THE EFFECTS OF DIGITAL TOOLS ON THE DEVELOPMENT OF ENGLISH LANGUAGE SKILLS: META-ANALYSIS

Svajune İSTİKBAL
211113107

MASTER OF ARTS

Department of Foreign Languages Education
English Language Teaching Programme with Thesis
Advisor: Asst. Prof. Dr. Hakan DİLMAN

İstanbul
T.C. Maltepe University
Graduate School
February, 2024

THE EFFECTS OF DIGITAL TOOLS ON THE DEVELOPMENT OF ENGLISH LANGUAGE SKILLS: META-ANALYSIS

Svajune İSTİKBAL
211113107

ORCID: 0000-0002-1128-0090

MASTER OF ARTS

Department of Foreign Languages Education
English Language Teaching Programme with Thesis
Advisor: Asst. Prof. Dr. Hakan DİLMAN

İstanbul
T.C. Maltepe University
Graduate School
February, 2024



JÜRİ VE ENSTİTÜ ONAYI

SVAJUNE ISTIKBAL'ın "The Effects of Digital Tools on the Development of English Language Skills: Meta-analysis" başlıklı tezi 21.02.2024 tarihinde aşağıdaki jüri tarafından değerlendirilerek "Maltepe Üniversitesi Lisansüstü Eğitim ve Öğretim Yönetmeliği" nin ilgili maddeleri uyarınca Yabancı Diller Eğitimi Anabilim Dalı Yüksek Lisans/Doktora/Sanatta Yeterlik tezi oy birliğiyle/oy çokluğuyla, başarılı/başarısız olarak kabul edilmiştir.

	Unvanı, Adı ve Soyadı	İmza
Üye (Tez Danışmanı)	Dr.Öğr.Üyesi Hakan DİLMAN Maltepe Üniversitesi	.....
Üye	Prof.Dr. Aysu ERDEN Maltepe Üniversitesi	.....
Üye	Dr. Öğr. Üyesi Aybars ERÖZDEN Okan Üniversitesi	.....

Enstitü Müdürü

ETİK İLKE VE KURALLARA UYUM BEYANI

Bu belge, Yükseköğretim Kurulu tarafından 19.01.2021 tarihli "Lisansüstü Tezlerin Elektronik Ortamda Toplanması, Düzenlenmesi ve Erişime Açılmasına İlişkin Yönerge" ile bildirilen 6698 Sayılı Kişisel Verilerin Korunması Kanunu kapsamında gizlenmiştir.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the individuals who have played an integral role in the completion of my thesis. First and foremost, I am deeply thankful to my thesis advisor, Assist. Prof. Dr. Hakan Dilman, for his invaluable guidance, unwavering support, and insightful feedback throughout the research process.

I am also immensely grateful to my parents, Violeta Monstviliene and Pranas Monstvilas, for their continuous encouragement, love, and understanding. Their belief in my abilities has been a constant source of motivation.

A special thank you goes to my husband, Kenan Istikbal, for his patience, encouragement, and unwavering support during the challenging moments of thesis writing. His belief in my capabilities has been a driving force behind my success.

I extend my heartfelt appreciation to my son, Aras Timur, for his understanding and support during the demanding times when I had to focus on my research.

Last but not least, I want to express my gratitude to my mother-in-law, Hatice Peçe, for her support and understanding throughout this academic journey.

I am truly blessed to have such a supportive and understanding circle of family and friends. Thank you all for being an integral part of my academic success.

Svajune İSTİKBAL

February, 2024

ÖZET

DİJİTAL ARAÇLARIN İNGİLİZCE DİL BECERİLERİN GELİŞİMİNE ETKİLERİ: META-ANALİZ

Svajune İstikbal
Yüksek Lisans Tezi
Yabancı Diller Eğitimi Anabilim Dalı
İngiliz Dili Eğitimi Tezli Yüksek Lisans Programı
Danışman: Dr. Öğr. Üyesi Hakan Dilman
Maltepe Üniversitesi Lisansüstü Eğitim Enstitüsü, 2024

