T.C.

BAHCESEHIR UNIVERSITY

GRADUATE SCHOOL OF EDUCATION

THE DEPARTMENT OF EDUCATIONAL SCIENCES

THE IMPACT OF USING ONLINE VIDEOS IN TEACHING MATHEMATICS TO FIVE-YEAR BILINGUAL STUDENTS

MASTER'S THESIS

BAHAR GHELICHI

ISTANBUL 2023

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THESIS ADVISOR

ASST. PROF. GÜRSU AŞIK

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	Title, Name	**Institution**	**Signature**
Thesis Advisor	Asst. Prof. Gürsu Aşık	Bahçesehir University	
2nd Member	Asst. Prof. Defne Yabaş	Bahçesehir University	
3rd Member (Outside Institution)	Assoc. Prof. Mehmet Başaran	Gaziantep University	

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Surname: Bahar Ghelichi

Signature:

ABSTRACT

THE IMPACT OF USING ONLINE VIDEOS IN TEACHING MATHEMATICS TO FIVE-YEAR BILINGUAL STUDENTS

Ghelichi, Bahar
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The present study aims to determine whether watching online videos has a statistically significant effect on the mathematical understanding of shapes and numbers of bilingual five-year-old children who were taught in kindergarten. Therefore, this study used a quantitative method and there were 37 participants in both control and experimental groups. The experimental group watched selected YouTube videos focusing on numbers and shapes, while the control group followed their usual routines. The treatment of the experimental group consisted of three instructional sessions per week, spanning a period of six weeks. The students had been asked to answer verbal questions in individual sessions before and after treatment and was recorded as their pretest and posttest. The findings indicate that the treatment, exposure to educational videos, leads to a significant improvement in the mathematical understanding of shapes and numbers among learners. The analysis using ANCOVA and independent sample t-test reveals that the experimental group demonstrates a higher level of achievement compared to the control group.

Keywords: Early Childhood Education, Bilingual Learning, Mathematics Education, Use of Online Videos

ÖZ

BEŞ YAŞ GRUBU İKİ DİLLİ ÖĞRENCİLERE MATEMATİK ÖĞRETİMİNDE ÇEVRİMİÇİ VİDEOLARIN KULLANIMININ ETKİSİ

Ghelichi, Bahar
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Bu çalışmanın amacı, okul öncesi grubunda iki dilli eğitim gören beş yaş grubu çocukların geometrik şekil ve sayı algılarının gelişimi üzerinde çevrim içi eğitici videolar izlemelerinin etkisinin olup olmadığını araştırmaktır. Çalışmada nicel bir yöntem kullanılmıştır. Deney ve kontrol gruplarında toplam 37 çocuk yer almaktadır. Deney grubunda yer alan çocukların matematik öğrenimi şekil ve sayılara odaklanan belirlenmiş videolar ile desteklenirken, kontrol grubunda yer alan çocuklar rutin sınıf içi öğrenme süreçlerine devam etmişlerdir. Deney grubunda yapılan müdahale programı, altı haftalık bir süreyi kapsayan ve haftada üç ders saati olarak ilerlemiştir. Deneysel müdahale programının uygulanması öncesi ve sonrasında, tüm katılımcılardan bire bir oturumlarda sorulan soruları cevaplamaları istenmiş ve verdikleri cevaplar ön-test ve son-test olarak kaydedilmiştir. Ön-test ve son-test karşılaştırmaları için ANCOVA analizi kullanılmıştır. Bulgular, eğitici videoların kullanıldığı sınıftaki çocukların kontrol grubunda yer alan çocuklardan şekil ve sayı algısında daha iyi performans gösterdiğini ortaya koymuştur. Sonuçlar erken yaş gruplarındaki çocuklara matematik öğretiminin, çocukların dikkatini çekecek ve farkındalıklarını arttıracak eğitsel videolar ile desteklenmesinin olumlu katkı sağlayacağını göstermektedir.

Anahtar Kelimeler: Okul Öncesi Eğitim, İki Dilli Öğrenim, Matematik Eğitimi, Çevrimiçi Video Kullanımı

TO MY LOVING HUSBAND,

Nemat,

for his unwavering support and belief in me

AND TO MY EMPOWERING PARENTS,

Jamileh and Majid

who taught me that anything is possible

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LIST OF ABBREVIATIONS

ASD	Autism Spectrum Disorder
ELL	English Language Learners
ICT	Information and Communication Technology
L1	First Language
L2	Second Language
TC	Teacher Candidates
VBI	Video-Based Instruction
VBL	Video-Based Learning
VLAM	Video Lesson Analysis Method

Chapter 1
Introduction

Kindergarten is the beginning of formal classroom instruction for the majority of youngsters. Even for children who have previously attended childcare, the change is significant. Among all challenges that a kindergarten student experiences, introduction to math is one of the confusing ones. It is crucial to help young kids to develop mathematical thinking because math is essential. Among preschool-age kids, early math ability predicts future academic success more accurately than early reading or attention skills. Each of these mathematical possibilities can be utilized to improve math abilities. The challenge of introducing to math in kindergarten becomes more complicated when math should be taught in the student's non-native language. Given the importance of communication in the formation of knowledge, language plays an important and critical role in teaching and learning mathematics (Boulet, 2007).

On the other hand, multimedia content especially educational videos contribute to the variation and improvement of the learning process, as well as improved knowledge retention. Students are more engaged with the content if they watch informative videos. For English-language learners, multimedia-enhanced education has a beneficial effect on a measure of general vocabulary knowledge (Silverman & Hines, 2009).

It is worth stating at this point that the overview of information and communication technologies for children at kindergartens for a long time has been a striking point and also a controversial issue among researchers. Computer-aided learning has become more realistic than it once was as a result of the rapidly evolving emergence of computers into the educational real world of the western community and the influence of related research, progressively displacing any early resistance reactions toward the use of information, and communication technologies in an educational atmosphere. For kids in kindergarten and elementary school, a diverse range of applications is now more progressively acknowledged as developmentally adequate instructional materials (Druin & Fast, 2002; Plowman & Stephen, 2003). However, recent researchers have broadened the definition of the phrase "information and communication technologies" to include mobile technologies integrated into a

variety of devices in addition to the desktop computer (Gjelaj, 2013; Plowman & Stephen, 2005) like electronic tablets, electronic toys, smart games, digital cameras, and smart mobile devices (Voithofer, 2005).

Teaching of math is an important and serious element of education all around the world. Math and related subjects like known science, art, engineering, etc., bring up critical thinking and reasoning abilities required to gain employment in some of the fastest expanding fields, including computer science and engineering (Ebosele, 2012).

It seems that the capability to apply higher level thinking is also required to address national and international problems on the one hand and on the other hand it needed advanced knowledge across disciplines (Dossey, McCrone, & Halvorsen, 2016). Walters et al. (2014) in their studies mention that mathematics also emphasizes the development of problem-solving abilities, creative and collaborative thinking, and other talents that are highly sought after by employers across all industries. Consequently, excellent mathematics instruction probably prepares students for the next level of their education and enables them to participate in and face challenges in vocations across the international community (Dossey, McCrone, & Halvorsen, 2016).

Mathematics instruction is undeniably crucial for students' preparedness for higher education and their future careers (Smith, 2018). Particularly in kindergarten, where formal classroom education begins for most children, mathematics holds a foundational role. It is of utmost importance to support young learners in developing their thinking abilities during this critical stage. By providing primary and academic knowledge in math, we can significantly enhance the academic achievements of kindergarten-aged children (Johnson et al., 2020).

1.1 Statement of the Problem

Kindergarten students do not have a clear understanding of math and they need specialized training to improve their understanding of math, comprehension of numbers, and support their learning and understanding. It is crucial that instructors modify relevant content to address these requirements. However, direct and understandable educational training and the use of technology have been studied as ways to increase theoretical success and academic participation. There are many studies to support and integrate education through technology and compare it with

traditional methods. However, few studies have been conducted on bilingual students. Therefore, this study examined these cases that have been less discussed.

Today, gadget devices are especially popular with people all around the world, and children and students also find the use of these tools effective in improving their education. For example, Smith and Basham (2014) mentioned that mobile gadgets like iPads and Kindles are becoming more and more common in math lessons as teaching aids.

It is quite obvious that technology is growing rapidly and this growth has gone into the educational system and we cannot ignore the effects and influence of these devices in the educational system. Tetzlaff (2017) in his study indicated that several papers endorse the use of mobile devices to improve mathematics instruction and learner educational performance.

Although technology education has rapidly entered the education system around the world, its impact and comparison with previous methods in terms of increasing students' engagement and performance have received limited attention. Additionally, there is a lack of information regarding studies conducted on bilingual students, their utilization of technology, and the effects of technology on their academic performance.

Language is believed to be a crucial tool for young children in learning and developing their understanding of numbers (Purpura, Napoli, Wehrspann, & Gold, 2016; Spelke, 2003). It is used as a teaching instrument in classrooms. Research by Foster et al. (2018) has shown through experimental studies that English language scores at the beginning of schooling can be indicative of subsequent growth in English math exam scores up to the ninth grade. However, it is evident that there is a lack of research that specifically focuses on bilingual preschool children when assessing their mathematics achievements in kindergarten.

Kleemans, Segers, and Verhoeven (2011) have proved in their studies that second language (L2) phonological consciousness, as well as grammatical skills, are related to L2 logical operations skills and calculation skills in a sample of bilingual Turkish and Moroccan (students' first language – L1) speaking kindergarten students learning Dutch (students' L2). In other research, which was done on Canadian students, Romano et al. (2010) showed that for students whose first language was French, English vocabulary in kindergarten predicted English math proficiency in the third

grade. Also, they indicated that bilingual kids' L2 mathematics outcomes depend on L2 language skills. In the end, they have concluded that it can be accepted that second language skills at school can have an impact on students' mathematics results at the end of kindergarten.

To illustrate the goal of our study one needs to refer to another issue that is important in this study. One of the most striking features of our study's goal is the effect of the online videos and internet-based system on bilingual kindergarten students. It is obvious that today's technology may make it much easier to complete all of the objectives of the preschool curriculum. This includes using the internet and online systems. Also, if the offered developmentally suitable software products are included in suitable pedagogical scenarios (Zaranis & Kalogiannakis, 2011).

The usage of computers in kindergarten is regarded as primarily a learning activity, in addition to serving an educational purpose, although the average child will see it more as a game. We firmly believe that concentrating our study on meaningful learning through play is essential, as do many other academics working in both formal and informal contexts. It should also be pointed out that according to Plowman and Stephen (2005) and also Zaranis (2012) it is more than beneficial to employ this teaching and learning approach to help kindergarten and elementary school students meet their academic goals. Hence, the online world allows students to get accustomed to the new system and serves as a tool for research, interaction, comprehension, and learning. Zaranis (2011) compared the learning effects of computer-based instruction with mathematical theme instruction in the field of mathematics, focusing in particular on the teaching of "Realistic Mathematics" to Greek Kindergarten students between the ages of four and six. In his studies, he came to the conclusion that compared to the traditional subject teaching method, learning with the help of computers and modern internet systems can significantly boost the development of mathematical abilities and the formation of a richer perceptual capacity for students (Zaranis, 2011; Zaranis & Kalogiannakis, 2011b).

In this study, we want to see if and how online videos mixed with traditional teaching methods can help kindergarten students improve their math skills. To do this important we will use online YouTube videos and explore their effect on bilingual students in age 5 in a private school.

