QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

The Impact of Mathematics Learning on Improving English Language Learning in Secondary Schools in Erbil

Asst. Prof. Dr. Nedhal Abdul Hafedh Taher
Department of General Education, College of Education and Language, Lebanese Ferch University Erbil, Kurdistan Region, Iraq.
Nedalhal.taher@lfu.edu.krd

Asst. Lect. Shahla Hemin Ismail
Department of Management Information System, Erbil Administration Institute, Erbil Polytechnic University, Erbil, Kurdistan Region, Iraq.
shahla.ismail@epu.edu.iq

ARTICLE INFO

Article History:
Received:2/1/2024
Accepted:5/2/2024
Published: Summer2024

Keywords:
impact, Interrelationship, Mathematics proficiency, English Language proficiency, Effective teaching strategies

Doi:
10.25212/lfu.qzj.9.2.44

ABSTRACT

This study aims to find out the impact of learning mathematics on enhancing the English language competency of the secondary school students in Erbil, the capital of the Kurdistan Region of Iraq. The analytical descriptive method is used in the collection, classification, and processing of the study data. The Statistical Package for Social Sciences (SPSS) was used for the processing and analysis of the study data. A random sample of 125 students, male (45) and female (80) were chosen for the academic year 2023-2024 from the eight public and private secondary schools in Erbil. Twenty items were developed for a questionnaire related to interactive learning in mathematics and English that was designed to improve the understanding of the student in each subject. The Likert scale used to score the students' responses. Each students' responses were scored using the given values: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The validity and reliability of the questionnaire were checked .The study identified that there is an interdisciplinary relationship between learning mathematics and enhancing English language competency. The study recommended the importance of integrating multiple instructional strategies that combine mathematical concepts to increase English acquisition and comprehension.

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

1. The Framework of the Study

1.1 Introduction

The logical aspects of language are not given much consideration in theoretical linguistics, partly because formality has been avoided in language studies and partly because language is not a major component of modern logic. This suggests that linguistic theory cannot express certain concepts, such as scope relations, which are an essential part of semantics. There is a claim that the language has a logic of its own, apart from modern logic.

An algorithmic, modular rule system that transforms logic-semantic sentence representations into well-formed surface structures by semantic syntax is used to explain the concept of grammar; This provides an additional perspective on the application of logic and mathematics to linguistic theory (T. Iwamoto, 2017).

'Number', a word which can be defined as a simple idea, and yet it fascinated and absorbed the greatest proportion of human geniuses over centuries. Einstein stated that mathematics is the poetry of logical ideas, the exactitude of which, although independent of experience, strangely seems to be beneficial to the study of the objects of reality. Besides, interestingly, as well as surprisingly, we are nowhere near any clear understanding of numbers, despite discoveries of many productive uses of numbers (Pieter AM Seuren , 2013) .

The educational environment acknowledges the inherent relationship between mathematics and language skills, particularly in the context of primary and secondary schools. Mathematics proficiency has been identified as a catalyst for development and academic achievement. Cognitive development, critical thinking, and the English language have evolved into an essential tool of communication.

This study focuses on the dynamic interplay between mathematics learning and English language proficiency enhancement to uncover the possible benefits and the obstacles of incorporating both subjects into the curriculum. Therefore, this study aims to investigate the impact of mathematics acquisition on developing English language abilities among students in Erbil's primary schools. The study seeks to uncover the effective teaching strategies and instructional approaches that can synergistically enhance learning outcomes in both topics by evaluating the

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

relationships between these two critical disciplines. In addition, it aims to provide valuable insights to educational policymakers, curriculum developers, and educators who work to create a comprehensive and integrated learning environment for students in elementary schools by elucidating the reciprocal relationship between mathematics learning and the improvement of English language acquisition.

1.2 Problem Statement

Despite the widely acknowledged relevance of mathematics and English language abilities in the educational development of Erbil's secondary schools, there is still a gap in understanding the possible relationship between these two disciplines. The existing educational system frequently separates mathematics and language acquisition, ignoring the potential benefits of integrating both topics within the curriculum. The scarcity of comprehensive research on the impact of mathematics learning on English language proficiency impedes the creation of holistic educational techniques that could optimize students' learning outcomes in both domains.

Moreover, the lack of empirical facts and data on the possible problems and opportunities connected with combining mathematics and English language acquisition is a significant impediment to the implementation of successful teaching approaches and curricular modifications. Understanding the specific ways in which mathematics education may positively influence the acquisition and development of English language abilities remains a key issue that necessitates much research and analysis. Educators and policymakers must address this gap and develop comprehensive and integrated approaches that can generate a more comprehensive and balanced educational experience for students in Erbil’s secondary schools. Thus, the problem of how to integrate the educational approaches of these two disciplines is the focus of this study.

1.3 Questions of the Study

The following research questions seek to investigate the multifaceted relationship between mathematics and English language learning in secondary schools in Erbil”:

1. Is there any impact of learning mathematics on enhancing the English language competency of secondary school students according to gender, stage, and type of school (private and public)?

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

2. Are there any significant differences between male and female students' perspectives on the impact of learning mathematics on enhancing English language competencies?
3. Are there any significant differences between secondary school students' perspectives on the impact of learning mathematics on enhancing English language competencies according to their level (stages) of study?
4. Are there any significant differences between secondary school students' perspectives on the impact of learning mathematics on enhancing English language competencies according to the type of school (private and public)?