Bu tez İngilizceyi yabancı dil olarak öğrenen öğrencilerin dil becerilerinin gelişimi üzerinde dijital araçların etkisini kapsamlı bir meta-analitik yaklaşım ile araştırmaktadır. *Google Scholar, ERIC, Web of Science* ve *Yükseköğretim Kurulu Ulusal Tez Merkezi* veritabanlarından seçilen makale ve yüksek lisans tezlerinden toplam 56'sını içeren bir veri kümesi üç araştırma sorusuna yanıt bulmak amacıyla incelenmiştir. Çalışmada ilk olarak dil becerilerini geliştirmek için kullanılan mesajlaşma uygulamaları, sesli ve görsel içeriklere erişimi sağlayan dijital platformlar ve İngilizce öğretimi odaklı araçlar da dahil olmak üzere çeşitli dijital araçlar tanımlanmaktadır. Sonraki nicel çözümlemede dijital araçların dil becerisinin gelişimi üzerinde genellikle olumlu bir etkiye sahip olduğu belirlenmiştir. Bu etki söz konusu araçlar arasında farklı boyutlarda değişmektedir. Dijital araçların her dil becerisi üzerindeki etkisi Cohen d değeri dinleme için 1.12, konuşma için 1.74, okuma için 0.99 ve yazma için 1.03 olarak saptanmıştır. Bu meta-analizde yaş ve dil yeterliliği düzeyi ayırt edici etmenler olarak ortaya çıkmış olup daha küçük yaşta öğrenenler ile daha düşük dil yeterliliği düzeyine sahip olan öğrenenlerin özellikle dinleme ve konuşma becerilerinde daha fazla yarar sağladığı belirlenmiştir. Yaş ve dil yeterlilik düzeyi; okuma ve yazma becerilerinin gelişimi üzerinde belirgin bir etkiye sahip değildir.

Anahtar Sözcükler: Meta-analiz, dijital araçlar, teknoloji kullanımı, EFL, dil becerileri

ABSTRACT

THE EFFECTS OF DIGITAL TOOLS ON THE DEVELOPMENT OF ENGLISH LANGUAGE SKILLS: META-ANALYSIS

Svajune İstikbal
Master Thesis
Department of Foreign Languages Education
English Language Teaching Master's Programme with Thesis
Thesis Advisor: Asst. Prof. Dr. Hakan Dilman
Maltepe University Graduate School, 2024

This thesis investigates the impact of digital tools on the language skills development of English as a Foreign Language (EFL) learners through a comprehensive meta-analytical approach. A total of 56 papers, comprising articles and Master's theses, were scrutinized to address three key research questions. Firstly, the study identified a diverse array of digital tools employed to enhance language skills, including messaging apps, audio-video platforms, and EFL-focused tools. Secondly, quantitative analysis revealed a predominantly positive impact of digital tools on language skill development, with effect sizes varying across different tools. The overall effect of digital tools on each language skill was found to be substantial, with theta values of 1.12 for listening, 1.74 for speaking,

0.99 for reading, and 1.03 for writing. Thirdly, age and proficiency level emerged as significant moderators, indicating that younger learners and those at lower proficiency levels derived more substantial benefits, particularly in listening and speaking skills. Notably, age and proficiency level did not significantly moderate the development of reading and writing skills.

