Examining the Impact of Information and Communication Technology (ICT) Integration in Chinese Middle School Mathematics Teaching and Learning.

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Abstract- The study investigated the impact of Information Communication Technology (ICT) integration in Chinese middle school mathematics teaching and learning. ICT integration in mathematics teaching and learning continues to assist mathematics instructors in the global requirement to replace the traditional mathematics teaching and learning method. ICT is considered one of the main elements in transforming and developing the education sector in China. China has invested much in using ICT tools and facilities and training its teachers to be equipped with the 21st-century demands of effective teachers. For the study, the researchers used survey questionnaires designed and distributed to 70 middle school mathematics students and 13 mathematics teachers from 3 public middle schools in Shaoxing City, China. The data analysis included frequencies, percentages, and means to find answers to all the study's research questions. The findings indicated that integrating ICT into mathematics instruction significantly impacts teachers and their students. The findings also indicated that Chinese middle school mathematics teachers have the knowledge and skills to integrate ICT into lesson planning and teaching. Chinese middle school mathematics classrooms also have well-equipped ICT facilities for mathematics lessons, which are vital in enhancing students' understanding and performance in mathematics. The paper provides empirical evidence of the extent and impact of ICT integration in Chinese middle school mathematics education, which is worth emulating by other countries.

Index Terms- Mathematics teachers, Information Communication and Technology (ICT), Impact of ICT, Chinese Middle School students, Teaching and Learning, ICT integration.

I. Introduction

1.1 Background of the Study

Countries worldwide have called for integrating ICT (Information and Communication Technology) in education, creating significant concern for other countries to find ways of adhering to these calls. Before recent years, the primary teaching resources available to teachers before, during, and after classroom instruction were printed textbooks. However, ICT has provided a new source of support for instruction by developing ICT facilities that support the teaching and learning process. Increasing knowledge and teaching have recently depended on new technology to deliver and construct classroom teaching and learning. According to (Lin, 2004), teachers must perform classroom instruction by integrating technology (Lin, 2004). According to other research studies, integrating ICT into the classroom makes instruction more successful and enhances students' learning attitudes and performance than traditional teaching techniques (Lin, 2005; Mehra & Mital, 2007). According to findings from some academics and researchers, the teacher's position changes from being the conventional "sage on the stage" to being a "guide on the side" when they integrate ICT into the teaching and learning process (Alley, 1996; Mehra & Mital, 2007), which means that a successful integration of ICT in mathematics instruction changes students' roles from passive knowledge receivers to more active participants in the mathematics classroom. According to Jonassen (2000), educators' numerous ICT tools and resources allow pupils to engage in practical learning activities and additional opportunities to develop their critical thinking and sophisticated ideas.

The term "ICT integration in education" describes the incorporation of computer-based communication, tools, and techniques into regular teaching and learning activities in the classroom. According to Alberni (2006), ICT integration refers to the advantages of networking learning communities to meet the problems of contemporary globalization, even though its primary goal is to enhance and raise the quality, accessibility, and cost-efficiency of education delivered to students. A crucial component of preparing pupils for the contemporary digital world is the teacher's integration of ICT into regular classroom activities. ICT instructors can create a dynamic and proactive learning environment (Arnseth & Hatleric, 2012). ICT adoption is a continuous process that involves many steps to adequately support information resources for teaching and learning (Young, 2003). Technology-based teaching and learning using learning technologies in schools is termed ICT integration in education. Students knowledgeable in the use of technology will learn more effectively in technology-enhanced classrooms, making ICT integration in schools and especially the classroom, a critical concern for many educational stakeholders globally. According to Jameison-Procter et al. (2013), using ICT tools and the required skills in education greatly adds to the pedagogical features, resulting in successful learning. Technology-based teaching and

learning allow Students to learn more deeply in all subjects and develop the technological experiences they will apply in other fields after school. Jorge et al. (2003) also indicated that ICT provides help and support for teachers and students by using computers, software, and other technological devices to assist in effective student comprehension learning. Technology and computers are add-on supplements necessary for improved teaching and learning. Technology and computers do not replace the critical role of skilled, trained, or professional teachers. Recently, because technology is capable of making teaching and learning possible even when teachers and students are in different locations due to distance, ICT integration in education has become essential. ICT integration, however, does not offer a teaching and learning environment in a single step (Young, 2003).