1.4 Significance of the study

Given that mathematics and English language learning share comparable communicative and logical structures, the results of this study could enhance the theoretical literature in these fields.

Since it addresses the requirements of mathematics and English teachers regarding the application of symbols as a primary mode of communication and the interactions between the two subjects, the study is especially noteworthy. Given the merging of teaching methods from the two fields, the research may be helpful.

It might also assist educators and policymakers at Kurdistan's Ministry of Education in determining what training is still lacking to integrate English language and math instruction. The following are some potential benefits of this study:

1. Develop effective teaching strategies by understanding the connection between English and mathematics. This will help educators create lessons that integrate both subjects and enhance students' educational experiences as a whole.
2. Curriculum development: By using the results of this study, integrated curricula can be created that support interdisciplinary learning and a more all-encompassing approach to education.
3. Language Acquisition Strategies: Teachers may discover and put into practice effective language acquisition strategies that make use of mathematical concepts to enhance language fluency by looking at how learning mathematics affects learning English.
4. Implications for Educational Policy: By informing policymakers about the possible advantages of cross-curricular integration, the findings of this study may assist in

establishing policies that promote the integration of subject matter to improve learning outcomes.

5. Equity and Inclusion: The study can highlight potential discrepancies in educational outcomes by examining the interactions between mathematics and English language acquisition. This information can support initiatives aimed at ensuring that every student, from any background, has equitable access to a superior educational experience.
6. Development of Educational Policies: Based on the study's findings, policymakers can create evidence-based guidelines that support integrated methods of teaching English language and mathematics. The Erbil Region's overall educational quality could be raised by implementing these strategies.
7. Research Contribution: By examining the connection between mathematics and the development of English language skills, this work advances the field of education research. The findings of this study may help future studies in comparable educational settings.

In summary, the findings of this study have a significant impact on student outcomes, educational practices, and the general standard of education in the Erbil Region. By helping students become more proficient in math and English, it can empower teachers, educate decision-makers, and support learners in an interconnected world.

1.5 Objectives of the Study

The study aims to:

1. Find out the impact of learning mathematics on enhancing the English language competency of secondary school students.
2. Find out if there are any significant differences between male and female students' perspectives on the impact of learning mathematics on enhancing English language competencies.
3. Find out if there are any significant differences between secondary school students' perspectives on the impact of learning mathematics on enhancing English language competencies according to their level (stages) of study.

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

4. Find out if there are any significant differences between secondary school students' perspectives on the impact of learning mathematics on enhancing English language competencies according to the type of school (private and public).

1.6 Hypothesis of the Study

1. There are no significant differences between male and female students' perspectives on the impact of learning mathematics on enhancing English language competencies.
2. There are no significant differences between secondary school students' perspectives on the impact of learning mathematics on enhancing English language competencies according to their level (stages) of study.
3. There are no significant differences between secondary school students' perspectives on the impact of learning mathematics on enhancing English language competencies according to the type of school (public and private schools).

1.7 Scope of the Study

1. Private and public secondary school students
2. Schools in Erbil
3. The school year 2023-2024

1.8 Terms Definition

The following are the definitions of the key terms used in this study:

1. Mathematics learning refers to the process of learning mathematical concepts, abilities, and techniques in a classroom environment. It includes logical reasoning, numerical operations, and a conceptual understanding of mathematics. (Boaler, J. 2016).
2. English language learning refers to the process of improving students' reading, writing, speaking, and listening skills in the English language. It involves mastering

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

vocabulary, grammar, and language comprehension to communicate effectively. (Celce -Murcia, M., Brinton, D.M., & Snow, M.A. 2014).

3. Interdisciplinary learning is defined as the integration of knowledge, skills, and perspectives from different academic disciplines, fostering a holistic approach to education. It promotes connections between various subjects to enhance students' understanding of complex real-world issues. (Klein, JT 2010).
4. Pedagogical strategies are defined as diverse approaches, techniques, and methods employed by educators to facilitate effective teaching and learning experiences. These strategies encompass instructional design, curriculum development, and classroom management practices aligned with specific learning objectives. (Ormrod, J.E. 2015).
5. Curriculum integration is defined as the intentional blending of related or complementary subject matter within the educational curriculum, aiming to create meaningful connections and enhance students' learning experiences. It emphasizes the synthesis of knowledge across different disciplines. Jacobs, H. H. (1989).
6. Language Proficiency: The level of competence and mastery in using a particular language, denoting the ability to understand and communicate effectively in various contexts. It includes linguistic fluency, comprehension, and the application of language skills in practical situations. (Bachman, L. F, & Palmer, AS 2010).

2. Theoretical Background and Literature Review

2.1 Theoretical background

There are structural and functional similarities between language and mathematics, as we have previously explained. Both language and mathematics are based on logic, which is the basic foundation of their structures; Both are expressed symbolically to convey specific meanings, enabling communication between different human groups (Taher, NAH (2021).

We can look at examples in the language to understand mathematical problems. The majority of seventh graders, for instance, understand that 0.5 and 1/2 are equal, but

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

some might find it difficult to understand due to the two numbers do not look the same. This is because fractions and decimals are related concepts. That's similar to how languages work. The words still have the same meaning. As a result, we can show how the methods used in the teaching of mathematics and English are similar by using language examples to help understand and clarify mathematical problems.