Keywords: Meta-analysis, digital tools, technology use, EFL, language skills

GENİŞLETİLMİŞ TÜRKÇE ÖZET

DİJİTAL ARAÇLARIN İNGİLİZCE DİL BECERİLERİN GELİŞİMİNE ETKİLERİ: META-ANALİZ

Yabancı Dil Olarak İngilizce (EFL) eğitimi alanı son yıllarda dijital araçların hızlı bir şekilde entegrasyonuna tanık olmuştur. Teknolojinin dil öğrenimi üzerindeki etkisini araştıran giderek artan sayıda araştırma olsa da çeşitli dijital araçların farklı dil becerilerini özel olarak nasıl etkilediğine ilişkin kapsamlı incelemeler sınırlı kalmaktadır. Var olan alanyazın çalışmalarına bakıldığında bulgular üzerine dizgesel bir sonuç çıkarmanın sentezinin bulunmaması eğitimcilerin ve eğitim politikalarını düzenleyenlerin dijital araçların etkililiğine ilişkin net bir bakış açısı elde etmelerini engellemektedir. Ayrıca, yaş ve yeterlilik düzeyi gibi öğrenene özgü etmenlerin bu araçların dil becerisi gelişimi üzerindeki etkililiğinin de yeterli düzeyde araştırılmadığı söylenebilir. Elinizdeki araştırma dijital araçların İngilizceyi yabancı dil olarak öğrenenlerin dinleme, konuşma, okuma ve yazma becerileri üzerindeki etkilerine ilişkin kapsamlı bir genel bakış sağlamak amacıyla bir meta-analiz yapmakta ve böylece ilgili çalışmaların dizgesel olarak gözden geçirilmesi ve birleştirilmesiyle bu boşlukları bir ölçüde gidermeyi amaçlamaktadır.

Çalışmada üç araştırma sorusuna yanıt aranmıştır:

1. Her bir dil becerisini geliştirmek için kullanılan dijital araçlar nelerdir?

2. Dijital araçların öğrencilerin dil becerileri (dinleme, konuşma, okuma ve yazma) üzerindeki genel etkisi nedir?

3. Dijital araçlardan dil becerilerinin gelişimi özellikle öğrenenle ilgili aşağıdaki iki etmen açısından nasıl etkilenmektedir:

a) Öğrenenlerin yaşı

b) Öğrenenlerin yabancı dil yeterlilik düzeyi

Dijital araçların yabancı dil öğrenenlerin dil becerilerinin gelişimi üzerindeki etkilerini araştıran elinizdeki çalışma bir meta-analizdir. *Google Scholar, ERIC, Web of Science* ve

Yükseköğretim Kurulu Ulusal Tez Merkezi veritabanlarından seçilen makale ve yüksek lisans tezlerinden toplam 56 çalışma incelenerek çözümlenmiştir. Seçilen çalışmalar önceden belirlenmiş ölçütlere göre inceleme kümesine alınmış, her çalışmada sunulan veriler üst bakış açısıyla çözümlenerek tümü üzerinden sonuçlara varılmıştır.

İlk araştırma sorusu olarak İngilizce öğrenenlerin dil becerilerini geliştirmek için kullanılan dijital araçların kullanımı araştırılmıştır. Dil becerilerini kapsamlı bir biçimde geliştirmek için çeşitli dijital araçların kullanıldığı, *WhatsApp* ve *Telegram* gibi mesajlaşma uygulamalarının tüm dil becerileri için kullanıldığı, ve ses ve video içeriğine erişimi kolaylaştıran dijital araçların oldukça tercih edildiği ortaya çıkmıştır.

Araştırmacılar bu amaçla ağırlıklı olarak TED Konuşmalarını, çeşitli podcast'leri ve YouTube videolarını tercih etmektedir. Belirli dil becerilerini ele almak için İngilizce öğretimine yönelik araçlar kullanılmaktadır. Örneğin, dinleme becerilerini geliştirmek için *Rosetta Stone* ve *The Four Corners* yazılımlarından yararlanılmakta; ayrıca, dinleme becerilerini geliştirmek için *Two Minute English, BBC Learning English* uygulamaları, *Talk2Me English, Voscreen, Lyrics Training* ve *Miracle English* web siteleri gibi İngilizce öğretimine yönelik geniş çapta erişilebilir platformlardan yararlanılmaktadır. Konuşma becerileri, çok tanınan *BBC Learning English* uygulamaları aracılığıyla geliştirilmektedir. Diğer araçların yanı sıra okuma becerilerini geliştirmek için dijital okuma gereçlerinden yararlanılırken yazma becerilerinde *Oxford Dilbilgisi* ve sesletim uygulaması ve *Paragraph Punch* yazılımı gibi araçlardan yararlanılmaktadır. Genel olarak, her bir dil becerisinin gelişimini hedeflemek için seçilen dijital araçlarda geniş bir çeşitlilik vardır.