1.2 Purpose of the Study

The purpose of this research study is to examine and evaluate the impact of integrating YouTube videos as a technological component in kindergarten classrooms, specifically focusing on bilingual students. The primary aim is to gain a comprehensive understanding of the features and effects associated with the implementation of technology within kindergartens, with a specific emphasis on investigating its effectiveness as an educational tool. By utilizing online videos, specifically YouTube videos, and investigating their influence on bilingual 5-year-old students in a private school environment, the study intends to analyze the consequences of incorporating these videos in the teaching and learning processes of numerical concepts and geometric shapes among bilingual kindergarten students.

The current research aims to provide valuable insights into the integration of technology, specifically YouTube videos, as a pedagogical tool in kindergarten classrooms, thereby it can be found useful by educators, policymakers, and researchers to use its implications for the teaching and learning of numerical concepts and geometric shapes among bilingual kindergarten students.

1.3 Hypotheses/Research Questions

The present study sought to investigate the following research question:
Does the use of online videos have a statistically significant effect on the mathematics learning of five-year-old bilingual students?

1.4 Significance of the Study

The significance of this study lies in its examination of technology-based education, particularly through the use of educational videos, and its impact on bilingual kindergarten students. While previous research has compared technology-based education to traditional methods, there is limited research specifically focusing on bilingual kindergarteners. This study is an effort to fill this gap and contributes to the existing knowledge in the field.

The study addresses the prevailing belief that technology-enabled education, particularly educational videos, plays a crucial role in students' academic progress. By empirically examining the effects of technology-mediated instruction on student

learning outcomes, the study provides evidence to support or challenge this belief.

Moreover, technology-based education allows for individualized instruction, catering to the diverse needs of students from different backgrounds. The adaptability of multimedia presentations, including authentic content, enhances academic achievement, thereby increasing students' potential for success.

The findings of this study can have implications for comparing effective models in educational settings for bilingual students and teachers. Additionally, it has the potential to contribute to help curriculum creators and material designers benefit its results in generating impactful and engaging materials.

In summary, this study's significance lies in its contribution to understanding the impact of technology-based education on bilingual kindergarten students and its implications for educators, designers, and policymakers.

1.5 Definitions

Classroom instruction: Learning through lectures, study materials, classroom discussions, school books, or other organized formal education tools, such as video, closed circuit, or other forms of electronic implies, is referred to as classroom instruction. This is in contrast to individual teaching that occurs during on-the-job education or training (Smith, 2018).

Second language students: Any language that a person uses besides their first or mother tongue is considered their second language. Modern linguists and educators typically use the terms L1 and L2 to designate a first or native language and a second language or a foreign language that is being studied, respectively. L2 learners and L2 users are not always the same. For practical purposes, language users make use of whatever linguistic materials they have. Language students are developing a framework for future usage. (Nordquist, 2020).

Bilingual: A person who communicates in two or more languages is referred to by this phrase, typically from an early age or through extensive exposure and practice in both languages. (Franson, 2009; Grosjean, 2013)

Technology: The technology term referred to in this study mentions to the technology used in education which refers to the utilization of digital tools, multimedia, and platforms to enhance teaching and learning processes in educational

settings. Also, as an umbrella term, educational technology, encompasses the systematic application of scientific knowledge, pedagogical theories, and technical expertise to support and enhance educational practices. It involves the use of technology to create interactive learning environments, deliver educational content, foster collaboration and communication, personalize instruction, and provide access to educational resources beyond traditional classroom boundaries. The incorporation of technology in education aims to promote student-centered learning, digital literacy, critical thinking skills, and prepare students for the digital age.

Traditional teaching: The sole information source in the classroom in traditional teaching methods was indeed the teacher. It emphasizes the principle of a teacher-centered approach incorporating in-person communication, mainly between the teacher and the student (Babic and Nedelko, 2020).

Chapter 2
Literature Review

2.1 Theoretical Framework

This chapter provides a comprehensive exploration of the theoretical foundations that inform the present study and offers a review of relevant research. Within this chapter, particular attention is devoted to investigating the phenomenon of bilingualism and its implications for the learning process of bilingual students, with a specific focus on the influence of the environment and input. Additionally, the research related to acquisition of mathematical knowledge among second language learners, focused on the details of this process have been studied. Moreover, the chapter explores the researches of the effects and effectiveness of including technological tools, particularly online videos, in educational settings. By examining these critical areas of inquiry, this chapter contributes to the existing body of knowledge, trying to offer an insight of bilingual education, mathematics learning, and the impact of technology on educational practices.

2.1.1 Technology and Education. The initial technology for distance learning was print. It made it possible to widely disseminate instructional resources at a reasonably fair cost (Nipper, 1989). Yet, by providing a wide range of text-based apps that permitted two-way interaction between educators and learners, Computer Mediated Communication tools (CMC) fundamentally transformed the scenario. Settings built on two-way text offer a variety of chances for identification mediating. On the one side, users cannot rely on their beneficial non-verbal cues to interact with others due to their solely spoken character. Nonetheless, they do provide consumers the option to directly define the personality traits they wish to assert. While having this chance may be beneficial, if the user has sufficient writing skills, it can also have the disadvantage of inhibiting users from expressing aspects of their personalities that they may want to express. For the actors, presenting themselves as intellectual or sympathetic to others leads to a dilemma. Self-promotion in any form increases the likelihood of alienating others. Thus, likeability declines as demonstrated skill rises (Chester & Bretherton, 2007).

Teacher candidates (TCs) can examine education using video-based instruction, which uses technology to record scenes and films of teacher instruction (Harn & Meline, 2019). As they can pause, rewind, or revisit videos until they have understood the subject, learners can control their own learning when they employ them for education. This method, according to Kuiper, Carver, Posner, and Everson (2015), allows students to continue at their own pace, which implies they "can dramatically impact the pace of the course" (p256). For learners with special needs, who can watch the video as many times as necessary to guarantee accomplishment, this has tremendous ramifications (Plavnick, Sam, Hume, & Odom, 2013). With the help of numerous, affordable, and readily accessible technologies, picture, and video technology have substantially improved education over the past 20 years. A beneficial environment for teaching and learning has been created by affordable, functional software and hardware that can keep and broadcast educational videos. Moreover, multimedia platforms give educators the chance to connect techniques and processes used in education and support both instructors and learners in achieving specific learning objectives. Instructors can "break set" (Putnam & Borko, 2000, p. 6) from their regular teaching routines by using video to slow down educational interactions, carefully evaluate what transpired, and concentrate on specific individual ideas, learning encounters, or teaching techniques. Videos can be studied by educators as a technique to improve both their own and other teachers' lessons. These characteristics make video an excellent instrument to aid in the growth of instructor awareness (Sherin & van Es, 2005).

2.1.2 Bilingualism. At first, it should be pointed out that in the definition and review of the definitions of bilingualism and bilingual speaker, it is not possible to find a global consensus and express a complete and accurate definition in this case. But it should be considered that language ability is a crucial consideration for defining bilingualism, which causes numerous disputes and conflicts. Linguists at one end of the spectrum claim that bilingualism is the capacity to generate whole, relevant statements in the other language (Haugen, 1953, as cited in Mackey, 2000). According to the given criteria, a natural English speaker who travels to France and orders a meal in French can be claimed to be bilingual even though he has no prior knowledge of

another language. Diebold (1964), as cited in Romaine (1995), is even more radical, referring to the early phases of language communication between two speakers as incipient bilingualism. According to this description, a person may be considered an early-stage bilingual if they knew a word in a different language. The phrase used by Diebold also takes into account the possibility that a speaker may be able to comprehend words spoken in a different language but be unable to generate fully coherent sentences.

2.1.3 The Bilingual Child, Environment and Input. It seems that for bilinguals who learned their language in childhood, the characteristics and conditions of bilingualism are completely different, and these unique characteristics determine whether these languages are acquired simultaneously or sequentially. Vihman and Laughlin (1982), as cited in Lanza (1997) distinguish between the home or family and the society as the two primary environments in which a child may learn a language, as well as between three different kind of language data input: the use of one language by each caregiver, mixed use by all caregivers, and environment-bound language, in which one language is utilized in the home and another in the society.

By creating six categories of bilingual kids based on elements like the languages of the family and the society, Romaine (1995) broadens on these classifications.

The parents of the "One Person, One Language" child speak different native tongues, yet they are all at least reasonably proficient in one another's tongues. It can be said that the community's primary language is that of one of the parents, but from the moment the kid is born, both parents speak their own language to him or her. The kid who lives in a "Non-dominant Home Language/One Language One Environment" household also has parents whose native tongues are distinct from one another, with one of those languages being the community's primary tongue. The children are entirely exposed to the dominant language only during their time outside the family, despite the fact that both parents speak the nondominant language to them. In the "Double Non-dominant Home Language without Community Support" scenario, the parents speak their respective native tongues to the child from birth, just like in the "One Person, One Language" scenario. The main distinction is that the society's dominant tongue is not either of the parents' native tongues. The parents of the child

with "Nondominant Home Language without Community Support" speak the same tongue and also communicate with him or her in their home tongue, but the society's primary language is not the parents'. The fifth category identified by Romaine (1995) is known as "Non-native Parents," in which both parents speak their native tongues and the society's dominant language is also their native tongue, but one parent consistently communicates with the kid in a language that is not their native tongue. Lastly, there is the "Mixed languages" scenario, in which the parents code-switch and speak in multiple languages while simultaneously in some parts of society, people may be bilingual.

2.1.4 Mathematics and Language and Bilingualism. Planning mathematics teaching for children who are English Learners (ELs) and/or bilingual requires an awareness of the connection between language and math learning. We need to first look at the perspectives of bilingual mathematics students and how they use language to communicate quantitatively before we can answer problems about education for this demographic (Moschkovich, 2007).

One perspective on bilingual math students is that learning vocabulary is their biggest obstacle, in fact, their biggest obstacle is learning vocabulary. This view considers learning mathematics as a kind of stimulus for language learning, that is, according to a specific subject, people get the opportunity to learn new vocabulary. Initial studies on bilingual mathematicians shared this perspective and were primarily concerned with how learners translated traditional word problems from English to math symbols or grasped specific vocabulary phrases. (Cuevas, 1983). Vocabulary and reading skills have also been highlighted in guidelines for mathematics instruction for English language students (Dale & Cuevas, 1987).

It seems that in the past, focusing attention on vocabulary and understanding mathematics was considered necessary, but today such a perspective does not match with math and learning activities. Nowadays, numerical calculations, classic word problems, textbook reading, and worksheet filling are rarely the main task in math classes. Today, learners participate in presenting arguments and solving problems and use their opinions and views to learn in the mathematical process and participate in these discussions in a practical and physical way. As a result, these days, a view that

underlines only vocabulary and understanding of traditional mathematics content cannot have a proper way in the learning process. Learning a mathematical language requires more than just learning vocabulary, even in old - fashioned classrooms where there may not be much oral discussion. Words have various definitions and definitions that vary depending on the context, so mastering a mathematical language necessitates knowing when to use various meanings. Building vocabulary is undoubtedly a part of improving reading comprehension at the word level, along with decoding. But having a good vocabulary knowledge is insufficient to become a proficient reader. Reading comprehension requires abilities beyond word-level reading, including the ability to generate meaning from the material, use higher cognitive techniques, and engage in academic language practices (Pressley, 2000).