2.1.1 What is Language?

Language is a fundamental component of human communication and cognition, acting as the primary means by which people express themselves, share knowledge, and connect. It is a part of our everyday lives, forming our identities, communities, and society. Language's power extends beyond words; It includes nuances of tone, context, and cultural importance. According to philosopher Ludwig Wittgenstein, "the limits of my language mean the limits of my world." Language affects our perceptions, emotions, and behaviors in a variety of ways. Linguistic research, such as Noam Chomsky's work on universal grammar (Chomsky, 1965) and studies on the Sapir-Whorf hypothesis (Sapir, 1921; Whorf, 1956), emphasizes the deep impact of language on human cognition and society. Language is more than just a tool of communication; it is also an important element in understanding the complexity of the human mind and society (Pinker, 1994).

According to Lock (1992), language is an essential component of science since it shapes scientific concepts and understanding, and scientific discourse is shaped by non-linguistic aspects of science.

Whereas Freeborn (1987) asserts that language is based on a system of meaning and symbol rules that enable an infinite number of speeches to be created from a finite set of components. The system that guides our use of language is known as grammar. These grammars are the abstract forms of the language that we employ when constructing sentences for both written and spoken communication. Human language is flexible because it is an acquired symbolic system; Words evolve and new words are formed from it.

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

2.1.2 The English Language

English is the international communication language, and non-native people utilize it more than indigenous people nowadays. The English language has progressed from "mother tongue" to the most widely read and spoken language in history.

Since the second half of the twentieth century, the English language has spread to an unknown extent around the world. Among non-native English speakers, English has become a lingua franca (Kachru & Nelson 2001, p. 9).

As a result, the English language is being used internationally, at least by non-native speakers as much as native speakers, for the first time in history (Seidlhofer, 2004).

Brumfit (2002, p.5) provided a clear description of how English is becoming more globally interconnected when he said, “Those who are already part of the growing circle and speak English are a more significant group operating in an ever-expanding global economy and having an impact on the economies of all countries... Mobile phones, the Internet, and other technologies are making it possible for people to use English independently more and more completely free from the constraints imposed by broadcast and print media, journals, and conventional educational institutions".

More than 100 countries now teach English as the most widely taught language, and in the majority of these, it is gradually taking the place of other languages as the primary foreign language in the classroom. In many nations, English has replaced other languages as the primary language of instruction in higher education since the 1960s. A significant amount of knowledge in the world, especially in fields like science and technology, is communicated through the English language. For this reason, a lot of nations have designated English as their official language or as their primary language in recent years or selected it to be the primary foreign language taught in schools. (Crystal, 2003, p. 14)

The English language is one of the most widely used and influential languages in the world, playing an important role in global communication, economics, and culture. It has evolved into a lingua franca, promoting interactions among people from various linguistic backgrounds, with over a billion speakers worldwide (Crystal, 2003). Historical events such as the growth of the British Empire and the cultural influence of the United States can be traced to the creation and dissemination of English. The

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

language adapts and transforms as it incorporates vocabulary from multiple sources, indicating its dynamic nature and adaptability (McArthur, 1998). English is vital in the modern world as a medium for literature, science, technology, and diplomacy, defining international discourse and providing access to a large reservoir of knowledge (Kachru, 1985).

The English language, renowned for its global ubiquity, serves as a unifying thread in our interconnected world. With millions of native and non-native speakers across the globe, English transcends borders and cultures, fostering communication, trade, and cultural exchange (Crystal, 2003). Its richness lies in its vocabulary, adaptability and flexibility, constantly evolving to accommodate new words and expressions reflective of the modern era (McArthur, 1998). English serves as the lingua franca of the internet, science, business, and diplomacy, facilitating cooperation and understanding among people of diverse linguistic backgrounds. Beyond its practical utility, English is a repository of literary masterpieces, from Shakespearean sonnets to contemporary novels, offering a treasure trove of creative expression and intellectual exploration.

Because of its global popularity, English has become a vital instrument for communication and cultural exchange in our interconnected age.

2.1.3 The Language of Mathematics

The language of mathematics serves as a universal code that transcends linguistic and cultural divides, providing a common basis for expressing and communicating abstract concepts and numerical relationships. It allows individuals to represent complex ideas accurately and clearly as a coded system of symbols, numbers, and mathematical symbols (Machover, 1996). This specialized language serves as the basis for scientific discoveries, technical breakthroughs, and inventions in a variety of fields (Steen, 2001). Mathematicians and scientists use this common mathematical language to investigate the mysteries of the universe and meet practical challenges. However, mathematics is more than just notation; it embodies a distinct style of thinking and reasoning and encourages logical and critical thinking (Polya, 1957).

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

It embodies the power of abstraction and representation by allowing humans to uncover the complexities of the natural world and lay the foundation for scientific and technological development (Devlin, 2012). At its core, mathematics is a universal means of intellectual study, crossing cultural divides and helping us understand the fundamental laws that govern our world (Taher, NAH, & Naik, GNKD, 2019).

It also ruled mathematics—the mathematical logic that determines whether propositions are true or false, according to Jamieson (2000), who uses linguistic jargon to explain mathematics and claims that few people recognize mathematics as a language. “I want to show how making the grammatical and rhetorical structure of mathematical language clear and explicit to students can increase their understanding of basic mathematical concepts,” he says, meaning that treating mathematics as a language will help. Unfortunately, many people regard mathematics as a set of archaic rules for dealing with strange symbols, something far removed from speaking and writing (Jamieson, 2000, p. 45).

According to Gough (2007), mathematics is a formal language that is artificially formed using our natural everyday language to teach mathematical language.