The Curriculum and Evaluation Standards for Schools Mathematics (2000) have also indicated the importance of ICT integration as an essential element in influencing mathematics content and teaching to improve mathematics instruction and students' achievement in mathematics at all levels. The National Council of Teachers of Mathematics (NCTM) has recommended the wide use of technology in the classroom by well-trained teachers to help students comprehend mathematical concepts or ideas. In traditional mathematics classrooms, the mathematics instructor usually models procedures for solving the mathematics problem for the class before assigning them to group or individual work. The instructor's duty in the traditional classroom is to display the process to the students while they follow and do what they see on their work papers. Thankfully, the emergence of ICT is helping to change traditional mathematics instruction globally. ICT-enhanced classrooms are becoming increasingly common, and the use of ICT in mathematics instruction has grown significantly. ICT tools and devices used in mathematics classrooms vary, such as overhead projecting systems, computers, interactive whiteboards, graphing calculators, digital video and camera equipment, and many ICT software. This paper sought to analyze the impact of ICT integration in mathematics instruction in Chinese Middle Schools. Specifically, it aims to identify whether or not ICT in mathematics in Chinese middle school classrooms has yielded the needed results or the set objectives and the need for stakeholders of education worldwide to integrate ICT in the teaching and learning of mathematics.

II. LITERATURE REVIEW

2.1 Importance Of ICT Integration In Mathematics Teaching And Learning

Integrating ICT in schools, particularly in the classroom, is critical because pupils are accustomed to it and will learn more effectively in a technology-based setting. The pedagogical features of using technology in education are greatly enhanced by its application, which, with the aid and assistance of ICT elements and components, will result in successful learning (Jamieson-Procter et al., 2013). Using technologically based tools and equipment, students may learn all courses more efficiently. By incorporating efficient learning with computers as learning aids, ICT offers assistance and supplementary support to educators and learners (Jorge et al., 2003). ICT integration in education is paramount since, thanks to technology, learning and teaching may occur not just in traditional classroom settings but also when teachers and students are geographically separated.

ICT supports instructors' and students' mathematics subject-matter learning when applied in various ways. According to earlier studies, using ICT in the classroom improves student learning and makes the most of their capacity for active learning (Finger & Trinidad, 2002; Jorge et al., 2003; Young, 2003; Jamieson-Procter et al., 3013). According to Hermans et al. (2008), integration, enhancement, and complimentary are the three primary stages teachers have identified for ICT to be highly appreciated and esteemed. Increasing students' accomplishment and attainment should focus on integrating the appropriate ICT tools in specific subject areas that need complex ideas and abilities. The enhancement technique focuses on highlighting the issue through the use of ICT. Using ICT to help students learn and become more efficient and organized includes taking computerized notes, emailing assignments home as long as they finish on time, and searching the internet for information from various sources to complete assigned tasks. According to (Hermans et al., 2008), these strategies mentioned earlier complement one another). ICT integration in mathematics teaching and learning makes mathematics easier for teachers and students to teach and learn. It also makes students solve mathematics problems more efficiently and effectively.

2.2 Teachers' Perception Of ICT Integrated Teaching And Learning

Throughout the 20th century, education ministries worldwide have offered a wealth of resources and training to improve the integration of cutting-edge ICT into their nations' educational systems. Ministries of Education allocate enormous sums to enhance the educational system. Most nations struggle with instructors not making the most of the ICT resources available, even with all the efforts to improve ICT education (Albirini, 2006). It is a severe issue when there is insufficient use of ICT in teaching and learning, as several studies have shown that this integration may enhance students' academic performance. Numerous scholars have examined what influences teachers' approval of using ICT in the classroom (Dudeney, 2010; Zhang, 2013; Capan, 2012). Teachers' perception that they are the ones who make changes to the teaching and learning processes is a significant obstacle to integrating ICT in the classrooms.

Other studies, like the one conducted by Cox & Marshall (2007), demonstrate that instructors merely need to use a traditional-centered approach when teaching ICT in the classroom. Even though the kind of ICT utilized in the classroom does not represent what teachers teach, the instructors are quite competent and confident in using it. These educators think using ICT might support learning, particularly regarding real-world applications. This element has changed how ICT is integrated into instructional approaches so that students may produce and develop knowledge. According to research, the link between confidence and competitiveness may indicate how well instructional strategies and training fit in ICT professional development. By doing this, the school administration could ensure that the instructors had enough assistance integrating ICT into the classroom. However, as instructors age and gain more years of job experience, their effectiveness in the classroom varies (Caban, 2001). It implies that as teachers' age and years of expertise rise, so does their

effectiveness. Schools that give instructors the chance to pursue ICT training ultimately assist the teachers in incorporating new ICT concepts into the teaching and learning process.