If we want to focus only on vocabulary, we will have a limited view of mathematical properties and connections. Therefore, such a view can have a negative and destructive effect on the education of bilingual people. On the other hand, the skill and proficiency of the teachers in the language can have a significant impact on the learning process of bilingual people. If we limit language only to words, in this case we have also limited the range of communication activities used in the process of learning mathematics. Therefore, this view can limit the learning of bilingual students and have a negative effect on students' access to math education. In this case, language learners may have less mathematical vocabulary or rather more vocabulary than native speakers (Sipra, 2013).

Therefore, we can consider this problem as a kind of imperfection. Vocabulary need not be viewed as a tool that bilingual learners need to learn more vocabulary before they can learn math skills. It is not necessary to view vocabulary as a defect, a justification for remedial training, or a need that bilingual students must meet before they may engage in more conceptual or higher mathematical education (Sibold, 2011).

How to function and plan in teaching mathematics is one of the most important things in schooling mathematics. Students, most of the time, are facing problems to learn math issues, and a specific program can make these matters easier for students. Weak educational efficiency in math is a significant problem since many students find it difficult to understand the crucial mathematical ideas that are being taught to them. (Ministry of Education, Jamaica, 2014). Language is an essential component of

instruction and learning. (DiCerbo, Anstrom, Baker, & Rivera, 2014). Therefore, this issue itself can be a kind of information transfer tool through which the teacher can easily find out whether the students can understand the concepts and materials taught or whether the understanding of these materials in this way is difficult for them. Therefore, one of the most important elements in creating comprehension in a 21st-century math classroom is communication. Star and Stylianides (2013) stated that mathematical thinking is built on conceptual comprehension and procedural expertise. So, a wider spectrum of mathematical discourse that involves conceptual and procedural comprehension would be helpful for teaching methods.

Alt et al., (2014) noted that the achievement of English Language Learners (ELL) learners will decrease as math problems' language complexity increases. Things have written using the specific vocabulary of mathematics decrease ELLs' performance. Haag et al. (2013) noted that language proficiency among ELL students affects their performance on math standardized exams. Greer and Mukhopadhyay (2015) noted that only when mathematics is deeply embedded within historical, cultural, social, and political contexts, it does make meaning. Cho, Yang, and Mandracchia (2015) stated that new methods for educating ELLs involve experiential learning, protected instruction, and specifically intentional English language instruction. Brantlinger (2014) suggested that academic language can make math problems more challenging for ELLs, therefore math discussion comprising clarification, debate, and justification of mathematical concepts should be a key trait of a successful mathematics classroom experience.

Language influences how learners understand mathematical concepts, according to Vukovic and Lesaux (2013). Their study's findings demonstrated that without paying attention to language, human communication techniques, knowledge, and abilities acquired over time are crucial for the development of math. These results suggest that ELL students require more in-depth and targeted chances to build a knowledge of fundamental mathematics ideas and principles. Language proficiency is a significant component of academic success according to Zhu, Chen, Moyzis, Dong, and Lin (2015). Math competency is also essential to academic accomplishment. We can perhaps go further and mention that several teachers struggle to balance teachings in both literacy and content knowledge because they possess little to no experience

teaching mathematics to ELL learners. (Bunch, 2013). According to Kanno and Cromley (2013), ELLs are not in a good situation when they join postsecondary education since they are less proficient in the English language and their teachers don't understand their culture. Therefore, in many classrooms, Imperfect classroom training restricts ELL students' chances of acquiring math in many classes (Valle, Waxman, Diaz, & Padrón, 2013).

According to Guglielmi (2012), there has been significant debate about how to educate English language learners most effectively. ELLs will perform better academically if their native language is integrated into math learning and instruction. It is impossible to teach math material to students who are unable to comprehend the English language according to Delli Carpini and Alonso (2014). It's mentioned in their study that the fact that Jamaica's student population is multiracial and intellectually diverse adds to the difficulties faced by math instructors. Sarama, Lange, Clements, and Wolfe (2012) suggested that students who do not have a high social status in society, in other words, are poor and belong to ethnic and regional minority groups in a region with a specific language, cannot progress in their studies like normal people. In Jamaica, academic establishments are having trouble implementing policy frameworks due to a lack of appropriate funding and PD support (Williams & Staulters, 2014). Academic standards in 21st-century classrooms, according to Bunch (2013), place more expectations on teachers in terms of language proficiency.

Making math teachers prepared to include and help ELLs in the math class as they attempt to improve mathematical understanding might be justified by demonstrating to them how to communicate effectively. As Valle, Waxman, Diaz, and Padrón (2013) mentioned, math teachers must employ instructional strategies to build an educational and training setting that is accommodating to ELL students' learning preferences in order to foster math competency. It's important for teachers to dispel the myth that mathematics is a language that everyone can understand. Alternatively, advocate for strategies that will assist all ELL students to succeed more in mathematics.

2.1.5 Youth's Math Knowledge. Mathematics plays a crucial role in the development and education of children, offering a multitude of benefits that extend

beyond numerical proficiency. It provides a foundation for logical reasoning, critical thinking, problem-solving, and analytical skills, which are essential in various aspects of life. Mathematics education enables children to develop abstract thinking abilities and enhances their spatial awareness and pattern recognition skills. Moreover, it fosters precision, attention to detail, and the ability to think systematically, all of which are transferable skills applicable to other subjects and real-life situations. As emphasized by the National Council of Teachers of Mathematics (NCTM, 2000), mathematics equips children with the necessary tools to make sense of the world around them, make informed decisions, and engage in quantitative reasoning. By developing a strong mathematical foundation in childhood, children are better prepared for future educational pursuits and career opportunities (Gilligan, Hodgkiss, Thomas, & Farran, 2019).

Three statistically noteworthiness developmental pathways for number perception have been identified by researchers from the beginning of US preschool and the midway of first grade. Kids who begin preschool at a high level and stay there, kids who begin preschool at a low to medium level but begin to display sharp development in the middle of the year, and kids who begin preschool at a poor stage and experience tiny development, according to Jordan et al. (2006) and 2007. Kids from low-income families were found to be more prevalent in the last category, which had low performance and development, whereas they were underrepresented in the other two.

Furthermore, longitudinal research showed that number sense development and performance in US kindergartners explain 66% of the variance in first-grade math success (Jordan et al., 2007). Different factors such as people's social status, gender, age, ability to read and learn, etc., are involved in learning and developing mathematical knowledge.

Despite the fact that the literature on early math treatments has gotten very little emphasis (Gersten et al., 2005), studies that have been conducted have provided intuition into who may be at risk for math learning difficulties. Number sense seems to be changeable, and young kids likely advantage from direct help in expressing, assessing, and ranking tiny numbers, as well as in joining and separating sets of more or less (Fuson, 1992; NCTM, 2006).

Studies show that activities such as various games in the classroom help children gain meaningful knowledge about mathematical equations and increase their learning progress. However, this claim needs to be tested through randomized controlled studies of number sense interventions. Our number sense installment should be useful for reliable monitoring of progress and response to targeted interventions.

2.1.6 Multi Media's Impact on Teaching Techniques. Castells (2010) claims, through social media, people can converse verbally and visually. A straightforward statement that is tied to an image has the maximum impact. Social media undermines traditional media and other data exchange methods, enabling anybody to share ideas and thoughts with a worldwide audience for the first time. Platforms like YouTube, Facebook, and Twitter have made it possible for activists worldwide to broadcast events live to large online viewers. The most popular way to instruct learners is through online presentations of instructional methods. It improves learners' comprehension, interaction, and confidence more than acquiring those abilities in lectures. (Packer et al, 1999). Some research has examined a variety of teaching and skill-development methods, including tutorial videos. Learners differ in their learning preferences and how they interpret information. Learners' cognitive and psychomotor abilities improved along with their memory when educational videos were used along with traditional classroom instruction (Wong et al, 2019).

2.1.7 Literature Review on Related Studies. The use of video and digital systems is a decent tool for various activities, including training in education. This tool allows the observable items in the learning interactions to proceed slowly and thus makes the details of the instructional items to be considered as well. Today, due to the advances that have been made in the field of technology and digital, the features of video programs have also been strengthened. Therefore, videos can be considered as a suitable and cost-effective tool in supporting teachers and education system.

In their study, Santagata et al. (2021) concentrated on the mathematics teacher's development of observational skills through a comprehensive review of studies of the video-based curricula. This study evaluates the research on teacher-centered mathematics programs that have been done over the past 20 years and discovers that

video is used as a support tool for teacher learning. Articles that had been studied were found and categorized into three categories: first, theoretical viewpoints, second, usage of video technology, and last research topics and techniques. Only a small number of the studies examined in-service instructors; the majority dealt with pre-service educators. Most programs' creators adopted a psychological viewpoint and put an emphasis on the presence/comprehension and interpretation/reasoning facets of attention. Only a small number of research used video-based software, grouping, and even smaller numbers used randomized grouping. Today, it is quite clear that the use of video technologies in the education system has increased and accelerated due to the widespread use of various tools in technology, as well as the increase of users on the Internet and free and extensive online searches. Instructional videos available on the Internet are increasingly popular with students and teachers because of their variety of effects. In addition to being effective in student learning, these tools have proven that video-based learning is a powerful tool for teachers and students in developing learning.

In their study titled "Video-based learning (VBL) history, present, and future," Sablic et al. (2021) looked into the Studies Published from 2008 to 2019. In order to better inform instructors and other educational professionals on the advantages of video-based learning, this project will examine published research on the topic. Additionally, this study offers video-based learning opportunities that can enhance both student and instructor learning and the overall classroom environment. In this review, thirty-nine papers were chosen and grouped into three categories: instructor professional development, student learning achievements, and teacher observation and evaluation. The examination of this study results to the idea that online practice-based discussion encourages teachers to consider their views, attitudes, and instructional strategies in a group setting. A detailed plan of action and a transparent execution procedure are essential for the complex process of video production.

The effectiveness of alternative math lessons vs conventional instruction was investigated by Alzabut (2017). This study looked at 225 mathematics courses to see how well different math instructions performed compared to the conventional educational strategy. In order to aid learner-teachers in determining the best efficient methods of instruction, he intended to give an overview of a few prospective

interactive math lessons. In differential equations, he assumed that combining various forms of instruction, such as using web-based resources and applying the flipped classroom, in addition to the traditional approach would assist to minimize all of its drawbacks. Lessons are more fun and engaging, and learners pay more attention.

In their study, Hughes and Yakubova (2018) summarized research on the use of video-based instruction (VBI) to teach math to learners with autism spectrum disorder (ASD). The results demonstrated that VBI had strong evidence supporting its beneficial benefits across VBI kinds, learner characteristics, and math subjects. Both behavioral and academic elements included efficient treatments, which had a solid research base.

In their 2009 study, Alsawie and Alghazo examined how a video-based method affected futuristic teachers' capacity to evaluate math instruction. This intervention project examines the impact of the Video Lesson Analysis Method (VLAM) on the aspiring middle-level and high-school math instructors' capacity to evaluate math instruction. 26 ambitious female math instructors from the United Arab Emirates University who were registered in a method curriculum made up the research sample. The volunteers were split equally between the two groups—one experimental and one control. In the course of the semester, 10 video lessons were examined by the experimental group. Through the use of blackboard technology, members of the group communicated through discussion forums. Two video lessons were recorded by each analysis group: one before and one after the treatment program. The treatment was found to have had a considerable positive impact on the experimental group's capacity for mathematical analysis, whereas the control group's capacity showed only little improvement.