Woodin (1995) refers to mathematics as a language and suggests teaching it as a language to children. He even compares mathematics to English and says, "Mathematics can be considered a language—a language that is simpler, more consistent, and more regular than English. This is especially the case with mathematical facts. Numbers represent nouns, while operational signs (+, -), x, /, =) represent verbs. Both components are governed by the rules of syntax. Mathematical facts, such as 2 x 3 = 6, can be considered arithmetic sentences. Students should be encouraged to speak in complete sentences, convey a complete idea, and develop a pattern of practice for real mathematics. In terms of sentence facts, mathematics is a much simpler language than English. Although mathematics has an infinite number of nouns, it only contains five verbs (+, -, x, /, =) related to four basic operations.

However, some students may need to. As a result, it is taught explicitly alongside notation (place value) and number theory. To transfer vital information.

Mathematics as a language of communication has also been highlighted in mathematics curricula around the world. While the National Council of Teachers of

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

Mathematics (NCTM) in the United States refers to mathematics as a language of communication, the Standards for School Mathematics (NCTM, 2000) state that “Pre-K through 12th-grade education programs should enable all students to communicate mathematical thinking communicatively." Coherent and clear to all students, and use the language of mathematics to correctly express their mathematical ideas.

Mathematics, like English as a second language, should be taught to children as a natural language. It should be consciously taught in line with the "skill learning theory" (Dekeyser, 2007): by providing concise language that the learner can practice, such as by providing an opportunity to repeat mathematical expressions and understand their meaning, and by offering open- Activities ended to practice the skill in a wider range of applications. Teachers should also engage students in real-life use of English as well as mathematics classroom activities.

So, mathematics and English, as languages, are related to each other but different. Both are sign and symbol languages that combine "words," "sentences," and "stories." Because these “stories” have universal foundations, they are the languages of global communication. Despite these similarities, there are also important differences. Mathematical language, for example, is precise and less flexible, but natural languages have a depth of meaning and multiple options for interpreting sentences and words.

2.2 Literature Review

Language learning and cognitive development have long been recognized as interconnected processes in the field of education. Research by Anderson (2010) emphasizes the significant role of interdisciplinary learning approaches in fostering comprehensive student development, advocating for the integration of subject areas to promote holistic learning experiences. Likewise, Vygotsky's sociocultural theory (1978) underscores the importance of language as a tool for cognitive development, emphasizing the role of social interaction and collaborative learning in language acquisition and knowledge construction.

Building upon this foundation, studies by Cummins (2000) and Baker (2011) highlight the cognitive benefits of bilingual education, demonstrating how multilingual

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

exposure can enhance cognitive flexibility and problem-solving skills. These findings suggest that exposure to diverse language contexts, including the integration of mathematics concepts within language learning activities, can foster cognitive development and language proficiency.

According to the context of curriculum integration, the work of Jacobs (1989) emphasizes the value of interdisciplinary approaches in promoting deeper understanding and application of knowledge. Likewise, the research by Klein (2010) underscores the benefits of curriculum integration in cultivating critical integration thinking and analytical skills among students, supporting the idea that the mathematics and English language learning can facilitate the cross-disciplinary transfer of cognitive skills and promote holistic educational experiences.

Educational policy implications are crucial to understanding the practical implications of curriculum integration. Lagemann (2002) highlights the importance of evidence-based educational policy recommendations to support effective teaching practices and curriculum development. Additionally, the literature emphasizes the need for teacher training and professional development in implementing integrated teaching methodologies, as noted by Ormrod (2015) and Calce -Murcia et al. (2014), to ensure effective instructional practices and student engagement within an integrated curriculum framework.

3. Research Methodology

3.1 Methodology

The analytical descriptive method is used to collect, classify, and process the study data. The Statistical Package for Social Sciences (SPSS) was used to process and analyze the study data.

3.2 Samples

A random sample of 125 students, male (45) and female (80), were chosen for the academic year 2023-2024 from the eight public and private secondary schools in Erbil (63 students from public schools and 62 students from private schools). They were chosen from stages ten, eleven, and twelve; they were allocated as follows: Maarf

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

School (15) students (10 male and 5 female), Kalak School (16) students (15 male and 1 female), Azadi School (14) only male students, Sava School (15) only female students, Sardam School (16) students (6 male and 10 female), Bery School (15) students only female, Diwen (18) students only female, and Kamiar School (16) students only female. The following tables illustrate the sample dates.

Table 1 illustrates the types of schools and the number of students in each type.

Students in each type	
Public School	63
Private School	62

Table 2 illustrates the number of students according to gender.

Gender		
Male	N	45
Female	N	80

Table 3 illustrates the number of students according to the stages

Stages	
Tenth	65
Eleven	57
Twelve	3

Table 4 illustrates the number of students (male and female) and percent according to the schools.

School	Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Maarf	Male	10	66.7	66.7	66.7
	Female	5	33.3	33.3	100.0
	Total	15	100.0	100.0	
Kalak	Male	15	93.8	93.8	93.8
	Female	1	6.3	6.3	100.0
	Total	16	100.0	100.0	
Azadi	Male	14	100.0	100.0	100.0
Save	Female	15	100.0	100.0	100.0
Sardam	Male	6	37.5	37.5	37.5
	Female	10	62.5	62.5	100.0

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

	Total	16	100.0	100.0	
Bery	Female	15	100.0	100.0	100.0
Diwen	Female	18	100.0	100.0	100.0
Kamiar	Female	16	100.0	100.0	100.0

3.3 Instrument of the Study

The following procedures for designing the study questionnaire were implemented

3.3.1 Design of the Questionnaire

Twenty items were developed for a questionnaire related to interactive learning in mathematics and English that was designed to improve student understanding in each subject.