2.3 Integration Of ICT In Chinese Middle School Education

ICT integration in the classroom is becoming increasingly important since it helps students learn more collaboratively and develop social skills, problem-solving abilities, self-reliance, responsibility, and the ability to think critically and come to conclusions. Students must attain these fundamental principles in an active teaching and learning environment. According to Ghavifekkr et al. (2014) comparably, China has made great strides in ICT during the past few decades. ICT debuted in the Chinese Middle School Education system in the late 1990s. It has carried high expectations of transforming the Chinese education system and facilitating the teaching and learning all subjects, including mathematics. Li and Zhang (2008) noted that the impact of ICT on Chinese education is dichotomous. From a cultural perspective, ICT can help learners improve their information awareness and ethics. From a technology perspective, ICT can allow learners to acquire skills in and outside the classroom. ICT integration in Chinese middle school education is an essential aspect of educational development strategy, aiming to improve the development of compulsory education, achieve educational quality and equity, and construct a technology learning environment for all students, including middle school classrooms.

2.4 The Development Of ICT Integration In Chinese Middle School Education

ICT development in Chinese middle schools mathematics classrooms started over two decades ago to aid in achieving the set objectives for the integration processes, divided into two phases: the technology-dominated phase, which lasted from 1986 to 2000, and the symmetric stage, which has continued from 2000 to the present (Wang & Song, 2002). During the initial phase, the implementation of ICT infrastructure was the primary issue. The second phase concentrated on enhancing the efficiency of ICT integration by creating instructional resources, teacher preparation, and ICT integration in classrooms. The People's Republic of China's Ministry of Education has released several essential initiatives to improve ICT integration in the classroom. To meet the pressing demands of China's education reforms and compete globally in the integration of ICT development, the National Development Plan for ICT in Education (2011–2012) outlines the key challenges and development strategies that ICT must support at every level of the educational system. The Chinese government launched several initiatives to support teacher ICT education. These initiatives include Planning for the Development of National Teachers Competence of Education Technology in Schools (MOE, 2005), Enhancing High-Quality Teacher and Management Team Engineering (MOE, 2004), and Facilitating Education Information for Teachers (MOE, 2012). In addition to the national training programs, the Chinese government set up remote learning courses, with over 2.77 million teachers participating in ICT-assisted topic training. In 95% of China's middle schools, students must take ICT courses, including teaching arithmetic (MOE, 2012). Even though there may be some challenges in the Chinese integration process, the efforts of teachers, the government, schools, and all stakeholders in Chinese education are worth emulating by other countries.

III. METHODOLOGY

3.1 Purpose Of The Study

This study aimed to ascertain how ICT integration affected mathematics instruction and learning in middle schools in China. It was essential to look into the effects of ICT integration in mathematics teaching and learning in Chinese middle schools because findings from this study could help in determining how much the use of ICT in mathematics instruction has improved teaching and learning in Chinese middle schools and the needed changes or area of improvement if any. Additionally, the study will promote increased ICT usage in mathematics teaching and learning by foreign education ministries and instructors who wish to benefit from China's ICT integration in their educational system and advancements.

3.2 Research Questions

1. To what extent do Chinese middle school mathematics teachers use ICT in the teaching and learning of mathematics?
2. What are the perceptions of Chinese middle school mathematics students and teachers in integrating ICT into teaching and learning mathematics?
3. How does ICT integration impact Chinese middle school mathematics teaching and learning?

3.3 Research design

The data gathered from each respondent was analyzed in this study using a quantitative technique. The target group answered the questionnaires that the researchers had created. A cross-sectional survey was employed in the study to gather data about the effects of ICT integration on the teaching and learning of mathematics in Chinese middle schools. According to Lavrakas (2008), respondents often provide cross-sectional data gathered from them in a short amount of time to create the sample. According to Creswell (2012), a cross-sectional survey offers the benefit of assessing present practices. The questionnaires explicitly addressed the study's goals concerning the effects of ICT integration on mathematics instruction and learning in Chinese middle schools.

3.4 Population

All middle school mathematics teachers and students in Shaoxing, Zhejiang Province, China, comprised the study population. Because China's mathematics curriculum emphasizes the integration of ICT in the teaching and learning mathematics, this population will help find answers to the research questions.