The study conducted by Clements and Sarama (2009), focused on learning trajectories in early mathematics. The researchers aimed to understand the natural developmental progressions that children follow in learning math and how educators can use this knowledge to create effective and developmentally appropriate learning environments. The study identified three main components of learning trajectories: mathematical goals, developmental paths, and instructional activities. The mathematical goals were based on important concepts and skills in mathematics, such as counting and geometric shapes. The developmental paths described the typical

progression of children's understanding and skill development in these mathematical topics. The instructional activities were designed to match each level of thinking in the developmental progression and help children develop higher levels of thinking. The researchers provided examples of instructional tasks for different levels of counting proficiency. The study highlighted the potential of learning trajectories to improve professional development and teaching in early mathematics, but also acknowledged the need for further research and exploration in this area.

Gavin and Casa (2013), in their study aimed to develop a community of student mathematicians by providing teachers with tools to support students' mathematical communication skills. The study consisted of two projects, which focused on creating a conducive classroom environment, promoting verbal communication, developing mathematical vocabulary, and using a talk frame as a tool to connect verbal and written communication. The classroom environment was designed to foster a respectful and collaborative community of thinkers and problem solvers. The Rights and Obligations were introduced to establish learning expectations and encourage students to take responsibility for their own learning. Verbal communication was facilitated through the use of specific talk moves, such as repeat and check, agree/disagree and why, partner talk, add on, and think time, which allowed students to engage in meaningful mathematical discussions. Developing mathematical vocabulary was emphasized through the inclusion of vocabulary sections, glossaries, and word walls in the lessons. Finally, the talk frame was used as a graphic organizer to capture student ideas during discussions and provide a visual representation of their understanding.

Zaranis and Synodi (2017), conducted a study in nine state-run kindergartens in Rethymno, Crete (Greece) during the 2012-13 school year. It was an experimental research comparing three teaching approaches: ICT teaching, interactionist teaching, and traditional teaching. The sample consisted of 139 kindergarten students, aged five to six, with 73 girls and 66 boys. The sample was divided into one control group and two experimental groups. The control group had three classes, the first experimental group (ICT group) had three classes, and the second experimental group (interactionist group) had three classes. The sample selection used multistage sampling in October 2012. The teachers in the experimental and control groups received instructions on the teaching process. The experimental group teachers were senior student teachers from

the University of Crete, and they were treated as teachers at the beginning of their careers. The study design included three phases: pre-experimental phase, experimental phase, and post-experimental phase. The pre-test was administered individually to each child to assess their geometry performance. The experimental phase involved specific educational activities for each group, such as computer-based activities for the ICT group and interaction-based activities for the interactionist group. The control group followed the regular curriculum with additional activities. The post-test was administered to all groups after the intervention. The data analysis was conducted using the SPSS software, with the group and shapes as independent variables and the children's geometry post-test scores as the dependent variable.

Chapter 3
Methodology

This chapter focuses on the implementation of the research methodology, covering various aspects such as the research design, participants and setting, data collection and procedures, data analysis, data validity and reliability, and a comprehensive examination of the limitations of the current study. This study aims the effectiveness of YouTube videos on the knowledge of the shapes and numbers of the kindergarteners. More details are explained in this chapter.

3.1 Research Design

As Figure 1 (below) shows, the study takes a quasi-experimental approach. Quasi-experimental research designs seek to determine the effects of a particular intervention, program, or event, called treatment, by comparing treated units with control units (Cook, Campbell, & Shadish, 2002). Two groups of bilingual kindergarten students were selected for this study, a control group, and an experimental group. The experimental group was exposed to selected YouTube online videos that engage learners in learning number and shapes while the control group followed their normal routines.

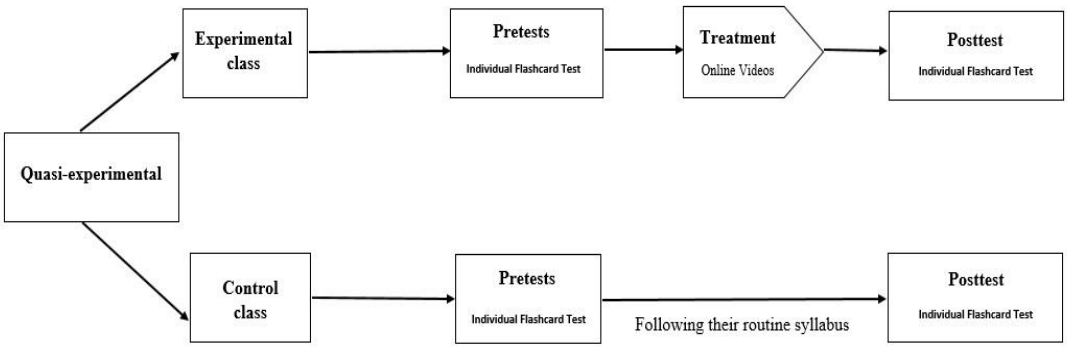

Figure 1. Research design diagram

3.2 Procedure

The study was performed in Istanbul, Turkey, in a private school with more than

125 branches in the country. Established in 2004, this educational institution aimed to offer a comprehensive learning environment for students from kindergarten to eighth grade, following the Turkish National Education System. Specifically, the research was conducted within age 5 preschooler classes at this school. On some campuses including the campus this study was carried out, a system called “bilingual education system” is implemented in primary school departments. In each kindergarten class, a teaching team consisting of two instructors is assigned: a Turkish teacher and a foreign English teacher. Both teachers collaborate to deliver the curriculum in a coordinated manner, ensuring that instruction is provided in both languages. The classes used in this study were classes in which bilingual students received mathematics instruction in Turkish and English from related teachers. The classes in the experimental and control groups have the same number of Turkish and English lessons per week. The amount of mathematics instruction is also precisely the same.

In the experimental group, students watched a total of 15 videos, spanning around 40 minutes in total within a lesson. This occurred over a 6-week period, with three lessons per week. This structured approach ensured that students in the experimental group received consistent exposure to the videos over an extended period, allowing for a comprehensive exploration of the content. During this time, students in the experimental group had math lessons with YouTube videos instead of their playtime, while students in the control group followed their normal curriculum.

3.2.1 Participants. All participants were native Turkish speakers. The participants were aged between five and six. In this study, purposeful sampling of non-probability sampling was used to sample the population.

In this school, it is imperative that all students meet the necessary academic qualifications for enrollment. The profile of students admitted to this institution is carefully curated to ensure a consistent standard. As part of the admission process, all prospective students are required to undertake a school entrance test. This test serves as an objective measure of their academic capabilities. Furthermore, it is important to note that this school does not cater to students with special needs, be it physical, motivational, or otherwise. The school's focus lies in providing a supportive and challenging educational experience for students who meet the established academic

criteria.

There were 37 participants from two different classes. The participants divided into the experimental group (1 class, N = 18) and the control group (1 class, N = 19). Classrooms randomly selected for participation. Both groups of students tested on their math skills in English and Turkish before (pretest) and after (posttest) the study.

3.2.2 Online Videos. There are several reasons for choosing YouTube videos as a treatment in this study. Firstly, YouTube is free, which means everyone can access a wide range of educational content without any additional costs. Secondly, YouTube is easily accessible all around the world. It can be accessed on various devices and doesn't require high-speed Internet. Lastly, since YouTube is widely used and familiar to many people, participants are more likely to engage with the treatment, increasing its potential impact.

The chosen YouTube online videos used as a treatment in this study were justified based on the following reasons:

- Considering the attention span of kindergarten students, these videos are short, with an average video length of 2 minutes and 37 seconds.
- The chosen videos were selected for their animated and vibrant nature, to make them more appealing to kindergarten students.
- Selected videos are simple and focused on educational objectives.
- These videos integrate audio and visual components to effectively convey the necessary explanations. Rather than being redundant, they are complementary.
- A signal is used to emphasize significant ideas or concepts.

To conduct the treatment for experimental group, the videos were played using the video projectors, and speakers by the teacher in the classrooms. The topics of the videos were about numbers and shapes including: *The number 1 to 9* from *Bubble Pop Box* YouTube channel, *Triangle Song For Kids* from *123ABCtv* YouTube channel, *circle song* from *Silly School Education* YouTube channel, *Rectangle and square song* from *Have Fun Teaching* YouTube channel, *Pentagon* from *Sesame studios* YouTube channel, *The hexagon song* from *HeidiSongs* YouTube channel. Figure 2 represents a

sample screenshot of *the number 8* video.

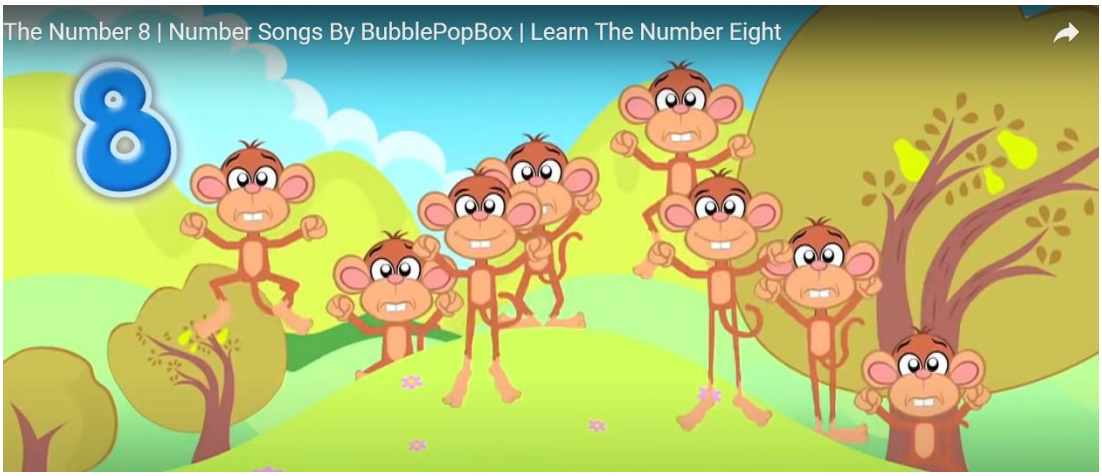

Figure 2. A sample episode

3.3 Data Collection

The data collection phase of this study was performed to address the research objectives and answer the research questions. This section outlines the methods and procedures employed to gather relevant data from the selected participants or sources.

The study was conducted in the experimental group (1 class, N = 18) and the control group (1 class, N = 19). The kindergarten students where this study was conducted serve a diverse population that is made up of people from different cultures, ethnicities, and socioeconomic levels from all around Turkey. Before the study started, the principal filled out the facility's consent form. The pretests and posttests were conducted, and data were collected. Each correct answer was valued as "1" and the incorrect answer was valued as "0".

3.4 Data Collection Instruments

3.4.1 Math Knowledge Test. In this study, due to the age of the students, the pretest and posttest were administered individually and orally using number and shape flashcards (see Figure 3). These tests were conducted in English and Turkish.

Figure 3. Number and shapes flashcard

For half of the flashcards, the examiner held a flashcard in her hand and asked, "What number/shape is this?"; for the other half, she asked the students to find the corresponding number/shape among the other cards. (see Figure 4). The pretests and posttests were conducted, and data were collected. Each correct answer was valued as "1" and the incorrect answer was valued as "0".