İkinci araştırma sorusu olarak dijital araçların her bir dil becerisinin geliştirilmesi üzerindeki genel etkisinin ne olduğu incelenmiştir. Bu amaçla, seçilen çalışmalarda bulunan nicel veriler araştırma öncesi ve araştırma sonrası sayıl ölçümleri ve küme büyüklükleri aracılığıyla değerlendirilmiştir. Veriler istatistiksel veri analiz yazılımı olan *Stata 17* aracılığıyla işlenmiştir. İlk olarak her bir uygulama için etki büyüklükleri hesaplanmıştır. Sonuçlar, cep telefonu aracılığıyla yüksek sesle okuma görevleri dışında tüm dijital araçların dil becerilerinin gelişimi üzerinde olumlu bir etkiye sahip olduğunu göstermektedir. Her bir dijital aracın etki büyüklüğü çoğunlukla orta ila önemli arasında değişmekte olup geriye sadece küçük bir etkiye sahip olan birkaç araç kalmaktadır.

Ayrıca, dijital araçların her bir dil becerisinin geliştirilmesi üzerindeki genel etkisinin tüm dil becerileri için önemli olduğu bulunmuştur. Bu araştırmanın bulguları daha önce yapılmış benzer meta-analiz çalışmalarıyla uyum göstermektedir. Kümülatif kanıtlar, dijital araçların yabancı dil İngilizce eğitimine entegre edilmesinin çeşitli dil yeterlilik alanlarında önemli avantajlar sağladığı görüşünü doğrulamaktadır.

Üçüncü araştırma sorusu olarak dil becerilerini geliştirirken dijital teknolojilerin etkinliği üzerinde yaş ve dil yeterlilik düzeyinin belirleyiciliği araştırılmıştır. İstatistiksel olarak anlamlı iki bulgu elde edilmiştir. İlk olarak; aracı çözümlemesi sonuçları dinleme becerilerinin gelişiminde yaşın önemli bir aracı rolü olduğunu göstermiştir. Bu dijital araçların küçük yaştaki öğrenenlerde dinleme becerilerini geliştirmek için özellikle avantajlı olabileceğini ortaya koymaktadır. Bu korelasyon küçük yaştaki bireylerin özellikle video ve ses gibi dijital teknolojilere olan tanışıklıklarının artması nedeniyle bu tür araçların dil öğrenme çabalarına entegrasyonundan belirgin yararlar elde edilebileceği görüşüyle uyumludur. İkinci olarak araştırmada dil yeterlilik düzeyinin konuşma becerilerinin gelişimini biçimlendirmede önemli bir etmen olduğu saptanmış, bu da dijital araçların daha düşük dil yeterliliği düzeylerindeki öğrenenler için daha etkili olabileceğini göstermiştir. Bu bulgunun bir yorumu; daha düşük yeterlilik düzeyine sahip bireylerin kendilerini erek dilde sözlü olarak dile getirmede sıklıkla temel zorluklarla karşılaşması olarak yapılabilir. Dijital araçların etkileşimli özellikleri İngilizceyi yabancı dil olarak öğrenenlerin pratik yapmaları ve konuşma yeteneklerini geliştirmeleri için sağlam bir destek sunabilmektedir. Dijital araçların görsel ve etkileşimli ögeleri dil öğreniminin ilk aşamalarında öğrenenlere ek kaynaklar sağlayarak yardımcı olabilmektedir. Ancak, meta-regresyon okuma ve yazma becerilerinin gelişiminde ne yaş ne de dil yeterlilik düzeyinin etkili aracılar olduğunu göstermiştir.

Elinizdeki çalışmanın bulguları yabancı dil öğretmenleri için anlamlı eğitsel çıkarımlar içermektedir. İlk olarak, eğitimciler dil becerilerini geliştirmek için belirlenen çeşitli dijital araçları kabul etmelidir. Bu çeşitliliği anlamak öğretmenlerin geliştirmeyi hedefledikleri belirli dil becerisine dayalı olarak öğretim yaklaşımlarını özelleştirmelerine olanak sağlar. Ayrıca, dinleme ve konuşma becerileri üzerinde yaş ve dil yeterliliğinin aracı rolü etkilerinin olduğunun tanınması dijital araç entegrasyonunun öğrenenlerin belirli gereksinimlerine ve gelişim aşamalarına göre uyarlanmasının önemli

olduğunu ortaya çıkarmaktadır.

