who is behind Wang Ying? Where is Zhang Ning in line with Li Lin? Where is Wang Ying in line with Zhang Ning?			

	From the library, how many stops do you think the children will have to make to the exhibition hall according to the stop sign? What is the next stop? What is the fourth stop after the library? What is the previous stop in the park? (Show the textbook) 2) As you pass by the gymnasium, the puppies are having a fierce swimming competition: (text) What do you see? And complete the related questions If they continue to swim, how might their order before and after change? 3) Discuss in small groups. 4) Summary: We have to say whether a person or object is in front or behind depends on what time it is. The time is different, and the position before and after is different, which is the relative nature of position in time. **3. Practice 20 minutes** 1) Use the sentences to say: What is on top of the desk? What is underneath the desk? Who is in front of you? Who is behind you? Say it to each other at the same table. 2) Doing the classroom exercise related to this lesson **4. Conclusion and homework 5 minutes** Teacher concludes the class. Give students the related worksheet and ask them review and finish it at home.			
7.	**Lesson 7: Using "...的上面/下面/前面/后面是…" to describe the position** **Duration: 60 minutes**			

	●Learning Objectives: 1. Use different expressions to describe the relative positions of objects above, below, in front and behind. 2. Students are able to dictate 上，下，前，后 3. Develop students' multiple-thinking skills **●Teaching and Learning Steps:** **1. Warm up 5 minutes** Game: Listen to the command and do the action **2. Teaching 30 minutes** 1) Find a few students and have them each say what they have on top, and then find a few more and have them give a few examples of what is on top and what is on the bottom compared to what. The teacher then guides the students to say the opposite, expressing the position relationship in a different way. 2) The teacher asks another 3 students to come up to the stage (facing north). Who is in front and who is behind. The student in the middle is in the front and the student in the back. 3) Who is at the front of the line? Who is at the end of the line? (Turn backwards) 4) Four students line up and change direction as required. What did you find? What is the difference from the original? Why is there this change? (When facing north, No. 1 is at the front and No. 3 is at the end; when facing south, No. 1 is at the end and No. 3 is at the front.) 5) Question: Why is No. 1 in the front at one time and at the end at another?			

	Group discussion. 6) Summary: We have to say whether a person or object is in front or behind depends on who it is compared with, and the front and back positions are different when compared with different people or objects. The direction is different, and the position relationship referred to is also different. **3. Practice 20 minutes** 1) Look at the bedroom picture and ask students to use different sentences to describe the position of objects in the bedroom. 2) Doing the classroom exercise related to this lesson **4. Conclusion and homework 5 minutes** Teacher concludes the class. Give students the related worksheet and ask them review and finish it at home.			
8.	**Lesson 8: Position “左”、“右”** **Duration: 60 minutes** **●Learning Objectives:** 1. Be able to determine the left and right position and order of objects, and be able to describe the position of objects in terms of left and right, and be able to express them in their own language. 2. Be able to initially use the knowledge learned to solve problems and initially develop the concept of space. **●Teaching and Learning Steps:** **1. Warm up 5 minutes** Quizzes: Raise your hand if you guessed correctly. Raise your			

	hand and don't put it down. Can you tell us which hand you are raising? Then the other hand is the left hand, and today we will learn about left and right together. (Write on the Board: left and right) **2. Teaching 30 minutes** Contact yourself, experience left and right. Teacher: For us, our hands can do a lot of work! Students think about what we usually do with our left and right hands in life? (Usually, we often use our right hand to write, hold chopsticks when we eat, raise our hand with our right hand when the teacher asks a question ..... press the book with our left hand, and hold the bowl when we eat .....) Teacher: Yes, the left hand and the right hand are a pair of good friends, they can do a lot of things together, is there such a pair of good friends in our body? (Students answer: left eye, right eye, left ear, right ear, left foot, right foot, left leg, right leg .....) Summary: The one on the same side as our right hand is our right side, and the one on the same side as our left hand is our left side. **3. Practice 20 minutes** 1) Activity: You tell, I do Hold out your left hand and hold out your right hand. Pat your left shoulder with your left hand and pat your right shoulder with your right hand. Feel your left ear with your left hand and your right ear with your right hand. Pat your right hand with your left hand, pat your left hand with			