3.5 Sample and Sampling technique

Random sampling selected three (3) middle schools, thirteen (13) middle school mathematics teachers, and seventy (70) students from Shaoxing City. The researchers chose random sampling to prevent any bias on the researchers' part. The teachers' questionnaires were randomly distributed to the respondents regardless of gender, teaching experience, and academic level. The students' questionnaires were also randomly distributed to

only seventy (70) students. The sample size was 70 because the researchers wanted to use students who have experienced years of learning mathematics aided by ICT integration.

3.6 Instrument

The researchers chose questionnaires for the study after a careful review of other works of literature. According to Fraenkel & Wallen (2000), questionnaires guarantee respondents' anonymity and require less time to administer, forming the basis of using questionnaires for the study. A total of 29 items and teachers' demographic background information formed the teachers' questionnaires, which were analyzed to answer the corresponding research questions. 11 items made up the instrument for students' questionnaires, including their demographic background information. The respondents' answers were on a 5-Likert scale ranging from ***5= Strongly Disagree, 4= Disagree, 3= It Doesn't Matter, 2= Agree, and 1= Strongly Agree.***

3.7 Data Analysis

The researchers ensured all the questionnaires were correctly filled out by crosschecking, coding, and analyzing the data using Statistical Package for Social Sciences (SPSS) version 2.0. Frequency and percentages were among the descriptive statistics used to examine the respondents' background data. The researchers further calculated the means and standard deviation to explore the impact of ICT integration in mathematics among the selected middle schools.

IV. RESULTS AND FINDINGS

4.1 Results

The research findings answer the research questions stated for the study. The findings follow the sections of the items in the teacher's and students' questionnaire sections.

Table 1. The demographic background of students.

Factor	Category	Frequency	Percentage %
	Male	38	54.3%
Gender	**Female**	32	45.7%
	Total	**70**	**100%**
Factor	**Category**	**Frequency**	**Percentage %**
	12 years	19	27.1%
Age	**13 years**	31	44.3%
	14 years	20	28.6%
	Total	**70**	**100%**
Factor	**Category**	**Frequency**	**Percentage %**
	Grade 7	30	42.2%
Grade	**Grade 8**	20	28.6%
	Grade 9	20	28.6%
	Total	**70**	**100%**

Table 1 represents the demographic background of students, based on the overall student sample size (n=70) used, 38 of the students representing 54.3% were males, compared to 32 students representing 45.7% females. Out of the 70 students used for the study, 19 students, with a percentage of 27.1%, were at the age of 12 years, 31 students, representing 44.3%, were at the age of 13 years, and 20 students with a percentage of 28.6% were at the age of 14 years. Also, from the overall student sample, 30 students, with a percentage of 42.9%, were in grade 7, and grade 8 and grade 9 recorded 20 students, representing 28.6% each. The grade category results show that many student respondents were in base 7 from the data above.

Table 2. The demographic background of teachers.

Factor	Category	Frequency	Percentage %
	Male	9	69.2%
Gender	**Female**	4	30.8%
	Total	**13**	**100%**
Factor	**Category**	**Frequency**	**Percentage %**
	<30 years	1	7.7%
Age	**30-40 years**	7	53.8%
	41-50 years	3	23.1%
	51-60 years	2	15.4%
	Total	**13**	**100%**
Factor	**Category**	**Frequency**	**Percentage %**
	<1 year	0	0%
Teaching	**1-5 years**	0	0%
Experience	**6-10 years**	5	38.5%

	>10 years	8	61.5%
	Total	**13**	**100%**
Factor	**Category**	**Frequency**	**Percentage %**
	Diploma	1	7.7%
	Bachelor's degree	12	92.3%
Academic	**Master's**	0	0%
Qualification	**PhD**	0	0%
	Total	**13**	**100%**

Table 2, which represents the demographic background of teachers used for the study, shows that out of the total number of teachers used (n=13), 9% of them, with a percentage of 69.2%, were males, compared to only 4 females representing 30.8%. There are more Chinese middle school mathematics teachers than their female colleagues. Based on the age factor of the teachers, only one (1) teacher was below the age of 30 years with a percentage of 7.7%, seven (7) teachers representing 53.8% were between the ages of 30-40 years, three (3) teachers representing 15.4% were also between the ages of 41-50 years and two (2) teachers representing 15.4% were also between the ages of 51-60 years. The majority of the Chinese middle school mathematics teachers used for the study are primarily in their young age, thus between the ages of 30 and 40 years, with a frequency of 7. Based on the teaching experience of the respondents, most of them had more than 10 years of teaching experience with 8(61.5%), followed by 6-10 years of teaching experience with 5(38.5%), teaching experience of <1 year, and between 1-5 years did not record any of the respondents in those categories with both having 0(0.%). Also, based on the academic qualifications, most of the teacher respondents had bachelor's degree qualifications with 12(92.3%), followed by diploma qualification with 1(7.7%). None of the teacher respondents used for the study had a master's degree or Ph.D. qualifications. Most Chinese middle school mathematics teachers mostly have bachelor's degree qualifications.