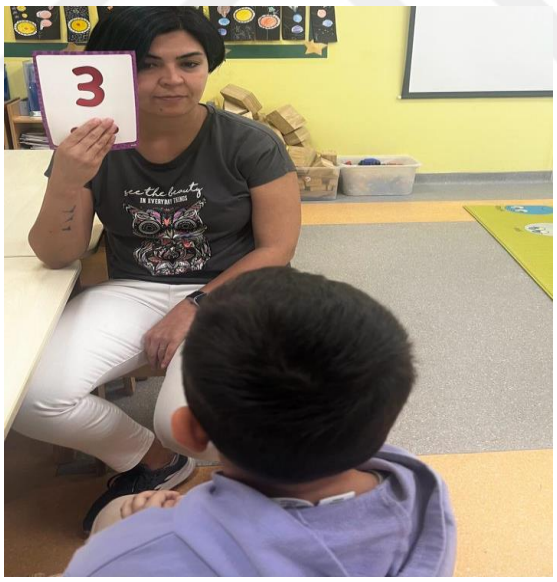

Figure 4. Pretest and posttest

In this study, the researcher designed a pretest and posttest to measure students' mastery of math knowledge, specifically in the areas of numbers and shapes. This

approach allowed the researcher to evaluate the effectiveness of the intervention in enhancing math understanding in the specified domains and it is not necessarily a standardized test. The content of the tests is presented in the table of specifications (See Table 1).

Table 1

Table of Specifications for Tests

Math Knowledge	Number of the Question	Mark	Percentage
Verbalize Numbers (1,3,5,7,9)	5	5	33.33
Identifying number (2,4,6,8)	4	4	26.67
Verbalize Shapes (Triangle, Rectangle, Circle)	3	3	20
Identifying Shapes (Square, Pentagon, Hexagon)	3	3	20
Sum	15	15	100

Following the implementation of the experimental treatment, a posttest assessment was administered to both the control and experimental groups, with the aim of evaluating their comprehension and mastery of numerical concepts and geometric shapes. This posttest serves as a critical means to measure and compare the knowledge of shapes and numbers attained by the two groups after the experimental intervention.

3.5 Data Analysis

The present study used quantitative analyses. A Kolmogorov-Smirnov test was performed to test normality. The Kolmogorov-Smirnov test was most appropriate for this study because the sample size (N = 37) was less than 50 (Gall et al., 2017). In order to test the research question in the inferential analysis using SPSS ver21, an ANCOVA and an independent samples t-test was used.

3.5.1 Reliability and Validity. To check the reliability of the pretest and posttest in the present study, test-retest reliability, which is also known as temporal stability

(Pallant, 2016), was computed for both English and Turkish versions of the test. According to George and Mallery (2020) and Koo and Li (2016), the test-retest reliability of a scale is used when a test is administered to the same group of people on two different occasions in order to calculate the correlation between the pretest and posttest scores. Since the present study benefits from a pretest and posttest in two languages of English and Turkish, the reliability coefficient was calculated for both the English and Turkish versions of the pretest and posttest. Therefore, Intraclass Correlation Coefficients (ICC) is reported in Table 2.

Table 2

Intraclass Correlation Coefficient for English Version of the Pre and Posttest

		95% Confidence Interval		F Test with True Value 0			
	Intraclass Correlation[b]	Lower Bound	Upper Bound	Value	*df1*	*df2*	*p*
Single Measures	.828[a]	.375	.935	17.891	35	35	.000
Average Measures	.906[c]	.545	.967	17.891	35	35	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

According to Table 2, resulting from the guidelines proposed by Koo and Li (2016) available in Appendix A, ICC = .90 with 95% confident interval = 0.54-0.96 confirms that the test-retest reliability is indicative of "excellent" reliability.

Table 3, below, shows the ICC reliability for the Turkish version of the pre and post-test.

Table 3

Intraclass Correlation Coefficient for Turkish Version of the Pre and Posttest

		95% Confidence Interval		F Test with True Value 0			
	Intraclass Correlation	Lower Bound	Upper Bound	Value	*df1*	*df2*	*p*
Single Measures	.936[a]	.865	.968	34.327	35	35	.000
Average Measures	.967[c]	.928	.984	34.327	35	35	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

According to Table 3, following the guidelines proposed by Koo and Li (2016) available in Appendix A, ICC = .96 with 95% confident interval = 0.92-0.98 supports that the test-retest reliability is indicative of “excellent” reliability. According to the results of the ICC in Tables 2 and 3, a confirmation was made regarding the reliability of both English and Turkish versions of the pre and post-test.

The term "validity" relates to the accuracy of measuring instruments, which helps researchers decide whether they are measuring what they were designed to measure (Golafshani, 2003). A mathematics education specialist was consulted to determine the content validity of the number and shape tests. Furthermore, face validity was verified with the help of an early childhood education expert.

3.6 Limitations

In spite of the efforts in performing the current study, it seems necessary to acknowledge some limitations. Firstly, five-year-old kindergarteners have a short

attention span. Consequently, the longer the tests, the more inaccurate the answers will be. Secondly, due to the age of students, the willingness to answer the questions is affected by uncontrollable factors e.g., the last night's sleep. Thirdly, in this age group, there is the possibility of giving the wrong answer despite knowing the correct one, merely to observe the instructor's reaction to the wrong answer. Lastly, the data of the current research has been conducted in the classes of five-year-old bilingual kindergarten students in the context of Istanbul province, Turkey. Then there may be some criticism of its generalizability.

Chapter 4
Results

This chapter explains the process of managing quantitative analyses and provides an assessment of the outcomes observed within the control and experimental groups. Here, the research question is examined through data analyses, and the subsequent findings are explained.

4.1 The Descriptive Statistics

In this section, some descriptive statistics are stated in general. Some statistics are mentioned here because these are general statistics and the tables in the following sections do not include some details such as the Skewness and Kurtosis.

Table 4

The General Descriptive Statistics

Group		*N*	Minimum	Maximum	*M*	*SD*
Experimental	English Total Pretest	18	0	15	7.28	4.612
	Turkish Total Pretest	18	0	15	12.50	3.792
	English Total Posttest	18	3	15	9.67	3.481
	Turkish Total Posttest	18	4	15	13.06	2.733
	Valid N (listwise)	18				
Control	English Total Pretest	19	1	15	8.89	4.665
	Turkish Total Pretest	19	6	15	13.63	2.266
	English Total Posttest	19	4	15	9.74	3.970
	Turkish Total Posttest	19	8	15	13.84	1.893
	Valid N (listwise)	19				

4.2 The Normality Statistics for English Tests

The quantitative analysis includes data interpretation and research question testing. A Kolmogorov-Smirnov test was conducted to test for normality. Kolmogorov-Smirnov test was most appropriate for this study because the sample size (N = 37) was less than 50 (Nagy & Obenchain, 2010). Since $p > .05$, the results of the

Kolmogorov-Smirnov test for English questionnaire indicated no statistical significance for the treatment and no treatment groups. Therefore, the data represented a normal distribution of the math capability results for students receiving the treatment and those not receiving instruction.

Table 5

Normality Statistics for English Tests

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	*df*	*p*	Statistic	*df*	*p*
Experimental	English Total Pretest	.201	18	.052	.926	18	.167
	English Total Posttest	.149	18	.200*	.932	18	.214
Control	English Total Pretest	.126	19	.200*	.927	19	.150
	English Total Posttest	.147	19	.200*	.905	19	.061

As it is shown in Table 6, this analysis table presents data gathered from 18 participants belonging to the experimental group during the English pretest. The mean scores ranged from 0 to 15 out of 15, with an average of 7.28. The standard error was calculated to be 4.612. Furthermore, the exam results displayed a Skewness value of -0.342 and a Kurtosis value of -0.980, indicating a normal distribution.

Table 6

The General Descriptive Statistics of the Experimental Group English Pretests

		Statistic	Std. Error
Experimental English Pretest	Mean	7.28	1.087

Table 6 (cont'd)

			Statistic	Std. Error
	95% Confidence Interval for Mean	Lower Bound	4.98	
		Upper Bound	9.57	
	5% Trimmed Mean		7.25	
	Median		9.00	
	Variance		21.271	
	SD		4.612	
	Min.		0	
	Max.		15	
	Range		15	
	Interquartile Range		8	
	Skewness		-.342	.536
	Kurtosis		-.980	1.038

The analysis in Table 7 displays information obtained from 18 members of the experimental group during the English posttest. The average mean score is 9.67, with a minimum score of 3 and a maximum score of 15 out of 15. Calculations demonstrated that the standard error was 3.481. The test findings also showed Skewness values of -0.466 and Kurtosis values of -0.860, both point to a normal distribution.

Table 7

The General Descriptive Statistics of the Experimental Group English Posttests

			Statistic	Std. Error
Experimental English Posttest	Mean		9.67	.820
	95% Confidence Interval for Mean	Lower Bound	7.94	
		Upper Bound	11.40	

Table 7 (cont'd)

		Statistic	Std. Error
	5% Trimmed Mean	9.74	
	Median	10.00	
	Variance	12.118	
	SD	3.481	
	Min.	3	
	Max.	15	
	Range	12	
	Interquartile Range	7	
	Skewness	-.466	.536
	Kurtosis	-.860	1.038

The analysis in Table 8 displays information obtained from 19 members of the control group during the English pretest. The average mean score is 8.89, with a minimum score of 1 and a maximum score of 15 out of 15. Calculations demonstrated that the standard error was 4.665. The test findings also showed Skewness values of -0.124 and Kurtosis values of -1.286, both point to a normal distribution.

Table 8

The General Descriptive Statistics of the Control Group English Pretests

			Statistic	Std. Error
Control English Pretest	Mean		8.89	1.070
	95% Confidence Interval for Mean	Lower Bound	6.65	
		Upper Bound	11.14	
	5% Trimmed Mean		8.99	
	Median		9.00	
	Variance		21.766	
	SD		4.665	
	Min.		1	

Table 8 (cont'd)

			Statistic	Std. Error
Control	Max.		15	
English	Range		14	
Pretest	Interquartile Range		10	
	Skewness		-.124	.524
	Kurtosis		-1.286	1.014

Table 9 presents an analysis containing data collected from 19 participants who belonged to the control group during the English posttest. The mean score, averaging at 9.75, ranged from a minimum of 4 to a maximum of 15 out of 15. The standard error, calculated at 4.665, provides a measure of variability. Moreover, the test results revealed Skewness values of -0.157 and Kurtosis values of -1.275, indicating conformity to a normal distribution.

Table 9

The General Descriptive Statistics of the Control Group English Posttests

			Statistic	Std. Error
Control	Mean		9.74	.911
English	95%	Lower Bound	7.82	
Posttest	Confidence	Upper Bound	11.65	
	Interval for Mean			
	5% Trimmed Mean		9.76	
	Median		10.00	
	Variance		15.760	
	SD		3.970	
	Min.		4	
	Max.		15	
	Range		11	

Table 9 (cont'd)

		Statistic	Std. Error
Control English Posttest	Interquartile Range	9	
	Skewness	-1.527	.524
	Kurtosis	-1.275	1.014

4.3 The Normality Statistics for Turkish Tests

However, the Kolmogorov-Smirnov or Shapiro-Wilks report for the Turkish questionnaire showed that the data was not normally distributed since p-value is less than 0.05. It seems that since it is an assessment made in their mother tongue, it can be expected that it will not be normally distributed.