	your right hand. 2) Doing the classroom exercise related to this lesson **4. Conclusion and homework 5 minutes** Teacher concludes the class. Give students the related worksheet and ask them review and finish it at home.			
9.	**Lesson 9: Using "...的左边/右边是…"、"…在…的左边/右边" to describe the position** **Duration: 60 minutes** **●Learning Objectives:** 1. Use different expressions to describe the relative positions of objects left and right in sentences. 2. Students are able to dictate 左，右 3. Develop students' multiple-thinking skills **●Teaching and Learning Steps:** **1. Warm up 5 minutes** Chinese song: "Left Right Up Down" **2. Teaching 30 minutes** Contact life, we know the left and right, you are so smart, please help the teacher to put the food in the right place, okay? 1) Please ask the students to gently go to the table to take a kind of food. 2) What are the students holding in their hands, report it. 4) Listen to the command and put them on the table. In the middle of the table is a plate of apples. On the left of the apples is cake, on the right is Coke, on the top is banana,			

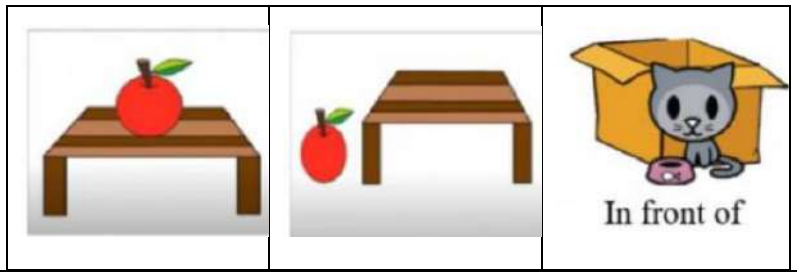
	on the bottom is ice cream, on the left of banana is orange, on the left is strawberry, peach is on the left of the ice cream, on the right is pear. After each food is placed, students repeat the sentences of the position described by the teacher. **3. Practice 20 minutes** 1) Game: "changing seat" game. The music starts, students listen to the music around the chair to do free movement, learners listen carefully, the music stops to find a chair. Music stops, students quickly go to find the small chair and sit down. Ask the learners to say: Who is on my left and who is on my right? (Or say: My left is whom and My right is whom?) Tell their fellows: Who is on my left? Who is on my right? 2) Doing the classroom exercise related to this lesson **4. Conclusion and homework 5 minutes** Teacher concludes the class. Give students the related worksheet and ask them review and finish it at home.			
10.	**Lesson 10: Post-test, YCT Level 1 test and summary the study** **Duration: 65 minutes** **●Learning Objectives:** 1. Teacher briefly summarizes the course 2. Doing Post-test to know students' math ability in Chinese after study 3. Doing YCT Level 1 Test again to know students' level of			

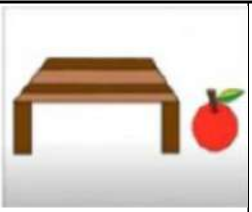
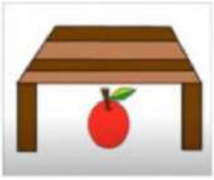
	Chinese language knowledge after study 4. Getting to know student's feeling through doing Semantic Differential Scale by participants. **●Teaching and Learning Steps:** **1. Summarize, 5 minutes** --Teacher briefly summarizes the whole study -- Introduce the purposes of Post-test and YCT Level 1 Test --Helping Students know the instruction of two tests **2. Post-test (Reading-Writing), 20 minutes** --Give students examination papers, students start answering questions --Listening and Speaking part will conduct one-on-one during the lesson break on the post-test day. **3.YCT Level 1 Test, 35 minutes** --Give students examination papers, the teacher starts to play the listening audio --Students start answering reading questions themselves after finishing the listening **4. Doing Semantic Differential Scale, 5 minutes** After class, the semantic differential scale was distributed to each of the 21 participants. They were asked to tick "√"at the number 1-7 that most corresponded their true feelings.			