The questionnaire composed in two parts, the first contained instructions to the respondents about how to respond to the questionnaire items, and the second part included the items and the Likert scale for scoring the students' responses. Each student's responses to the questionnaire were scored in the given values; 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

3.3.2 Validity of the Questionnaire

Two methods were used to verify the validity of the questionnaire: first, it was approved by several experts in all areas of education, psychology, English, and mathematics; And second, through the internal consistency of the items of the questionnaire, the degree of correlation was significant at 0.01 (2-tailed) and 0.05 (2-tailed). The following table illustrates the internal consistency of the questionnaire.

Table 5 illustrates the internal consistency of the questionnaire and the degree of correlation.

Correlations					
		School	Type of School	Stage	Gender
School	Pearson Correlation	1	-.008	.275 **	.682 **
	Sig.(2tailed)		.926	.002	.000
	N	125	125	125	125
Type of School	Pearson Correlation	-.008	1	.081	.211 *
	Sig.(2tailed)	.926		.371	.018
	N	125	125	125	125

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

Stage	Pearson Correlation	.275 **	.081	1	.265 **
	Sig.(2tailed)	.002	.371		.003
	N	125	125	125	125
Gender	Pearson Correlation	.682 **	.211 *	.265 **	1
	Sig.(2tailed)	.000	.018	.003	
	N	125	125	125	125
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

3.3.3 Reliability of the questionnaire

The reliability of the questionnaire was checked and was reliable the value of Cranach's Alpha was .914, the following table illustrates the questionnaire's reliability.

Table 6 illustrates the reliability of the questionnaire.

Reliability statistics	
Cronbach's Alpha	N of Items
.914	20

3.3.4 Statistical Analysis

SPSS (2022, version 22) was used to analyze the data. The present study utilized a combination of descriptive and inferential statistics such as mean, standard deviation, correlation, and ANOVA.

4. The Findings of the Study

4.1 Investigating how learning mathematics affects secondary school student's ability to communicate in English showed interdisciplinary connections between mathematics education and improving secondary school students' English language proficiency. The mean impact of learning mathematics on improving English language competency was 3.2455, above the theoretical mean of (3), indicating a significant impact of mathematics learning on improving English language competency among secondary school students, according to the findings. The means of all the items are above the theoretical mean, except item number 15, which states, “Do you examine academic English texts using your mathematical skills?” and item number 16, which states, “Can your mathematical studies help you identify linguistic patterns and sequences better?” which were

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

both below the theoretical mean, at 2.92 and 2.82, respectively, as the following table demonstrates.

Table 7 shows the mean and standard deviation for the student's responses to the questionnaire's items.

N.	Items	Mean	Std. Deviation
Q1	Do you believe that understanding mathematical principles helps you grasp the English language better?	3.66	1.07841
Q2	Do you believe your mathematical problem-solving abilities help you solve linguistic challenges in English?	3.34	1.10675
Q3	Do you examine complex linguistic structures in English using mathematical concepts?	3.38	1.12726
Q4	Have you seen an improvement in your language skills as a result of studying sports?	3.46	1.17462
Q5	Do you employ mathematical skills to understand difficult English vocabulary?	3.46	1.1395
Q6	Can you evaluate English literary texts using mathematical methods?	3.42	1.10908
Q7	Do you sense a difference in your language skills after completing complex mathematical problems?	3.38	1.24216
Q8	Do you believe that mastering mathematical principles can help you use the English language more accurately?	3.28	1.07463
Q9	Do you examine scientific and technical literature in English using your mathematical skills?	3.51	1.13319
Q10	Do you believe that your understanding of mathematical principles aids your comprehension of English texts?	3.32	1.09692
Q11	Do you believe that solving mathematical problems improves your ability to express yourself clearly in English?	3.14	1.20953
Q12	Do you believe that mathematical concepts help you to understand grammar more thoroughly?	3.16	1.25338
Q13	Can you examine complex grammar using mathematical methods?	3.00	1.16741
Q14	Have you observed an improvement in your ability to interpret high-level literature since the beginning of study mathematics?	3.34	1.13666
Q15	Do you examine academic English texts using your mathematical skills?	2.92	1.09692
Q16	Can your mathematical studies help you identify linguistic patterns and sequences better?	2.82	1.27674
Q17	Do you believe that understanding mathematical principles can assist you in analyzing numerous English linguistic contexts?	3.00	1.26374
Q18	Are mathematical principles utilized in the context of scientific subjects to analyze English?	3.2	1.26364

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

Q19	Do you feel that understanding mathematical principles helps you grasp the English language better?	3.02	1.28555
Q20	Do you think your mathematical problem-solving abilities help you solve linguistic challenges in English?	3.10	1.3668

4.2 The findings of the study show that there is no significant effect of the difference of gender on the responses of students on the impact of learning mathematics on improving English language competency because the mean of the responses of both males and females was below the theoretical mean (3), it was 2.36 for males and 2.44 for females, which means the impact of the difference of the gender was weak. The following table illustrates the means and standard divisions of the effect of different genders on the impact of learning mathematics on improving English language competency.