Table 10

Normality Statistics for Turkish Tests

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Group		Statistic	*df*	*p*	Statistic	*df*	*p*
Experi-mental	Turkish Total Pretest	.265	18	.002	.695	18	.000
	Turkish Total Posttest	.246	18	.005	.712	18	.000
Control	Turkish Total Pretest	.285	19	.000	.646	19	.000
	Turkish Total Posttest	.270	19	.001	.664	19	.000

Table 11 illustrates the data collected from 18 participants in the experimental group during the Turkish pretest. The mean scores varied from 0 to 15 out of 15, with an average of 12.5. The standard error was computed as 3.792. Moreover, the examination results exhibited a Skewness value of -2.388 and a Kurtosis value of -6.629, indicating a departure from a normal distribution.

Table 11

The General Descriptive Statistics of the Experimental Group Turkish Pretest

			Statistic	Std. Error
Experimental Turkish Prettest	Mean		12.50	.894
	95% Confidence Interval for Mean	Lower Bound	10.61	
		Upper Bound	14.39	
	5% Trimmed Mean		13.06	
	Median		14.00	
	Variance		14.382	
	SD		3.792	
	Min.		0	
	Max.		15	
	Range		15	
	Interquartile Range		3	
	Skewness		-2.388	.536
	Kurtosis		6.629	1.038

Table 12 illustrates the data collected from 18 participants in the experimental group during the Turkish posttest. The mean scores varied from 4 to 15 out of 15, with an average of 13.06. The standard error was computed as 2.733. Moreover, the examination results exhibited a Skewness value of -2.388 and a Kurtosis value of -6.736, indicating a departure from a normal distribution.

Table 12

The General Descriptive Statistics of the Experimental Group Turkish Posttest

		Statistic	Std. Error
Experimental Turkish Posttest	Mean	13.06	.644

Table 12 (cont'd)

			Statistic	Std. Error
Experimental Turkish Postttest	95% Confidence Interval for Mean	Lower Bound	11.70	
		Upper Bound	14.41	
	5% Trimmed Mean		13.45	
	Median		14.00	
	Variance		7.467	
	SD		2.733	
	Min.		4	
	Max.		15	
	Range		11	
	Interquartile Range		3	
	Skewness		-2.323	.536
	Kurtosis		6.736	1.038

Table 13 displays the data collected from 19 participants in the control group during the Turkish pretest. The mean scores ranged from 6 to 15 out of 15, with an average of 13.63. The standard error was calculated to be 2.266. Additionally, the examination results revealed a Skewness value of -2.497 and a Kurtosis value of 7.030, indicating a deviation from a normal distribution.

Table 13

The General Descriptive Statistics of the Control Group Turkish Pretest

			Statistic	Std. Error
Control Turkish Prettest	Mean		13.63	.520
	95% Confidence Interval for Mean	Lower Bound	12.54	
		Upper Bound	14.72	
	5% Trimmed Mean		13.98	

Table 13 (cont'd)

			Statistic	Std. Error
Control	Median		15.00	
Turkish	Variance		5.135	
Pretest	SD		2.266	
	Min.		6	
	Max.		15	
	Range		9	
	Interquartile Range		2	
	Skewness		-2.497	.524
	Kurtosis		7.030	1.014

Table 14 illustrates the collected data from 19 participants in the control group during the Turkish posttest. The mean scores ranged from 8 to 15 out of 15, with an average of 13.84. The standard error was calculated as 1.893, providing a measure of the variability within the data. Moreover, the examination results revealed a Skewness value of -2.217 and a Kurtosis value of 4.896, indicating a departure from the assumption of a normal distribution.

Table 14

The General Descriptive Statistics of the Control Group Turkish Posttest

			Statistic	Std. Error
Control	Mean		13.84	.434
Turkish	95% Confidence Interval for Mean	Lower Bound	12.93	
Posttest		Upper Bound	14.75	
	5% Trimmed Mean		14.10	
	Median		15.00	
	Variance		3.585	
	SD		1.893	

Table 14 (cont'd)

		Statistic	Std. Error
Control	Min.	8	
Turkish	Max.	15	
Posttest	Range	7	
	Interquartile Range	2	
	Skewness	-2.217	.524
	Kurtosis	4.896	1.014

4.4 The Pretest Differences

This section examined the research question of the current study:

RQ: Does the use of online videos have a statistically significant effect on the mathematics learning of five-year-old bilingual students?

Prior to conducting the exposure experiment, an independent samples t-test was performed to compare the level of number and shape knowledge among bilingual children in both the treatment and control groups. The statistical analysis revealed that there was no significant difference in pretest scores between the two groups. (Table 15) After the exposure experiment, an independent samples t-test was conducted to compare the math learning level of the bilingual kids in the treatment and no-treatment conditions.

Table 15

The independent sample t-test results of pretest scores

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
ENG_total_pre	Equal variances assumed	.000	.986	-1.060	35	.297	-1.617	1.526
	Equal variances not assumed			-1.060	34.932	.296	-1.617	1.526
TR_total_pre	Equal variances assumed	2.268	.141	-1.109	35	.275	-1.132	1.021
	Equal variances not assumed			-1.094	27.476	.283	-1.132	1.034

4.5 Statistical Results

A one-way analysis of covariance (ANCOVA) was conducted to determine if there was a statistically significant difference in students' post-test scores on shape and number knowledge between two experimental and control groups with students' post-test scores as the dependent variable, watching online videos as the independent variable, and students' pre-test scores as the covariate.

The experimental group's English pretest resulted in a mean score of 7.28 (SD = 4.612), while the control group achieved a mean score of 8.89 (SD = 4.665). For the posttest scores, the experimental group achieved a mean score of 9.67 (SD = 3.481), while the control group attained a mean score of 9.74 (SD = 3.970).

The analysis revealed a significant effect, with a large effect size indicated by a partial eta squared value of 0.273. This demonstrates a substantial impact of the independent variable on the observed outcomes. (Table 16).

Table 16

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	*df*	MeanSquare	*F*	*p*	Partial Eta Squared
Corrected Model	456.059[a]	2	228.029	230.256	.000	.931
Intercept	102.189	1	102.189	103.187	.000	.752
English Total Pretest	456.013	1	456.013	460.467	.000	.931
Group	12.636	1	12.636	12.759	.001	.273
Error	33.671	34	.990			
Total	3973.000	37				
Connected Total	489.730	36				

a. R Squared = .931 (Adjusted R Squared = .927)
b. Dependent Variable: English Total Posttest

A one-way, between-subjects analysis of covariance (ANCOVA) was used to compare experimental and control post-test scores. The adjusted mean of the post-test

score for the experimental group was higher than the adjusted mean post-test score for the control group (Table 17). The findings of this study support the rejection of the null hypothesis that there is no statistically significant effect of using online videos on the mathematics learning of five-year-old bilingual students. The results suggest that the inclusion of online videos as a supplemental instructional tool can enhance mathematics learning in this population. The use of online videos may provide visual and interactive resources that engage students and facilitate their understanding of mathematical concepts.

Table 17

Estimated Post-Test Score

			95% Confidence Interval	
Group	Mean	Std. Error	Lower Bound	Upper Bound
Experimental	10.313	.236	9.832	10.793
Control	9.125	.230	8.657	9.592

a. Covariates appearing in the model are evaluated at the following values: English Total Pretest = 8.11.

b. Dependent Variable: English Total Posttest

Table 18

Pairwise Comparisons

					95% Confidence Interval for Difference	
(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	*p*	Lower Bound	Upper Bound
Experimental	Control	1.188*	.333	.001	.512	1.864
Control	Experimental	-1.188*	.333	.001	-1.864	-.512

Dependent Variable: English Total Posttest

Based on estimated marginal means

Chapter 5
Discussion and Conclusion

This research study aimed to investigate the impact of YouTube online videos on the acquisition of shape and number knowledge in bilingual five-year-old kindergarteners. The study involved both experimental and control groups, involving English and Turkish languages. Considering the age of the learners, the pretest and posttest assessments were conducted individually and orally using flashcards. The mean test scores of both groups were compared using SPSS ANCOVA analysis to assess their respective levels of shape and number knowledge. The initial participant count comprised 37 students, with 18 in the experimental group and 19 in the control group.

Throughout the study, the experimental group underwent a series of fifteen YouTube videos per lesson, three times a week, spanning a total duration of six weeks. Pretests were administered before the intervention to assess the learners' baseline knowledge of shapes and numbers in both Turkish and English. The outcomes of these pretests were then compared. To address the research objective, a SPSS ANCOVA was employed, treating the students' knowledge of shapes and numbers as the dependent variable. The statistical analyses employed a significance level of $p<0.05$.

This chapter delves into the discussion of the research findings in relation to theoretical foundations and relevant previous studies. It begins with an examination of the influences of online videos on the acquisition of shape and number learning. Subsequently, the chapter addresses pedagogical implications, draws conclusions based on the results, and concludes with recommendations for future research studies.

5.1 Discussion of Findings for The Research Question

This section examines the research question of the present study:

Does the use of online videos have a statistically significant effect on the mathematics learning of five-year-old bilingual students?

The findings of the study revealed a statistically significant difference between the outcomes of learners who watched online videos and those who did not. Thus, the results provided a positive response to the research question, affirming that online

videos can have an influence on the acquisition of number and shape knowledge in five-year-old bilingual students. In continuation, below are some additional studies that have demonstrated similar results to the findings presented in this research. These studies provide further corroboration and strengthen the robustness of the conclusions drawn in this study.

A conventional teacher-oriented society significantly influences their views and experiences, demonstrating a paradoxical attitude that is both approbative and worried. (Serin, 2018). The results give empirical data that might assist in modifying teaching techniques and learning strategies in mathematics education, integrating technology into teaching, and promoting student-centered reform. The examination of the pedagogical significance of incorporating videos in teaching and learning, specifically focusing on digital and online video materials, is undertaken by Karppinen (2005). The author spotted six characteristics associated with meaningful learning, namely, active engagement, individual and constructive processes, collaborative discourse, contextualization, guided instruction, and emotional involvement. They engage in a discussion regarding the application of these characteristics to augment the utilization of digital and online videos within educational contexts. The article accentuates the notion that while videos possess potential as valuable tools for learning, their efficacy is contingent upon their integration within a comprehensive learning milieu encompassing various resources and tasks.

This research discovered that online videos can increase interest and engagement, which supports previous findings. Sari et al. (2018) have focus on investigating the impact of YouTube Educative as an educational tool for students, parents, and teachers in enhancing knowledge, skills, and creativity, particularly in the field of mathematics. The study suggests that YouTube Educative can contribute to making the learning of mathematics enjoyable and recommends its usage to support students. The research employed descriptive qualitative methods and involved the participation of principals, students, and mathematics teachers. However, the findings indicate that the potential benefits of YouTube as an educational platform for mathematics were not fully utilized by the principals, teachers, and students. Currently, YouTube is primarily used for entertainment purposes, such as gaming, cartoons, funny videos, arts, and cooking recipes. The study recommends the integration of

YouTube Educative to facilitate better comprehension of mathematical concepts and to foster a more enjoyable learning experience.