Experts Assessments of IOC Lesson Plans

No.	Experts 1	Experts 2	Experts 3	IOC
1.	+1	+1	+1	1
2.	+1	+1	+1	1
3.	+1	+1	+1	1
4.	+1	+1	+1	1
5.	+1	+1	+1	1
6.	+1	+1	+1	1
7.	+1	+1	+1	1
8.	+1	+1	+1	1
9.	+1	+1	+1	1
10.	+1	+1	+1	1
IOC	1			

Item Objective Congruence (IOC) for Pre/Post-test of Chinese Math

NO.	Questions	Experts Review		
		+ 1	0	- 1
Part 1. Listening & Speaking	**一. 请读出下面的数字。(5 marks)** **Please read out the following numbers.** **3 2 7 1 9 4 6 8 5 10**			
	二. 请正确说出下面物品的数量关系。(15 marks) **Please state the correct relationship between the quantities of the following items.** 1. 小明有 8 个苹果, 小花有 2 个苹果, 谁比谁的苹果多? 2. 兔子有 6 瓶牛奶, 小猫有 3 瓶牛奶, 谁比谁的苹果少? 3. 小狗吃了 10 块蛋糕，乌龟也吃了 10 块蛋糕，他们吃的蛋糕数量一样吗?			
	三. 请用正确的方式描述下面物品的位置。(30 marks) **Please describe the location of the following items in the correct way.** 			

	 Behind	

Part 2. Reading & Writing

xiě chū xià mian diū shī de shù zì
四. 写出下面丢失的数字。(5 marks)

Write the missing numbers below.

1									10

qǐng xiě chū zhèng què de hàn zì miáo shù tā men de guān xì
五. 请写出正确的汉字描述他们的关系。(15 marks)

Please write the correct Chinese characters to describe their relationship.

____

____

____

gēn jù tú piàn nèi róng xiě chū zhèng què de wèi zhì guān xì
六. 根据图片内容写出正确的位置关系。(30 marks)

Please write the correct position relationship according to the content of the picture.

píng guǒ zài zhuō zi de　　biān
苹果在桌子的（　　）边。

	 píngguǒ zài zhuō zi de biān 苹果在桌子的（ ）边。  In front of māo zài xiāng zi de miàn 猫在箱子的（ ）面。  píngguǒ zài zhuō zi de biān 苹果在桌子的（ ）边。  píngguǒ zài zhuō zi de miàn 苹果在桌子的（ ）面。  Behind māo zài xiāng zi de miàn 猫在箱子的（ ）面。			

Experts Assessments of IOC Pre/Post-test of Chinese Math

No.	Experts 1	Experts 2	Experts 3	IOC
1.	**+1**	**+1**	**+1**	**1**
2.	**+1**	**+1**	**+1**	**1**
3.	**+1**	**+1**	**+1**	**1**
4.	**+1**	**+1**	**+1**	**1**
5.	**+1**	**+1**	**-1**	**0.67**
6.	**+1**	**+1**	**+1**	**1**
IOC	**0.945**			

APPENDIX E

THE SCORES OF PRE-TESTS AND POST-TESTS OF CHINESE MATH AND CHINESE LAGUAGE KNOWLEDGE

Pre-Test Scores of Chinese Math

Student	Question 一	Question 二	Question 三	Question 四	Question 五	Question 六	Total
1	5	0	0	5	0	0	10
2	5	2.5	0	5	0	15	27.5
3	5	0	0	5	0	0	10
4	5	0	0	5	0	0	10
5	5	2.5	0	5	0	0	12.5
6	5	2.5	0	5	0	10	22.5
7	5	0	0	5	0	0	10
8	5	2.5	0	5	0	5	17.5
9	5	2.5	0	5	0	10	22.5
10	5	2.5	0	5	0	0	12.5
11	5	0	0	5	0	0	10
12	5	0	10	5	0	10	30
13	5	0	0	5	0	5	15
14	5	0	0	5	0	0	10
15	5	0	0	5	0	0	10
16	5	0	0	5	0	5	15
17	5	2.5	0	5	0	10	22.5
18	5	2.5	0	5	0	10	22.5
19	5	0	0	5	0	20	30
20	4	0	0	5	0	0	9
21	5	0	0	5	0	0	10