Table 3. Teachers' background information on ICT use.

Factor	**Category**	**Frequency**	**Percentage %**
Teaching	Traditional	4	30.8%
Preference	Modern (use of ICT)	9	69.2%
Style			
	Total	**13**	**100%**
Factor	**Category**	**Frequency**	**Percentage %**
Ability to	High	2	15.4%
Handle ICT	Medium	10	76.9%
In teaching	Low	1	7.7%
	Total	**13**	**100%**
Factor	**Category**	**Frequency**	**Percentage %**
	Overhead projecting system	2	15.4%
ICT tool used	Interactive whiteboard	10	76.9%
In teaching			
	Computers and ICT Software.	1	7.7%
	Graphing calculators, Video and camera equipment	0	0%
	Total	**13**	**100%**

From Table 3, which shows the teachers' background information on ICT use, most of the teachers 9(68.2%) use the modern method teaching style, that is, integrating ICT into their mathematics instruction as compared to 4(30.8%) teachers that still use traditional teaching method without ICT tools in the teaching process. On teachers' ability to handle ICT tools in teaching, 10(76.9%) of the teachers started to have medium ability to use ICT in their teaching as compared to 2(15.4%) and 1(7.7%) representing high and low ability to use ICT in teaching respectively. In Finding out teachers' type of ICT tools used in teaching, many of the teachers 10(76.9%) responded using an interactive whiteboard in their mathematics classroom. (15.4%) stated to use the overhead projecting system in their classroom, while 1(7.7%) uses other computer and ICT software in their mathematics teaching. These results show that many Chinese Middle School teachers have in-depth knowledge of using ICT in the mathematics classroom and beyond.

Table 4. Students' Perception on ICT Integration in Learning Mathematics.

N.	ITEMS	5	4	3	2	1	MEAN
		Frequency and Percentages (%)					
1	The school's ICT facilities are complete and used for my mathematics learning.	19 27 %	6 8.6 %	8 11.4 %	21 30 %	16 22.9%	2.87
2	Integrating ICT in mathematics classes has made me more creative and imaginative.	12 17.1 %	5 7.1 %	7 10 %	22 31.4%	24 34.3%	2.41
3	Integrating ICT in mathematics learning helps me find relevant mathematics knowledge and information.	9 12.9 %	8 11.4 %	6 8.6 %	18 25.7%	29 41.4%	2.29
4	Integrating ICT in mathematics teaching and learning helps me communicate with my classmates.	7 10 %	7 10%	12 17.1 %	16 22.9%	28 40 %	2.27
5	ICT integration in mathematics teaching can increase my confidence in taking mathematics courses.	5 7.1 %	7 10%	8 11.4 %	21 30 %	29 41.4%	2.11
6	I learn mathematics more effectively by using modern technologies such as computers.	10 14.3 %	4 5.7 %	9 12.9 %	17 24.3%	30 42.9%	2.24
7	The application of ICT in mathematics teaching helps to broaden my knowledge	12 17.1 %	6 8.6 %	6 8.6 %	17 24.3%	29 41.4%	2.36
8	Using advanced equipment such as computers in mathematics teaching and learning helps improve my ability to solve complex mathematical problems.	5 7.1 %	10 14.3 %	10 14.3 %	23 32.9%	22 31.4%	2.33
9	ICT integration teaching can better monitor students' learning.	9 12.9 %	6 8.6 %	7 10 %	21 30 %	27 38.6%	2.27
10	Using computers and ICT in mathematics teaching enabled me to express myself better.	9 12.9 %	4 5.7 %	11 15.7 %	17 24.3%	29 41.4%	2.24
11	Using multimedia presentations by teachers in mathematics teaching can provide me with a better learning experience.	9 12.9 %	9 12.9 %	3 4.3 %	19 27 %	30 42.9%	2.26

5-Likert scale ranged from 5= Strongly Disagree, 4 = Disagree, 3 = It Doesn't Matter 2= Agree, and 1 = Strongly Agree.