Also Wilson (2015), conducted a qualitative research study explores the integration of YouTube as an educational tool by educators in the classroom. The study addresses the importance of staying up-to-date with technology in the modern classroom and highlights the need for educators to possess sufficient technological knowledge to effectively utilize various forms of technology in their teaching methods. Key findings indicate a lack of awareness among educators regarding the diverse features available on YouTube, as well as the influence of Internet disruptions and school board policies on video consumption within the classroom setting.

Furthermore, Chtouki et al. (2012) in their study explore using YouTube videos to enhance learning in an introductory computer science course for non-computer science students. Comparing the two groups, those exposed to YouTube videos showed an improved understanding of complex concepts. YouTube's accessibility and wide range of educational content make it a valuable resource for educators to support their teaching. Moreover, the integration of YouTube videos encouraged students to develop a habit of seeking and utilizing similar educational materials.

In another research, Rahmatika et al. (2021) proposed that Youtube could serve as a beneficial online learning tool for students, particularly in instances where conventional learning media is inadequate. The researchers suggested that Youtube enables teachers to support independent learning as it offers quick and accessible resources, while also providing a sense of support to parents.

5.2 Pedagogical Implications

This study can be useful for curriculum designers, with the goals of keeping education current with the progression of technology in education and bringing it on par with the educational systems of other developed nations, which are increasingly incorporating the concept of online video into their curriculum. The study tries to not only contribute to online videos as future learning tools, but it also tries to serve as a model to how online videos could affect the teaching and learning that takes place in formal education, particularly within the bilingual system. This is because the study looked at how online video could impact the teaching and learning that takes place in

online video.

This study might benefit education stakeholders, policymakers, instructors, researchers, and business sectors, particularly in acquiring insights regarding whether or not to use online video to help students learn. As the study finds that online videos have the potential to improve student's learning significantly, educational stakeholders can take into account providing more content based on multimedia, a selection of online video and learning content, as well as management of the learning system, or the necessary skills and forms of training for teachers.

Despite this, more and more in-depth studies on the applications of online videos have to be carried out in order to arrive at credible conclusions before any final choice is made. Also, more research needs to be done to choose the most useful content type, length, and instruction for multimedia and the usage of online video in the classroom.

This study has the potential to serve as a template for future research into the effect that online videos have on other academic fields, such as the arts, languages, and sciences. It also has the potential to be expanded to the secondary and tertiary levels of education.

5.3 Conclusions

This study is being carried out because it is relevant to the current demands for sustainable education as well as the needs that will arise in the future. The researcher takes into account research areas in education that are relevant to technology-enhanced innovation in young learners' education. Based on what has been found in this study, it is essential for those involved in education to consider the possibility of using online video as a learning tool or to make sure that they are adequately prepared to face the emerging changes in technology on students' learning mode.

According to this study's findings, today's children are significantly impacted by technology, particularly online video. They rely on this new wave of technology as an alternative mode of education because of the influence that technology has had on them.

Based on the research's findings, online videos significantly and positively contribute to the learning process. There is a high possibility that video-watching is included in traditional education. Nevertheless, the employment of online video in

traditional education is still up for debate, e.g., Sablic et al, (2021), Hughes and Yakubova (2018), and Alsawie and Alghazo (2009). Consequently, several troubling challenges lie in waiting for this emerging modality of instruction.

5.4 Recommendations

The study was conducted using purposeful sampling of non-probability sampling. As a result, not all kindergarten students in Istanbul are represented by this research. Several types of schools and other random sampling techniques may be used. Further studies can use more participants to increase the reliability of the results. This study focused on children who were learning English and Turkish in kindergarten. Future studies can focus on participants who speak different languages than their native language. Further study can focus on the participants learning in the higher grades. In future studies, researchers can explore how 4D technology can effectively engage students and enhance their math skills.

In later research, the researchers can explore the impact of young people's out-of-school watching videos on teaching and learn in formal and informal learning environments. The future study can present the results of a study in which the researcher uses the case study method to examine how two adolescents watched online videos.

REFERENCES

Alsawaie, O. N., & Alghazo, I. M. (2009). The effect of video-based approach on prospective teachers' ability to analyze mathematics teaching. *Journal of Mathematics Teacher Education, 13*(3), 223-241.

Alzabut, J. (2017). On using various mathematics instructions versus traditional instruction: An action research. *Journal on Mathematics Education, 8*(2), 133-144.

Alt, M., Arizmendi, G. D., & Beal, C. R. (2014). The relationship between mathematics and language: Academic implications for children with specific language impairment and English language learners. *Language, speech, and hearing services in schools, 45*(3), 220-233.

Brantlinger, A. (2014). Critical mathematics discourse in a high school classroom: Examining patterns of student engagement and resistance. *Educational Studies in Mathematics, 85*(2), 201-220.

Boulet, G. (2007). How does language impact the learning of mathematics? Let me count the ways. *Journal of Teaching and Learning, 5*(1), 1-12.

Bunch, G. C. (2013). Pedagogical language knowledge: Preparing mainstream teachers for English learners in the new standards era. *Review of Research in Education, 37*(1), 298-341.

Castells, M. (2010) Communication power: Mass communication, mass self-communication, and power relationships in the network society. *Media and society, 25*(5), 3-17.

Cho, S., Yang, J., & Mandracchia, M. (2015). Effects of M3 curriculum on mathematics and English proficiency achievement of mathematically promising English language learners. *Journal of Advanced Academics, 26*(2), 112-142.

Chester, A., & Bretherton, D. (2007). Impression management and identity online. In A. N. Joinson, K. Y. A. McKenna, T. Postmes & U. Reips (Eds.), *The Oxford Handbook of Internet Psychology* (pp. 223-236). New York: Oxford University Press.

Chtouki, Y., Harroud, H., Khalidi, M., & Bennani, S. (2012). The impact of YouTube videos on the student's learning. *2012 International Conference on Information*

Technology Based Higher Education and Training (ITHET), 1-4. https://doi.org/10.1109/ITHET.2012.6246045.

Clements, D. H., & Sarama, J. (2009). Learning trajectories in early mathematics–sequences of acquisition and teaching. *Encyclopedia of Language and Literacy Development*, *7*, 1-6.

Cook, T. D., Campbell, D. T., & Shadish, W. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA: Houghton Mifflin.

Cuevas, G. J. (1983). Mathematics learning in English as a second language. *Journal for research in mathematics education*, *15*(2), 134-144.

Dale, T. C., & Cuevas, G. A. (1987). ESL through content-area instruction. In J. Crandall (Ed.), *Integrating Language and Mathematics learning* (pp. 9-23). Engelwood Cliffs, New Jersey: Prentice Hall Regents.

DelliCarpini, M. E., & Alonso, O. B. (2014). Teacher education that works: Preparing secondary-level math and science teachers for success with English language learners through content-based instruction. *Global Education Review*, *1*(4), 155-178.

Diebold, J. (1964). *Beyond automation: Managerial problems of an exploding technology*. New York, NY: McGraw-Hill.

DiCerbo, P. A., Anstrom, K. A., Baker, L. L., & Rivera, C. (2014). A review of the literature on teaching academic English to English language learners. *Review of educational research*, *84*(3), 446-482.

Dossey, J., Halvorsen, K., & McCrone, S. (2016). *Mathematics education in the United States 2016*. Hamburg, Germany: National Council of Teachers of Mathematics. Retrieved from: https://www.nctm.org/uploadedFiles/About/MathEdInUS2016.pdf

Druin, A., & Fast, K. (2002). The child as learner, critic, inventor, and technology design partner: An analysis of three years of Swedish student journals. *The International Journal for Technology and De-sign Education*, *12*(3), 189-213.

Ebosele Peter, E. (2012). Critical thinking: Essence for teaching mathematics and mathematics problem solving skills. *African Journal of Mathematics and Computer Science Research*, *5*(3), 39-43.

Franson, C. (2009). *What is bilingualism?* Retrieved from https://www.naldic.org. uk/Resources/NALDIC/Initial% 20Teacher% 20Education/Documents. *B1. pdf* at 2023, March 18.

Ford A., & Cena C. (2021). *What is technology, definitions and types.* Retrieved from https://study.com/academy/lesson/what-is-technology-definition-types.html

Foster, M. E., Anthony, J. L., Clements, D. H., Sarama, J., & Williams, J. J. (2018). Hispanic dual language learning kindergarten students' response to a numeracy intervention: A randomized control trial. *Early Childhood Research Quarterly*, *43*, 83-95.

Fuson, K. C. (1992). Research on learning and teaching addition and subtraction of whole numbers. In G. Leinhardt, R. T. Putnam, & R. A. Hattrup (Eds.), *The analysis of arithmetic for mathematics teaching* (pp. 53–187). Hillsdale, NJ: Erlbaum.

Gavin, M. K., & Casa, T. M. (2013). Nurturing young student mathematicians. *Gifted Education International*, *29*(2), 140-153.

George, D., & Mallery, P. (2020). *IBM SPSS statistics 26 step by step: A simple guide and reference*. New York, NY: Routledge.

Gersten, R., Jordan, N. C., & Flojo, J. R. (2005). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities*, *38*(4), 293-304.

Gilligan, K. A., Hodgkiss, A., Thomas, M. S., & Farran, E. K. (2019). The developmental relations between spatial cognition and mathematics in primary school children. *Developmental Science*, *22*(4), e12786.

Gjelaj, M. (2013). Effects of preschool education in preparing children for the first grade in terms of linguistic and mathematical development. *Creative Education*, *4*(4), 263-266.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report*, *8*(4), 597-607.

Greer, B., & Mukhopadhyay, S. (2015). Honoring diversity in intercultural mathematics education. *Intercultural Education*, *26*(4), 261-265.

Grosjean, F. (2013). Bilingualism: A short introduction. In F. Grosjean & P. Li (Eds.), *The psycholinguistics of bilingualism* (pp. 5-25). Hoboken, NJ: John Wiley & Sons.

Guglielmi, R. S. (2012). Math and science achievement in English language learners: Multivariate latent growth modeling of predictors, mediators, and moderators. *Journal of Educational Psychology*, *104*(3), 580-602.

Haag, N., Heppt, B., Stanat, P., Kuhl, P., & Pant, H. A. (2013). Second language learners' performance in mathematics: Disentangling the effects of academic language features. *Learning and Instruction*, *28*, 24-34.

Harn, B., & Meline, M. (2019). Developing Critical Thinking and Reflection in Teachers Within Teacher Preparation. In G. J. Mariano, & F. J. Figliano (Eds.), *Handbook of Research on Critical Thinking Strategies in Pre-Service Learning Environments* (pp. 126-145). Hershey, PA, United States: IGI Global

Haugen, E. (1953). *The Norwegian language in America: A study in bilingual behavior. Volume II: The American dialects of Norwegian*. Philadelphia: University of Pennsylvania Press.

Hughes, E. M., & Yakubova, G. (2018). Addressing the mathematics gap for students with ASD: An evidence-based systematic review of video-based mathematics interventions. *Review Journal of Autism and Developmental Disorders, 6*(2), 147-158.

Johnson, A., Davis, B., & Thompson, C. (2020). Enhancing academic achievements in kindergarten through mathematics education. *Early Childhood Education Journal, 35* (4), 567-579.

Jordan, N. C., Kaplan, D., Locuniak, M. N., & Ramineni, C. (2007). Predicting first-grade math achievement from developmental number sense trajectories. *Learning Disabilities Research & Practice, 22*(1), 36-46.