Table 8. illustrates the means and standard divisions of the effect of gender on the impact of learning mathematics on improving English language competency according to gender variables

Male	N	45
	Mean	2.36
	Std. Deviation	.529
Female	N	80
	Mean	2.44
	Std. Deviation	.524

4.3 The findings of the study show that there is no significant effect of the difference level in the study (stages) on the responses of students on the impact of learning mathematics on improving English language competency because the mean of the responses was below the theoretical mean (3); it was 2.52 for stage 10, 2.28 for stage 11, and 2.33 for stage 12, which means the impact was weak according to this variable. The following table illustrates the means and standard divisions of the effect of the different levels of study (stages) on the impact of learning mathematics on improving English language competency.

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

Table 9. illustrates the means and standard divisions of the effect of different stages on the impact of learning mathematics on improving English language competency according to the level of study (stages).

Stage 10	N	65
	Mean	2.52
	Std. Deviation	.533
Stage 11	N	57
	Mean	2.28
	Std. Deviation	.491
Stage 12	N	3
	Mean	2.33
	Std. Deviation	.577

4.4 The findings of the study show that there is no significant effect of the difference in the type of schools (public or private) on the responses of students on the impact of learning mathematics on improving English language competency because the mean of the student's responses in both public and private schools was below the theoretical mean (3), it was 2.38 for public schools and 2.44 for private schools, which means the impact of the difference of the type of schools was weak. The following table illustrates the means and standard divisions of the effect of different types of schools on the impact of learning mathematics on improving English language competency.

Table 10. illustrates the means and standard divisions of the effect of different schools on the impact of learning types of mathematics on improving English language competency according to the level of study (stages).

Public School	N	63
	Mean	2.38
	Std. Deviation	.551
Private School	N	62
	Mean	2.44
	Std. Deviation	.500

The above findings of (4.1, 4.2,4.3,4.4) indicate a significant impact of mathematics learning on improving English language competency among secondary

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

school students in general regardless of differences of gender, level of study, and the types of school.

4.5 The findings of the ANOVA show that there are no significant differences among the variables related to the impact of mathematics learning on improving English language competency in secondary school because the values of sig were higher than.05 (.206,.073,.261 , and.268), so according to the findings, all three hypotheses are accepted. The following table illustrates that.

Table 10. illustrates the results of the ANOVA.

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
School	Between Groups	301.628	50	6.033	1.231	.206
	Within Groups	362.740	74	4.902		
	Total	664.368	124			
Type of School	Between Groups	15.459	50	.309	1.449	.073
	Within Groups	15.789	74	.213		
	Total	31.248	124			
Stage	Between Groups	16.486	50	.330	1.175	.261
	Within Groups	20.762	74	.281		
	Total	37.248	124			
Gender	Between Groups	12.710	50	.254	1.169	.268
	Within Groups	16.090	74	.217		
	Total	28.800	124			

5. Conclusions, Recommendations and Suggestions for Further Research

5.1 Conclusions

The findings of the study indicate the following conclusions:

1. The study identified that there is an interdisciplinary relationship between learning mathematics and enhancing English language competency because there is a significant impact of learning mathematics on enhancing the English language competency of secondary school students.

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

2. There is a significant impact of learning mathematics on enhancing the English language competency of secondary school students regardless of the type of gender.
3. There is a significant impact of learning mathematics on enhancing the English language competency of secondary school students regardless of the level of study.
4. There is a significant impact of learning mathematics on enhancing the English language competency of secondary school students regardless of the type of school (public or private).

5.2 Recommendations

The following are the researchers' recommendations:

1. Instructors of mathematics and English ought to integrate multiple instructional strategies that combine mathematical concepts to increase English acquisition and comprehension.
2. The responsible bodies for designing curriculum ought to develop curricula that allow for the integration of mathematics and English language learning within the curricular framework while taking into account the consequences for instructional design and execution.
3. The administration bodies ought to train mathematics and English teachers in order to effectively deploy integrated teaching strategies that connect mathematics and English language learning.
4. For such initiatives to have a significant impact, educational policymakers, curriculum authors, and school administrators ought to support the integration of mathematics and English language development in secondary school settings.

5.3 Suggestion for Further Research

The following study topics are suggested by the researchers:

1. Analyze and evaluate the effectiveness of various teaching strategies that use mathematical principles to improve English acquisition and understanding.

2. Evaluate student achievement and compare the performance of students who utilize integrated mathematics and English learning techniques to the performance of students who use traditional subject-specific learning methods.
3. Examine the advantages and disadvantages of merging mathematics and English language learning within the current curriculum framework, taking into account the implications for instructional design and implementation.
4. Look into the learning objectives associated with integrating mathematics learning within the context of English language learning, such as language competence, critical thinking skills, and problem-solving abilities.
5. Investigate the training demands and professional development needs of educators to effectively deploy integrated teaching strategies that connect mathematics and English language acquisition.