Post-Test Scores of Chinese Math

Student	Question 一	Question 二	Question 三	Question 四	Question 五	Question 六	Total
1	5	15	30	5	15	30	100
2	5	15	30	5	15	30	100
3	5	10	30	5	15	25	90
4	5	15	30	5	15	30	100
5	5	15	30	5	15	30	100
6	5	15	30	5	15	30	100
7	5	15	20	5	10	20	75
8	5	15	30	5	15	30	100
9	5	15	30	5	15	30	100
10	5	15	30	5	15	30	100
11	5	15	30	5	15	30	100
12	5	15	30	5	15	30	100
13	5	15	30	5	15	30	100
14	5	15	30	5	15	30	100
15	5	10	25	5	10	30	85
16	5	10	30	5	10	25	85
17	5	15	30	5	15	30	100
18	5	15	30	5	15	30	100
19	5	15	30	5	15	30	100
20	5	15	20	5	15	30	90
21	5	15	30	5	5	30	90

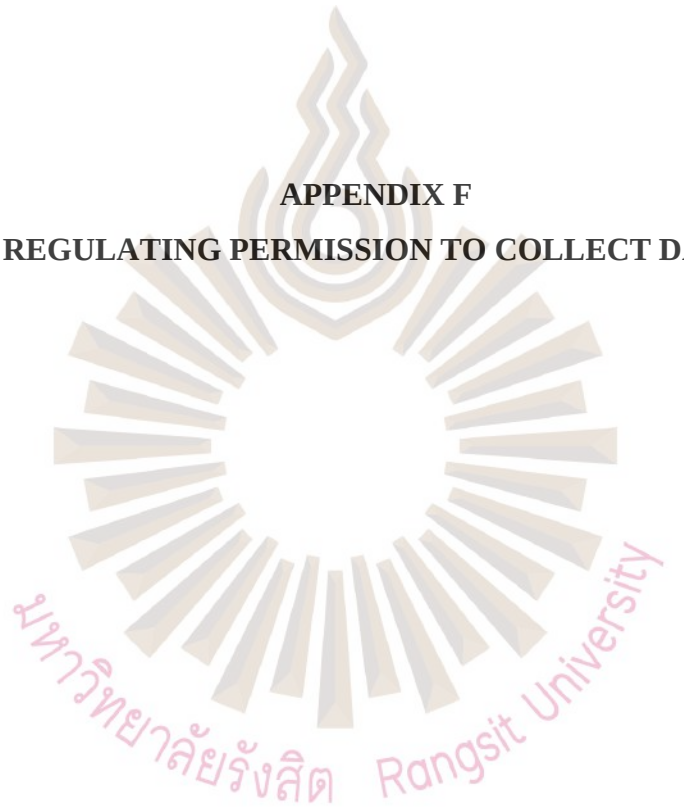
Pre-Test Scores of Chinese Language Knowledge

Student	Listening Part	Reading Part	Total
1	55	33.35	88.35
2	80	40.02	120.02
3	55	20.01	75.01
4	65	26.68	91.68
5	80	40.02	120.02
6	80	20.01	100.01
7	50	6.67	56.67
8	80	33.35	113.35
9	85	46.69	131.69
10	70	46.69	116.69
11	70	26.68	96.68
12	75	40.02	115.02
13	65	26.68	91.68
14	60	26.68	86.68
15	55	6.67	61.67
16	85	40.02	125.02
17	60	33.35	93.35
18	90	26.68	116.68
19	55	20.01	75.01
20	70	20.01	90.01
21	30	26.68	56.68

Post-Test Scores of Chinese Language Knowledge

Student	Listening Part	Reading Part	Total
1	100	100	200
2	100	100	200
3	100	93.38	193.38
4	100	100	200
5	100	100	200
6	100	100	200
7	95	86.71	181.71
8	100	100	200
9	100	100	200
10	100	100	200
11	100	100	200
12	100	100	200
13	100	100	200
14	100	100	200
15	100	86.71	186.71
16	100	93.38	193.38
17	100	100	200
18	100	100	200
19	100	100	200
20	100	86.71	186.71
21	95	93.38	188.38