Jordan, N. C., Kaplan, D., Nabors Oláh, L., & Locuniak, M. N. (2006). Number sense growth in kindergarten: A longitudinal investigation of children at risk for mathematics difficulties. *Child Development, 77*(1), 153-175.

Kanno, Y., & Cromley, J. G. (2013). English language learners' access to and attainment in postsecondary education. *Tesol Quarterly*, *47*(1), 89-121.

Karppinen, P. (2005). Meaningful learning with digital and online videos: Theoretical perspectives. *AACE Review (formerly AACE Journal)*, *13*(3), 233-250.

Kleemans, T., Segers, E., & Verhoeven, L. (2011). Cognitive and linguistic precursors to numeracy in kindergarten: Evidence from first and second language learners. *Learning and Individual Differences*, *21*(5), 555-561.

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med*, *15*(2), 155-163. https://doi.org/10.1016/j.jcm.2016.02.012

Kuiper, S. R., Carver, R. H., Posner, M. A., & Everson, M. G. (2015). Four perspectives on flipping the statistics classroom: Changing pedagogy to enhance student-centered learning. *Primus*, *25*(8), 655-682.

Lanza, E. (1997). *Language mixing in infant bilingualism: A sociolinguistic perspective.* Oxford: Clarendon Press.

Mackey, W. (2000). The description of bilingualism. In L.Weir (Ed.), *The bilingualism reader* (pp. 22-50). New York: Routledge.

Ministry of Education, Jamaica (2014). *Mathematics and numeracy*. Retrieved from https://moey.gov.jm/mathematics/

Moschkovich, J. (2007). Bilingual mathematics learners: How views of language, bilingual learners, and mathematical communication impact instruction. In N. S. Nasir, & P. Cobb (Eds.), *Improving access to mathematics: Diversity and equity in the classroom* (pp. 89-104). New York, NY: Teachers College Press.

Nagy, G., & Obenchain, R. L. (2010). A comparison of Kolmogorov-Smirnov and Kolmogorov-Simonov tests for normality. *Journal of Statistical Computation and Simulation, 80*(1), 93-105. Doi: 10.1080/00949650903164521

National Council of Teachers of Mathematics (NCTM). (2000). Principles and Standards for School Mathematics. Retrieved from https://www.nctm.org/standards/

National Council of Teachers of Mathematics (NCTM). (2006). Curriculum focal points. Reston.

Nedelko, Z., & Babic, V. (2020). *Handbook of research on enhancing innovation in higher education institutions.* Hershey, PA, United States: IGI Global.

Nipper, S. (1989). Third generation distance learning and computer conferencing. In R. Mason, & A. Kaye (Eds.), *Mindweave: Communication, Computers and Distance Education* (pp. 63-73). Oxford: Pergamon Press.

Nordquist, R. (2020). *What is a second language (L2)?* Retrieved from https://www.thoughtco.com/second-language-1691930 on 2020, February 4.

Packer, M. E., Scott, B. J. J., & Davis, D. M. (1999). An assessment of the influence of clinical demonstrations on the confidence of undergraduate dental students, when treating patients requiring removable partial dentures. *European Journal of Dental Education, 3*(3), 133-139.

Pallant, J. (2016). *SPSS survival manual: A step by step guide to data analysis using SPSS program* (6th ed.). London, UK: McGraw-Hill Education.

Plavnick, J. B., Sam, A. M., Hume, K., & Odom, S. L. (2013). Effects of video-based group instruction for adolescents with autism spectrum disorder. *Exceptional Children*, *80*(1), 67-83.

Plowman, L., & Stephen, C. (2003). A "benign addition"? Research on ICT and pre-school children. *Journal of Computer Assisted Learning, 19*, 149-164.

Plowman, L., & Stephen, C. (2005). Children, play and computers in pre-school education. *British Journal of Educational Technology, 36*(2), 145-157.

Purpura, D. J., Napoli, A. R., Wehrspann, E. A., & Gold, Z. S. (2017). Causal connections between mathematical language and mathematical knowledge: A dialogic reading intervention. *Journal of Research on Educational Effectiveness, 10*(1), 116-137.

Pressley, M. (2000). What should comprehension instruction be the instruction of? In M. L. Kamil, P. B. Mosenthai, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research*, Vol. 3 (pp. 545-561). Lawrence Eribaum Associates Publishers.

Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational researcher*, *29*(1), 4-15.

Rahmatika, R., Yusuf, M., & Agung, L. (2021). The Effectiveness of Youtube as an Online Learning Media. *Journal of Education Technology*, 5(1), 152–158. https://doi.org/10.23887/jet.v5i1.33628

Romaine, S. (1995). *Bilingualism*. (2nd edition). Oxford: Blackwell.

Romano, E., Babchishin, L., Pagani, L. S., & Kohen, D. (2010). School readiness and later achievement: Replication and extension using a nationwide Canadian survey. *Developmental Psychology, 46*(5), 995-1007.

Sablić, M., Mirosavljević, A., & Škugor, A. (2021). Video-based learning (VBL)—past, present and future: An overview of the research published from 2008 to 2019. *Technology, Knowledge and Learning*, *26*(4), 1061-1077.

Santagata, R., König, J., Scheiner, T., Nguyen, H., Adleff, A. K., Yang, X., & Kaiser, G. (2021). Mathematics teacher learning to notice: A systematic review of studies of video-based programs. *ZDM–Mathematics Education*, *53*(1), 119-134.

Sarama, J., Lange, A. A., Clements, D. H., & Wolfe, C. B. (2012). The impacts of an early mathematics curriculum on oral language and literacy. *Early Childhood Research Quarterly*, *27*(3), 489-502.

Sari, W. N., Samosir, B. S., Sahara, N., Agustina, L., & Anita, Y. (2020). Learning mathematics "Asyik" with Youtube educative media. *Journal of Physics: Conference Series*, *1477*(2), 1-4.

Serin, H. (2018). A comparison of teacher-centered and student-centered approaches in educational settings. *International Journal of Social Sciences & Educational Studies*, *5*(1), 164-167.

Sherin, M., & van Es, E. (2005). Using video to support teachers' ability to notice classroom interactions. *Journal of Technology and Teacher Education, 13*(3), 475-491.

Sherin, M. G., & Han, S. Y. (2004). Teacher learning in the context of a video club. *Teaching and Teacher education*, *20*(2), 163-183.

Sibold, C. (2011). Building English Language Learners' Academic Vocabulary: Strategies and Tips. *Multicultural Education*, *18*(2), 24-28.

Silverman, R., & Hines, S. (2009). The effects of multimedia-enhanced instruction on the vocabulary of English-language learners and non-English-language learners in pre-kindergarten through second grade. *Journal of educational psychology*, *101*(2), 305.

Sipra, M. (2013). Contribution of bilingualism in language teaching. *English Language Teaching*, *6*(1), 56-66.

Smith, J. (2018). Classroom Instruction: Learning through Lectures, Study Materials, and Educational Tools. *Journal of Education and Pedagogy*, *42*(2), 123-136.

Smith, J. (2018). The Importance of Mathematics Instruction in Student Preparation. *Journal of Education Research*, *45*(2), 123-135.

Smith, S. J., & Basham, J. D. (2014). Designing online learning opportunities for students with disabilities. *Teaching Exceptional Children*, *46*(5), 127-137.

Spelke, E. S. (2003). What makes us smart? Core knowledge and natural language. in D. Gentner & S. Goldin-Meadow (Eds.), *Language in mind: Advances in the study of language and thought* (pp. 277-311). Boston Review.

Star, J. R., & Stylianides, G. J. (2013). Procedural and conceptual knowledge: Exploring the gap between knowledge type and knowledge quality. *Canadian journal of science, mathematics and technology education*, *13*(2), 169-181.

Tetzlaff, D. M. (2017). *Using mobile technology to increase the math achievement and engagement of students with disabilities* (Doctoral dissertation, University of Nevada, Las Vegas). Retrieved from https://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=4108&context=thesesdissertations

Valle, M. S., Waxman, H. C., Diaz, Z., & Padrón, Y. N. (2013). Classroom instruction and the mathematics achievement of non-English learners and English learners. *The Journal of Educational Research*, *106*(3), 173-182.

Vihman, M. M. & McLaughlin, B. (1982). Bilingualism and Second Language Acquisition in Preschool Children. In C. J. Brainerd & M. Pressley (eds.), *Progress in cognitive development research: Verbal processes in children* (pp. 35-58). Berlin: Springer-Verlag.

Voithofer, R. (2005). Designing new media education research: The materiality of data, representation and dissemination. *Educational Researcher, 34*(9), 3-14.

Vukovic, R. K., & Lesaux, N. K. (2013). The language of mathematics: Investigating the ways language counts for children's mathematical development. *Journal of Experimental Child Psychology, 115*(2), 227-244.

Walters, K., Smith, T. M., Leinwand, S., Surr, W., Stein, A., & Bailey, P. (2014). *An up-close look at student-centered math teaching*. Quincy, MA: Nellie Mae Education.

Williams, S. A., & Staulters, M. L. (2014). Instructional collaboration with rural educators in Jamaica: Lessons learned from an international interdisciplinary consultation project. *Journal of Educational and Psychological Consultation*, *24*(4), 307-329.

Wilson, A. (2015). *YouTube in the Classroom* [Master's Thesis, University of Toronto]. Retrieved from https://hdl.handle.net/1807/68780

Wong, G., Apthorpe, H. C., Ruiz, K., & Nanayakkara, S. (2019). An innovative educational approach in using instructional videos to teach dental local anaesthetic skills. *European Journal of Dental Education*, *23*(1), 28-34.

Zaranis, N. (2012). The use of ICT in Preschool Education for geometry teaching. In R. Pintó, V. López, & C. Simarro (Eds.), *Proceedings of the 10th International Conference on Computer Based Learning in Science, Learning Science in the Society of Computers* (pp. 256-262). Barcelona: Centre for Research in Science and Mathematics Education (CRECIM), 26-29 June 2012.

Zaranis, N. (2011). The influence of ICT on the numeracy achievement of Greek kindergarten children, In A. Moreira, M.J. Loureiro, A. Balula, F. Nogueira, L. Pombo, L. Pedro, P. Almeida, (Eds.), *Proceedings of the 61st International Council for Educational Media and the XIII International Symposium on Computers in Education (ICEM&SIIE'2011) Joint Conference*, 28-30 September 2011(pp. 390-399). University of Aveiro, Portugal.

Zaranis, N., & Kalogiannakis, M. (2011, September). The use of ICT in preschool education for science teaching with the Van Hiele theory. In *Proceedings of the 8th International Conference on Hands-on Science* (pp. 21-27).

Zaranis, N., & Synodi, E. (2017). A comparative study on the effectiveness of the computer assisted method and the interactionist approach to teaching geometry shapes to young children. *Education and Information Technologies*, *22*, 1377-1393.

Zhu, B., Chen, C., Moyzis, R. K., Dong, Q., & Lin, C. (2015). Educational attainment-related loci identified by GWAS are associated with select personality traits and mathematics and language abilities. *Personality and Individual Differences*, *72*(1), 96-100.

Zlatanović, D., Babić, V., & Nikolić, J. (2020). Higher Education Institutions as Viable Systems: A Cybernetic Framework for Innovativeness. In V. Babic, & Z. Nedelko (Eds.), *Handbook of Research on Enhancing Innovation in Higher Education Institutions* (pp. 1-25). Hershey, PA, United States: IGI Global.