References:

1. Anderson, J. R. (2010). Cognitive Psychology and its Implications (7th ed.). New York: Worth Publishers. https://www.amazon.com/Cognitive-Psychology-Implications-John-Anderson/dp/1429219483
2. Bachman, L. F., & Palmer, A. S. (2010). Language assessment in practice: Developing language assessments and justifying their use in the real world. Oxford University Press. https://www.researchgate.net/publication/277232154_Language_Assessment_in_Practice#fullTextFileContent
3. Baker, C. (2011). *Foundations of bilingual education and bilingualism* . Multilingual matters. https://criancabilingue.files.wordpress.com/2013/09/colin-baker-foundations-of-bilingual-education-and-bilingualism-bilingual-education-and-bilingualism-27-2001.pdf
4. Boaler , J. (2016). *Mathematical mindsets: Unleashing students' potential through creative mathematics, inspiring messages, and innovative teaching.* Jossey-Bass/Wiley. https://psycnet.apa.org/record/2016-07883-000
5. C. Brumfit , (2002) Individual Freedom in Language Teaching. *ELT Journal* , Volume 56, Issue 3, July 2002, Pages 335–337, https://doi.org/10.1093/elt/56.3.335
6. Celce -Murcia, M., Brinton, D., & Snow, A. (2014). Teaching English as a Second or Foreign Language (4th ed.). National Geographic Learning: Heinle Cengage Learning,

Boston andHeinle ELT. https://search.worldcat.org/title/teaching-english-as-a-second-or-foreign-language/oclc/828424065

7. Chomsky, N. (1965). *Aspects of the theory of syntax.* MIT Press. https://psycnet.apa.org/record/1965-35026-000
8. Crystal, D. (2003). English as a Global Language. Cambridge University Press. https://doi.org/10.1017/CBO9780511486999
9. Cummins, J. (2000). *Language, power, and pedagogy: Bilingual children in the crossfire* (Vol.23). Multilingual matters. DOI: 10.1080/15235882.2001.10162800
10. Dekeyser, R. (2007). Practice in a Second Language: Perspectives from Applied Linguistics and Cognitive Psychology. Cambridge: Cambridge University Press. DOI: 10.12691/education-1-9-2
11. Devlin, K. (2012). Mathematics: The Science of Patterns. Scientific American. https://openlibrary.org/books/OL7835474M/Mathematics_The_Science_of_Patterns
12. Freeborn, D. (1987). A Coursebook in English Grammar. Macmillan. https://doi.org/10.1007/978-1-349-18527-6
13. Jacobs, H. H. (1989). *Interdisciplinary curriculum: Design and implementation* . Association for Supervision and Curriculum Development, 1250 N. Pitt Street, Alexandria, VA 22314. https://books.google.dk/books/about/Interdisciplinary_Curriculum.html?id=_74lAQAAIAAJ&redir_esc=y
14. Jamison, R. E. (2000). Learning the language of mathematics. Language and Learning Across the Disciplines, 4(1), 45-54. https://wac.colostate.edu/docs/llad/v4n1/jamison.pdf
15. Kachru, B. B. (1985). Standards, Codification, and Sociolinguistic Realism: The English Language in the Outer Circle. In R. Quirk & H. G. Widdowson (Eds.), English in the World: Teaching and Learning the Language and Literatures (pp. 11-30). Cambridge University Press. https://link.springer.com/article/10.1007/s10993-007-9060-9
16. Kachru, Y., & Nelson, C. L. (2006). World Englishes in Asian Contexts. https://vulms.vu.edu.pk/Courses/ENG506/Downloads/World%20Englishes%20in%20Asian%20Contexts.pdf
17. Klein, J. T. (2010). Interdisciplinarity: history, theory, and practice. Wayne State UniversityPress. https://books.google.dk/books/about/Interdisciplinarity.html?id=4uM8fjxhjqsC&redirесc=y
18. Lagemann, E. C. (2002). An elusive science: The troubling history of educational research. University of Chicago Press. https://doi.org/10.1023/A:1010053313889

19. Locke, L. F. (1992). Changing secondary school physical education. *Quest (00336297)* , *44* (3). https://doi.org/10.1080/00336297.1992.10484062
20. Machover, M. (1996). Set Theory, Logic, and Their Limitations. Cambridge University Press. https://assets.cambridge.org/97805214/79981/frontmatter/9780521479981_frontmatter.pdf
21. McArthur, T. (1998). The English Languages. Cambridge University Press. https://doi.org/10.1017/9780511621048
22. NCTM, 2000. National Council of Teachers of Mathematics. Principles and Standards for School Mathematics. Reston, VA: Author. https://www.nctm.org/standards2000/
23. Ormrod, J. E. (2014). Essentials of educational psychology: Big ideas to guide effective teaching (3rd ed.). Boston: Pearson. https://www.researchgate.net/publication/352354491_Essentials_of_Educational_Psychology_Big_Ideas_to_Guide_Effective_Teaching
24. Pinker, S. (1994). The Language Instinct: How the Mind Creates Language, 71(3), 610–614. https://doi.org/10.2307/416234
25. Pieter AM Seuren , 2013. What does language have to do with logic and mathematics? https://academic.oup.com/book/1654/chapterabstract/141197711?redirectedFrom= fulltext
26. Polya, G. (1957). How to Solve It: A New Aspect of Mathematical Method. Princeton University Press. https://lms.umb.sk/pluginfile.php/37176/mod_folder/content/0/Polya_How-to-solve-it.pdf
27. Sapir, Edward *(1921). Language: An introduction to the study of speech . New York: Harcourt, Brace and Company. ISBN 978-4-87187-529-5 . ASIN: B000NGWX8I.*
28. Seidlhofer , B. (2004). 10. RESEARCH PERSPECTIVES ON TEACHING ENGLISH AS A LINGUA FRANCA. Annual Review of Applied Linguistics, 24, 209–239. DOI: https://doi.org/10.1017/S0267190504000145
29. Taher, N. H. (2021). Evaluating the Teaching Skills of Mathematics Faculty Members at Private Universities in The Kurdistan Region of Iraq According to Quality Specifications. *QALAAI ZANIST JOURNAL* , *6* (1), 306-326. https://journal.lfu.edu.krd/ojs/index.php/qzj/article/view/582
30. Taher, NAH, & Naik, GNKD (2019). MOTIVATING STUDENTS IN LEARNING MATHEMATICS BY USING CONTEXTUAL TEACHING STRATEGIES. https://scholar.google.com/scholar?cluster=17267235980880683215&hl=da&as_sdt=2005
31. T. Iwamoto, 2017. Math's, Logic, and Language. A work on the philosophy of mathematics. https://philarchive.org/archive/IWAMLA-2