Ellinizdeki çalışmadaki bulgular karar mercilerinin yabancı dil olarak İngilizce eğitiminin yapısını biçimlendirmedeki kritik rolünün altını çizmektedir. Dil öğretiminde teknolojinin öneminin farkında olan karar mercileri teknoloji eğitiminin yararlarını İngilizce öğretmenlerinin hizmet öncesi eğitimi programlarıyla bütünleştirmeye önem vermelidir. Geleceğin eğitimcilerinin yalnızca dijital araçların avantajlarını anlamalarını sağlamakla kalmayıp aynı zamanda bunların yabancı dil sınıflarında etkili bir biçimde uygulanmasına ilişkin uygulamaya yönelik eğitim almalarını sağlamak önem taşımaktadır. Ek olarak, bu çıkarımlar hizmet içi öğretmen mesleki gelişimini de kapsamaktadır. Karar mercileri hizmet içi İngilizce öğretmenleri için sürekli eğitimi destekleyen, gelişen teknolojilere ayak uydurmalarına ve öğretim uygulamalarını sürekli olarak geliştirmelerine olanak tanıyan program ve girişimler oluşturmayı düşünmelidir. Politika yapıcılar hem hizmet öncesi hem de hizmet içi öğretmen gelişimini ele alan bütünsel bir yaklaşımı savunarak teknolojik açıdan yetkin ve yenilikçi bir yabancı dil eğitim programının geliştirilmesine önemli ölçüde katkıda bulunabilirler.

Elinizdeki çalışmanın bulguları gelecekteki araştırmalar için çeşitli öneriler vermektedir. Öncelikle, araştırmacılar okuma ve yazma gibi daha az dikkat çeken becerileri kapsayacak biçimde araştırmaları çeşitlendirebilirler. Ayrıca, dijital araçların 12 yaşın altındaki küçük yaştaki öğrencinler üzerindeki etkilerini araştırmak için daha fazla çalışma yapılmalıdır. Bu alandaki meta-analizi zenginleştirmek için dil gelişiminin dilbilgisi ve sözcük bilgisi gibi boyutları da dahil edilebilir. Ayrıca gelecekteki araştırmalar, süre veya eğitim düzeyi gibi deneyle ilgili değişkenlerin yanı sıra kültürel geçmiş ve okul türü gibi öğrenenle ilgili değişkenler de dahil olmak üzere genişletilmiş bir aracı kümesini ortaya çıkarabilirler. Veritabanlarının kapsamının genişletilmesi de bu öneriler arasında yer alabilir. Son olarak, gelecekteki meta-analizler bu alandaki nitel verileri de derinlemesine inceleyebilir.

TABLE OF CONTENTS

JÜRİ VE ENSTİTÜ ONAYI ii
ETİK İLKE VE KURALLARA UYUM BEYANI iii
ACKNOWLEDGEMENTS iv
ÖZET v
ABSTRACT vi
GENİŞLETİLMİŞ TÜRKÇE ÖZET vii
TABLE OF CONTENTS xi
LIST OF TABLES xv
LIST OF FIGURES xvii
ABBREVIATIONS xviii
1. INTRODUCTION 1
1.1 Statement of the Problem 1
1.2 The Purpose of the Research 5
1.3 Significance of the Study 5
1.4 Statement of Assumptions 6
1.5 Limitations of the Study 6
1.6 Definition of Terms 7
2. REVIEW OF LITERATURE 8
2.1 Technology in foreign language teaching 8
2.1.1 Related terminology 8
2.1.2 Theory of educational technology 10
2.1.3 Teaching with technology 11