The results from Table 4, which examines the students' perception of ICT integration in learning mathematics, show that all three schools used for the study have complete ICT facilities for mathematics learning with a shared mean of 2.87. This finding indicates that the Chinese Government and Education Ministry have invested significantly in introducing ICT facilities in its middle school classrooms, enabling its usage by both students and teachers in the learning and teaching of mathematics. Many students believe that the ICT application in mathematics learning helps them find relevant mathematics applications and information, with a shared mean of 2.29, as shown in Table 4. Again, most students agree that ICT integration in mathematics teaching can increase their confidence in

mathematics courses, with a recorded shared mean of 2.11. They believe that it is the result of ICT integration in mathematics learning that broadens their knowledge of mathematics learning and its applications.

To investigate whether or not ICT integration helps students improve their ability to solve complex math problems, many students responded positively, stating that ICT integration in learning mathematics helps them solve more complex mathematics problems with a shared mean of 2.33. Also, the students agree that ICT integration in teaching can better monitor students' learning progress, which recorded a shared mean of 2.27. Many students also agree that using ICT or multimedia presentations by teachers in mathematics teaching can provide students with a better learning experience, with a shared mean of 2.26. In conclusion, the data shows that many students know the importance or usefulness of ICT integration in learning mathematics. Therefore, the integration of ICT should be encouraged in all middle school mathematics classrooms around the world.

Table 5. Effective elements in ICT integration and teachers' Perception of ICT Integration in Teaching Mathematics.

NO	ITEMS	5	4	3	2	1	MEAN
		Frequency and Percentages (%)					
1	My school has all the ICT facilities needed for teaching and learning mathematics.	0 0 %	1 7.7 %	1 7.7 %	7 53.8 %	4 30.8 %	1.92
2	My school has well-functioning ICT facilities and tools I can use in my mathematics teaching.	0 0 %	1 7.7 %	1 7.7 %	8 61.5 %	3 23.1 %	2.00
3	My school has a computer laboratory where I can send my students to practice when needed.	0 0 %	2 15.3%	2 15.3 %	7 53.8 %	2 15.3 %	2.31
4	Teachers have enough time to learn to integrate ICT into teaching.	0 0%	4 30.8%	0 0%	6 46.2 %	3 23.1 %	2.38
5	Teachers can freely design their teaching with the help of the ICT available in my school.	0 0 %	0 0 %	1 7.7 %	11 84.6 %	1 7.7 %	2.00
6	Using ICT makes teaching mathematics easier for me.	0 0 %	1 7.7 %	2 15.3 %	9 69.2 %	1 7.7 %	2.23
7	ICT-integrated teaching makes my students learn more effectively.	0 0 %	1 7.7 %	0 0 %	11 84.6 %	1 7.7 %	2.08
8	ICT integration helps teachers improve their teaching by using modern teaching materials.	0 0 %	0 0 %	1 7.7 %	10 76.9 %	2 15.3 %	1.92
9	ICT integration improves the quality of teachers' teaching.	0 0 %	2 15.3%	2 15.3 %	8 61.5 %	1 7.7 %	2.38
10	ICT tools help me as a teacher to prepare adequate resources such as mathematics teaching and learning materials.	0 0%	1 7.7%	3 23.1 %	7 53.8 %	2 15.3 %	2.23
11	ICT enables students to be more active and engaging during mathematics lessons.	0 0 %	1 7.7 %	3 23.1 %	7 53.8 %	2 15.3 %	2.23
12	I have more time to cater for students' needs when integrating ICT into my teaching	0 0 %	1 7.7 %	4 30.8 %	7 53.8 %	1 7.7 %	2.38

13	Mathematics teachers can teach effectively without using ICT during mathematics lessons.	0 0%	0 0%	2 15.3 %	9 69.2 %	2 15.3 %	2.00
14	ICT integration in teaching mathematics is time-consuming.	1 7.7 %	6 46.2%	4 30.8 %	2 15.3 %	0 0 %	3.46
15	Teachers struggle to manage the classroom when integrating ICT into their teaching.	1 7.7 %	8 61.5%	2 15.3 %	2 15.3 %	0 0 %	3.62

4.1.1 Teachers View On Effective Elements In ICT Integration

The results in Table 5 show that many ICT facilities needed to facilitate teaching and learning mathematics are available in many Chinese middle schools. The teachers also emphasized that the ICT facilities in their schools are functioning well and that they use them during mathematics lessons with a shared mean of 2.00. A well-equipped ICT laboratory in their schools where teachers send their students when the needs arise is also available in most Chinese schools, according to the data presented in Table 5, recording a shared mean of 2.31. Teachers in Chinese middle schools also agree that they can design their lessons with the ICT facilities available for effective teaching and learning with a share mean of 2.23. The teachers have more time to learn effectively using facilities and training provided on using the ICT facilities available in their schools for teaching and learning mathematics, with a shared mean of 2.38. Many Chinese middle school mathematics teachers have the needed ICT facilities and are up-to-date with ICT integration in their teaching.