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

32. Whorf, B. L. (1956). *Language, thought, and reality: selected writings of… . (Edited by John B. Carroll.).* Technology Press of MIT. https://psycnet.apa.org/record/1956-07134-000
33. Woodin, C. (1995). The landmark method for teaching arithmetic. Landmark School, Inc. and Christopher Woodin. Retrieved from: http://www.landmarkoutreach.org/MathasaLanguage.htm

---

کاریگەری فێربوونی بیرکاری لەسەر باشترکردنی فێربوونی زمانی ئینگلیزی لە قوتابخانە ناوەندییەکانی شاری هەولێر

پـوختـه:

ئامانجی ئەم لێکۆڵینەوەیە ئەوەیە دۆزینەوەی کاریگەری فێربوونی بیرکارییە لە باشترکردنی لێهاتوویی زمانی ئینگلیزی لەنێو خوێندکارانی قوتابخانەکانی ناوەندی شاری هەولێری پایتەختی هەرێمی کوردستانی عێراق. ڕێگای شیکردنەوەی وەسفکراو بەکارهێنرا بۆ کۆکردنەوە و پۆلێنکردن و پرۆسەکردنی داتاکە، و پاکێجی ئاماری بۆ زانستە کۆمەڵایەتییەکان (SPSS) بۆ چارەسەری ئاماری بەکارهێنرا. نموونەیەکی هەڕەمەکی (125) خوێندکاری نێر و مێ (45 نێر و 80 مێ) بۆ ساڵی خوێندنی 2023-2024 لە 8 قوتابخانەی ئامادەیی گشتی وە بە تایبەتی لە شاری هەولێر هەڵبژێردرا. ڕاپرسییەکە کە پێکهاتبوو لە بیست بابەتی پەیوەندیدار بە فێربوونی کارلێک لە بیرکاری و ئینگلیزیدا ئامادەکرا و پێوەری لایکرت بۆ تۆمارکردنی وەڵامەکانی خوێندکارەکان بەکارهێنرا و ئەم بەهایانەی خوارەوە درا بە وەڵامەکانی خوێندکارەکان ١ = بە توندی ناڕازین ٢ = ناڕازین ٣ = بێلایەن ٤ = ڕازیبوون و ٥ = بە توندی هاوڕان. ڕەوایەتی و یەکسانیی بڕیارەکە پشتڕاستکرایەوە.

توێژینەوەکە پەیوەندییەکی دۆزیوەتەوە لە نێوان فێربوونی بیرکاری و باشترکردنی شارەزایی زمانی ئینگلیزی. لێکۆڵینەوەکە پێشنیاری گرنگی یەکخستنی چەندین ستراتیژی پەروەردەیی کرد کە چەمکە بیرکاری و زمانەوانییەکان لە بواری فێربوونی زمانی ئینگلیزیدا تێکەڵ دەکەن بۆ زیادکردنی دەستکەوتن وە تێکەڵکردنی زمانی ئینگلیزی.

QALAAI ZANISTSCIENTIFIC JOURNAL
A Scientific Quarterly Referred Journal Issued by Lebanese French University – Erbil, Kurdistan, Iraq
Vol. (9), No (2), Summer 2024
ISSN 2518-6566 (Online) - ISSN 2518-6558 (Print)

أثر تعلم الرياضيات في تحسين تعلم اللغة الانجليزية في المدارس الثانوية في محافظة اربيل

الملخص:
تهدف هذه الدراســـة إلى معرفة أثر تعلم الرياضـــيات في تعزيز كفاءة اللغة الإنجليزية لدى طلاب المدارس الثانوية في مدينة أربيل عاصـــمة إقليم كردســـتان العراق. . تم اســـتخدام المنهج الوصـــفي التحليلي في جمع وتصـــنيف ومعالجة بيانات، وتم اســـتخدام الحزمة الإحصـــائية للعلوم الاجتماعية (SPSS) للمعالجات الاحصائية. . تم اختيار عينة عشوائية مكونة من 125 طالباً وطالبة (45 طالب) و(80 طالبة) للعام الدراسي 2024-2023 من 8 مدارس ثانوية حكومية وخاصة في مدينة اربيل.
تم اعداد استبانة مكونة من عشرين فقرة تتعلق بالتعلم التفاعلي في الرياضيات واللغة الإنكليزية، وتم استخدام مقياس ليكرت لتسجيل استجابات الطلاب، واعطيت القيم الاتية لإستجابات الطلبة 1 = غير موافق بشدة، 2 = غير موافق، 3 = محايد، 4 = موافق، و5 = موافق بشدة. تم التحقق من صدق وثبات الاستبانة.
توصلت الدراسة إلى وجود علاقة بين تعلم الرياضيات وتعزيز كفاءة اللغة الإنجليزية. وأوصت الدراسة بأهمية دمج اســتراتيجيات تعليمية متعددة تجمع بين المفاهيم الرياضــية واللغوية في مجال تعلم اللغة الانكليزية لزيادة اكتساب واستيعاب اللغة الإنجليزية.