2.2 The historical overview of technology in ELT 13
2.3 The stages of technology integration in ELT 15
2.4 Advancement and future of digital tools 22
2.5 The advantages of digital tools in ELT 25
2.5.1 Learner-related factors 26
2.5.2 Motivation and attitudes 27
2.5.3 Feedback and progress report 27
2.5.4 Co-operative learning and communication 28
2.5.5 Access to information and cultures 29
2.5.6 Learning environment 30
2.6 The limitations of digital tools in EFL 30
2.6.1 Cost. 31
2.6.2 Teachers' attitudes 32
2.6.3 Training 32
2.6.4 Hardware and software 33
2.6.5 Feedback and evaluation 33
2.7 Language skills and digital tools 34
2.7.1 Listening 34
2.7.2 Speaking 35
2.7.3 Reading 36
2.7.4 Writing 38
3. RESEARCH METHOD 40
3.1 Research Design 40
3.2 Literature Search 41
3.3 Inclusion and Exclusion Criteria 42
3.4 Data Analysis 43

4. FINDINGS AND DISCUSSION 45
4.1 Listening Skill 45
4.1.1 Digital tools: listening 65
4.1.2 The results of meta-analysis: overall effect size on listening 69
4.1.3 The results of meta-regression: listening 72
4.1.4 Publication bias: listening 73
4.1.5 The overall summary of findings: listening 75
4.2 Speaking Skill 80
4.2.1 Digital tools: speaking 90
4.2.2 The results of meta-analysis: overall effect size on speaking 92
4.2.3 The results of meta-regression: speaking 94
4.2.4 Publication bias: speaking 96
4.2.5 The summary of findings: speaking 98
4.3 Reading Skill 101
4.3.1 Digital tools: reading 111
4.3.2 The results of meta-analysis: overall effect size on reading 111
4.3.3 The results of meta-regression: reading 113
4.3.4 Publication bias: reading 115
4.3.5 The overall summary of findings: reading 116
4.4 Writing Skill 118
4.4.1 Digital tools: writing 127
4.4.2 The results of meta-analysis: overall effect size on writing 128
4.4.3 The results of meta-regression: writing 129
4.4.4 Publication bias: writing 131
4.4.5 The summary of findings: writing 133
4.5 Discussion of Findings for Research Questions 137

4.5.1Discussion of research question 1.....137
4.5.2Discussion of research question 2.....138
4.5.3Discussion of research question 3.....139
5. CONCLUSIONS AND SUGGESTIONS.....141
REFERENCES.....147
CURRICULUM VITAE.....161

LIST OF TABLES

Table 1. The three stages of CALL 16

Table 2. Restricted, Open and Integrated CALL: an outline 20

Table 3. Stages of CALL 21

Table 4. The expansion of digital tools since 2000s 23

Table 5. Classification of the Studies Used for Meta-analysis: listening 45

Table 6. Characteristics of the Included Studies: Listening.....52

Table 7. The Types of Digital Tools Used for Treatments: listening 66

Table 8. The Results of Heterogeneity Test: listening.....71

Table 9. Meta-regression Results for Age Moderator: listening.....72

Table 10. Meta-regression Results for Level of Proficiency Moderator: listening.....73

Table 11. The Result of Trim and Fill test: listening 74

Table 12. The Summary of Findings: listening.....76

Table 13. Classification of the Studies used for Meta-analysis: speaking.....80

Table 14. Characteristics of the Included Studies: speaking.....84

Table 15. The Types of Digital Tools used for Treatments: speaking.....91

Table 16. The Results of Heterogeneity Test: speaking 94

Table 17. Meta-regression Results for Age Moderator: speaking 95

Table 18. Meta-regression Results for Level of Proficiency Moderator: speaking 96

Table 19. The Result of Trim and Fill Test: speaking 97

Table 20. The Summary of Findings: speaking 99

Table 21. Classification of the Studies Used for Meta-analysis: reading 101

Table 22. Characteristics of the Included Studies: reading.....105

Table 23. The types of Digital Tools Used for Treatments: reading 111

Table 24. The Results of Heterogeneity Test: reading.....113

Table 25. Meta-regression Results for Age Moderator: reading.....114

Table 26. Meta-regression Results for Level of Proficiency Moderator: reading 114

Table 27. The Result of Trim and Fill Test: reading.....116

Table 28. The Summary of Findings: reading 117

Table 29. Classification of the Studies Used for Meta-analysis: writing.....118

Table 30. Characteristics of the Included Studies: writing 121

Table 31. The Types of Digital Tools Used for Treatments: writing.....127

Table 32. The Results of Heterogeneity Test: writing 129

Table 33. Meta-regression Results for Age Moderator: writing 130

Table 34. Meta-regression Results for Level of Proficiency Moderator: writing.....131