4.1.2 Mathematics Teachers' Perception Of ICT Integration In Teaching Mathematics

The data shows that many teachers find it easier to teach mathematics using ICT in the instruction process, with a shared mean of 2.23. The teachers also believe that ICT-supported teaching improved students' learning with a shared mean of 2.08. Teachers also believe using ICT improves teaching quality and helps teachers with more updated teaching materials and contents, recording a shared mean of 1.92. Most teachers agreed that ICT makes students more active and engaging in the mathematics lesson, with a shared mean of 2.23. Therefore, teachers urged the management of schools to provide ICT facilities and encouraged teachers to incorporate or integrate ICT into their teaching process.

In many cases elsewhere, teachers think that integrating ICT into their teaching is time-consuming and wastes instructional time, but Chinese middle school mathematics teachers think otherwise. They believe that ICT integration into their teaching is not a waste of time but a helpful activity to incorporate during the mathematics lessons, showing a mean of 3.46. Shockingly, most teachers responded that they could also effectively teach without ICT since they can use different effective approaches to deliver their mathematics lessons, recording a shared mean of 2.00. These findings indicate that mathematics teachers must be free to plan their teaching, meet curriculum needs, and use ICT facilities and tools to help keep track of their students' progress.

Table 6. Impact of ICT Integration in Middle School Mathematics Teaching and Learning.

NO	**ITEM**	**5**	**4**	**3**	**2**	**1**	**MEAN**
		Frequency and Percentages (%)					
1	ICT makes students more creative and imaginative during a mathematics lesson	0 0%	0 0%	3 23.1 %	9 69.2%	1 7.7%	2.15

2	ICT integration in mathematics instruction helps students find knowledge and information related to mathematics.	0 0%	0 0%	2 15.3 %	10 76.9%	1 7.7%	2.08
3	ICT integration in mathematics teaching and learning helps students to communicate mathematics ideas effectively with their classmates.	0 0%	0 0%	1 7.7%	11 84.6%	1 7.7%	2.00
4	ICT integration in teaching and learning mathematics increases students' confidence to participate in mathematics class.	0 0%	2 15.3%	1 7.7%	9 61.5%	1 7.7%	2.31
5	My students learn mathematics more effectively using ICT in teaching them.	0 0%	2 15.3%	1 7.7%	8 69.2%	2 15.3 %	2.23
6	ICT integration in teaching and learning mathematics helps to broaden my student's knowledge of mathematics	0 0%	3 23.1%	1 7.7%	5 38.5%	4 30.8 %	2.23
7	ICT integration in mathematics teaching and learning helps to improve my student's ability to solve complex and tasking mathematics questions more easily	0 0%	2 15.3%	0 0%	9 69.2%	2 15.3 %	2.15
8	My students behave better and are easily controlled using ICT in the mathematics classroom.	0 0%	2 15.3%	3 23.1 %	7 53.8%	1 7.7%	2.46
9	ICT integration in mathematics in the classroom enables my students to express their ideas and thoughts better.	0 0%	2 15.3%	1 7.7%	8 61.5%	2 15.3 %	2.23
10	ICT integration in mathematics teaching and learning promotes active and engaging lessons for my students' best learning experience.	0 0%	1 7.7%	2 15.3 %	7 53.8%	3 23.1 %	2.08

Table 6, which presents the data on the Impact of ICT Integration in the teaching and learning of mathematics, indicates how the use of ICT in middle school mathematics instruction in China has a favorable impact on student performance as well as the performance of mathematics teachers. The teachers stated that integrating ICT into mathematics teaching and learning makes their students more creative and imaginative during the mathematics lesson, with a shared mean of 2.15. They also believe using ICT in mathematics teaching and learning helps students find relative knowledge and information in mathematics. ICT integration in mathematics teaching and learning increases students' confidence to participate more effectively in mathematics, with a shared mean of 2.31. Again, the data shows that ICT integration in mathematics teaching and learning helps students communicate more effectively with their classmates and the teachers during mathematics lessons, with a shared mean of 2.00, indicating that students can share mathematical ideas more effectively when teachers integrate ICT in the mathematics classroom.