APPENDIX F
REGULATING PERMISSION TO COLLECT DATA



RSU มหาวิทยาลัยรังสิต RANGSIT UNIVERSITY

มหาวิทยาลัยรังสิต Rangsit University T. (66) 2997 2200-10
99 หมู่ 18 ถนนพหลโยธิน Phahonyothin Rd. F. (66) 2791 5751
ปทุมธานี 12000 Pathumthani 12000, Thailand E. info@rsu.ac.th

STC.4800/0219

25 September 2023

Subject: Request for Permission to Collect Data for a Master's Thesis at Intertots Trilingual School

The Principal
Intertots Trilingual School

Dear Sir/Madam,

Miss Ruirui Li, Student ID: 6407477 is now studying in the Master in Education (Bilingual Education and English Language Teaching) at Suryadhep Teachers College, Rangsit University, Pathum Thani, Thailand. She is now planning to collect the data for her thesis in Grade 1 students. Four instruments will be used for her thesis entitled "**Exploring Students' Chinese Language Learning in Math Class at a Thai Private School: A Case Study of Using Chinese as a Medium of Instruction**".

The objectives of the research are:
1. To evaluate the effectiveness of CMI by comparing the pre- and post-treatment Chinese mathematics scores of 21 Thai first-grade students who studied mathematics in a private school in Chachoengsao using Mandarin as the Medium of Instruction (CMI).
2. To study the Chinese proficiency level of the 21 Thai first graders who study mathematics through using Chinese mandarin as a medium of instruction at a private school in Chachoengsao.

After completion, this study will be taken as partial fulfillment of the requirements for the Degree of Master of Education in Bilingual Education and English Language Teaching. It is hoped that the research findings will be useful for all the parties concerned to use for their benefits. Thus, I would like to seek for your kind permission for the student, Miss Ruirui Li, Student ID: 6407477 to collect the data in Intertots Trilingual School.

On behalf of Rangsit University, I truly appreciate all the help and support you can give in Miss Ruirui Li's thesis endeavor.

Yours sincerely,

Malivan Praditteera, Ed.D.
Dean
Suryadhep Teachers College

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Pathumthani 12000, Thailand

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E. info@rsu.ac.th

STC.4800/0325

20 October 2023

Subject: Invitation for you to be our IOC (Item Objective Congruence) expert

Dear Assistant Professor Dr. Pairin Srisinthorn,

Miss Ruirui Li student number 6407477, a student in the Master of Education (Bilingual Education) who has already completed her coursework and thesis proposal defense on 17 March 2023. Her research is entitled "Exploring Students' Chinese Language Learning in Math Class at a Thai Private School: A Case Study of Using Chinese as a Medium of Instruction". On this occasion, Suryadhep Teachers College is honored to invite you to be an Item Objective Congruence (IOC) expert of the instruments since the student is now ready to take the next step in research, that is, getting the IOC experts to review her instruments (Attached herewith) which are:

1) The Pre/Post Test
2) The Teacher's Journal
3) The Semantic Differential Scale
4) The Lesson Plans

I hope that you will kindly accept this invitation. On behalf of Suryadhep Teachers College, Rangsit University, I would like to thank you for your kind support.

Sincerely yours,

Malivan Praditteera, Ed.D.
Dean
Suryadhep Teachers College
Rangsit University

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มหาวิทยาลัยรังสิต
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จ.ปทุมธานี 12000

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STC.4800/0326

20 October 2023

Subject: Invitation for you to be our IOC (Item Objective Congruence) expert

Dear Dr. Mongkol Sodachan,

Miss Ruirui Li student number 6407477, a student in the Master of Education (Bilingual Education) who has already completed her coursework and thesis proposal defense on 17 March 2023. Her research is entitled "Exploring Students' Chinese Language Learning in Math Class at a Thai Private School: A Case Study of Using Chinese as a Medium of Instruction". On this occasion, Suryadhep Teachers College is honored to invite you to be an Item Objective Congruence (IOC) expert of the instruments since the student is now ready to take the next step in research, that is. getting the IOC experts to review her instruments (Attached herewith) which are:

1) The Pre/Post Test
2) The Teacher's Journal
3) The Semantic Differential Scale
4) The Lesson Plans

I hope that you will kindly accept this invitation. On behalf of Suryadhep Teachers College, Rangsit University, I would like to thank you for your kind support.