The results in Table 6 also show that ICT-integrated mathematics lessons help broaden students' knowledge of mathematical ideas with a shared mean of 2.23. Also, using ICT in teaching and learning mathematics helps improve students' ability to solve tasks and complex mathematics problems more efficiently, recording a shared mean of 2.15. Many of the teachers believed that ICT-integrated mathematics lessons do not negatively influence the attitudinal behavior of the students in terms of disturbing the class and making it difficult to control the class as the lesson progresses, showing a shared mean of 2.46. Integrating ICT into the mathematics classroom and beyond is a good activity or teaching approach that needs to be encouraged in all Middle School Mathematics classrooms. ICT integration enables mathematics students to express their mathematical ideas or thoughts better during mathematics lessons. It also helps to promote active and engaging lessons for the students' best mathematics learning experiences, as well as helping to promote a learner-centered instruction approach since students participate actively during the lesson.

V. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1. Summary and Conclusion

The research study examined the impact of ICT integration on mathematics teaching and learning in Chinese middle schools.

The study's findings demonstrate that using ICT to teach and learn mathematics is more successful than conventional teaching techniques. An active mathematics learning environment that is more engaging and productive for teachers and students may be created by effectively utilizing ICT tools and ideas in the mathematics classroom. The study revealed that ICT use in instructional delivery was very high because most teachers in the sampled schools had received adequate ICT training to help them integrate ICT into their profession. According to the study's findings, there is a negative correlation between ICT use and teaching experience—that is, the older a teacher is, the less ICT integration they make. The degree of ICT integration into mathematics instruction depends critically on one's ability to use it. Most middle school math instructors in China who worked in the tested schools assessed their use of ICT tools for teaching mathematics as "very good." They also concurred that ICT enhances classroom management by encouraging students to behave better and pay closer attention in the mathematics classroom.

Moreover, the study indicates that using ICT in designing students' mathematics lessons makes students learn more effectively since ICT-integrated lessons are more engaging and exciting. The attitude and perception of mathematics teachers towards ICT integration influence their decision to use ICT in teaching mathematics in their mathematics lessons. Teachers have a positive attitude and perception towards using ICT in their teaching since they always integrate these ICT tools in their daily teaching and take students to the school laboratory to give them extra tuition on integrating ICT in mathematics. ICT enables students to become more creative and innovative as their knowledge paradigm broadens since ICT-integrated lesson gives students the confidence to speak more effectively and convey their views. The study shows that most Chinese Middle School Mathematics students use ICT in mathematics learning, reflecting their high performance in mathematics compared to their counterparts in other countries worldwide. ICT integration implementations must be adequate to ensure that teachers and students can use it. ICT integration in mathematics teaching and learning will be a huge success and benefit for teachers and students if the implementation process is carried out correctly with continuous maintenance of ICT-integrated facilities, as done in China.

Finally, ICT integration in mathematics classrooms needs serious consideration worldwide to increase students' knowledge and performance in mathematics. To enhance ICT integration in mathematics classrooms, governments and other educational stakeholders need to encourage teachers to integrate ICT into their mathematics lessons by providing teachers with the required ICT tools, infrastructure, and training to the teachers to make them more effective in the integration process. For education stakeholders to satisfy the requirement for 21st-century mathematics teaching abilities and promote successful mathematics learning, mathematics instructors must possess strong ICT skills and knowledge.

5.2. Recommendations

This study recommends that education stakeholders take action, make informed educational decisions, and form the foundation for further research.

1. To support the successful integration of ICT in the teaching and learning process, educational stakeholders should regularly allocate the necessary funds for the upkeep, replacement, and expansion of ICT infrastructure in all middle schools.
2. In collaboration with other agencies, such as Ministries of Education, curriculum developers must design or review existing mathematics curricula and syllabi to improve how mathematics teachers can integrate ICT more effectively.
3. Educational stakeholders should arrange for their mathematics instructors to participate in in-service training in professional development courses on integrating ICT in mathematics teaching and learning.
4. Other studies can focus on a comparison study to investigate the impact of ICT integration between Chinese and other countries' middle schools on mathematics teaching and learning to ascertain the similarities and differences.
5. It is also highly recommended that a comparison study be conducted between Chinese middle schools and other Chinese educational levels on the impact of ICT integration in teaching and learning mathematics to see if the findings are similar or otherwise in all Chinese mathematics classrooms.

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