Sincerely yours,

Malivan Praditteera, Ed.D.
Dean
Suryadhep Teachers College
Rangsit University

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STC.4800/0327

20 October 2023

Subject: Invitation for you to be our IOC (Item Objective Congruence) expert

Dear Dr. Thanyapatra Soisuwan,

Miss Ruirui Li student number 6407477, a student in the Master of Education (Bilingual Education) who has already completed her coursework and thesis proposal defense on 17 March 2023. Her research is entitled "Exploring Students' Chinese Language Learning in Math Class at a Thai Private School: A Case Study of Using Chinese as a Medium of Instruction". On this occasion, Suryadhep Teachers College is honored to invite you to be an Item Objective Congruence (IOC) expert of the instruments since the student is now ready to take the next step in research, that is, getting the IOC experts to review her instruments (Attached herewith) which are:

1) The Pre/Post Test
2) The Teacher's Journal
3) The Semantic Differential Scale
4) The Lesson Plans

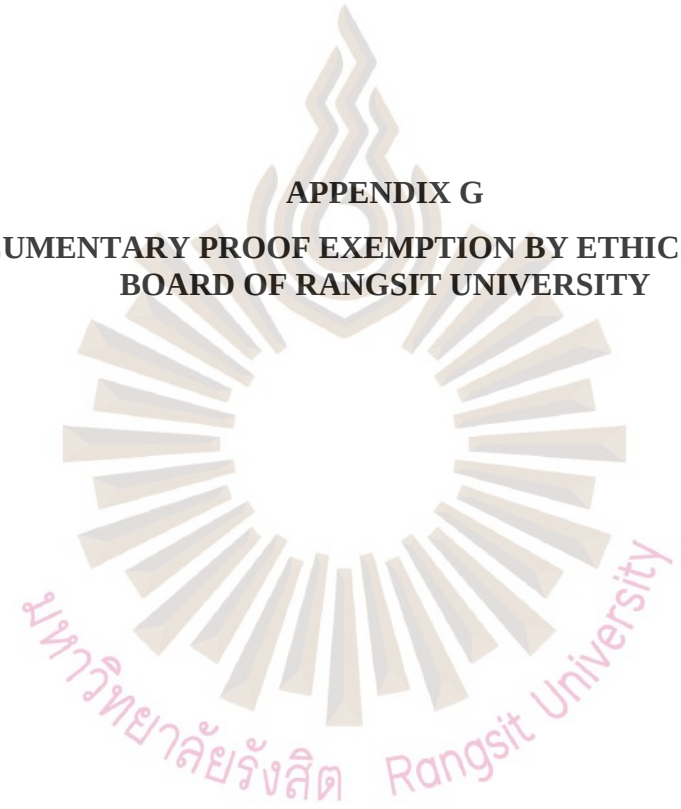
I hope that you will kindly accept this invitation. On behalf of Suryadhep Teachers College, Rangsit University, I would like to thank you for your kind support.

Sincerely yours,

Malivan Praditteera, Ed.D.
Dean
Suryadhep Teachers College
Rangsit University

APPENDIX G

DOCUMENTARY PROOF EXEMPTION BY ETHICS REVIEW BOARD OF RANGSIT UNIVERSITY



COA. No. RSUERB2023-160

Certificate of Approval
By
Ethics Review Board of Rangsit University

COA. No.	**COA. No. RSUERB2023-160**
Protocol Title	**EXPLORING STUDENTS' CHINESE LANGUAGE LEARNING IN MATH CLASS AT A THAI PRIVATE SCHOOL: A CASE STUDY OF USING CHINESE AS A MEDIUM OF INSTRUCTION**
Principle Investigator	**RUIRUI LI**
Affiliation	**Suryadhep Teachers College, Rangsit University**
How to review	**Full Board Review**
Approval includes	**1. Project proposal** **2. Information sheet** **3. Informed consent form** **4. Data collection form/Program or Activity plan**
Date of Approval:	**10 October 2023**
Date of Expiration:	**10 October 2025**

The prior mentioned documents have been reviewed and approved by Ethics Review Board of Rangsit University based Declaration of Helsinki, The Belmont Report, CIOMS Guideline and International Conference on Harmonization in Good Clinical Practice or ICH-GCP

Signature.....

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