Table 35. The Result of Trim and Fill Test: writing 132

Table 36. The Summary of Findings: writing.....134

LIST OF FIGURES

Figure 1. Model of Teaching with Technology 12

Figure 2. Model of Technology Mediation 13

Figure 3. Random-Effects Model Result of Effect Sizes: listening 70

Figure 4. Funnel Plot for Publication Bias Assessment: listening 74

Figure 5. Random-Effects Model Result of Effect Sizes: speaking 93

Figure 6. Funnel Plot for Publication Bias Assessment: speaking 97

Figure 7. Random-Effects Model Result of Effect Sizes: reading 112

Figure 8. Funnel Plot for Publication Bias Assessment: reading 115

Figure 9. Random-Effects Model Result of Effect Sizes: writing 128

Figure 10. Funnel Plot for Publication Bias Assessment: writing 132

ABBREVIATIONS

ELT **:** English Language Teaching

EFL **:** English as a Foreign Language

FL **:** Foreign Language

CALL **:** Computer-Assisted Language Learning

MALL **:** Mobile-Assisted Language Learning

IPA **:** Intelligent Personal Assistant

1. INTRODUCTION

Introduction focuses on the background of the study; therefore, it starts with the overview of the study. The aims of the research are as well as the research questions that are raised are also presented. Lastly, significance of the study, its limitations, statement of assumptions, and the information about the terms can be found.

1.1 Statement of the Problem

The evolution of technology has profoundly influenced various aspects of modern life, with a particularly noteworthy impact on education, specifically in the realm of foreign language (FL) instruction. The integration of computer technology into English as a foreign language (EFL) classroom has experienced significant growth and transformation since its inception in the 1950s, when it was initially coupled with traditional teaching methods. However, the scope and depth of technological integration in language education have expanded dramatically over the years, as educators worldwide have embraced an array of digital tools and resources within educational systems (Alsied & Pathan, 2013; Pesut, 2014; Akyuz & Yavuz, 2015).

During the nascent stages of incorporating technology into EFL classrooms, the available tools were relatively rudimentary. According to Pesut (2014), the early applications were largely confined to graphoscopes for displaying pictures, followed by the utilization of cassettes, CDs, and DVDs to facilitate listening practice. As technology progressed, more advanced tools such as portable tape recorders and film strip projectors were introduced (Shafaei, 2012). While these initial forays into technological integration undeniably enhanced language learning experiences, they represented only a modest departure from traditional teaching methods and were insufficient to revolutionize FL education.

The transformative impact of technology on FL education experienced a pivotal shift during the 1960s and 1970s when educators began utilizing computers to deliver instructional materials to language learners. This period marked a significant departure from traditional teaching methods as it introduced activities involving drills and repetitions facilitated by computer technology (Tafazoli & Golshan, 2014). However, it was the advent of personal computers in the 1980s, coupled with the growing popularity

of the Communicative Approach, that catalyzed further advancements in technology within EFL classrooms (Alsied & Pathan, 2013).

During the 1960s and 1970s, the use of computers in FL education was characterized by teachers delivering materials through these electronic devices. This shift allowed learners to engage in activities that emphasized drills and repetitions, offering a more interactive and dynamic learning experience. The intention was to provide learners with targeted practice, fostering language proficiency through focused exercises facilitated by computer-assisted learning.

The introduction of personal computers in the 1980s marked a watershed moment for EFL classrooms. These computers were not merely tools for content delivery; they became integral to fostering communication skills. Educators could leverage various programs for spelling and grammar checks, as well as text reconstruction exercises. Teachers now had the means to create interactive and engaging lessons that went beyond traditional methodologies. Simultaneously, learners were empowered to practice their FL skills in activities involving both spoken and written communication.

Concordancer software emerged as a particularly noteworthy development during this period. This tool enabled learners to explore vocabulary and grammatical items independently (Tafazoli & Golshan, 2014). By allowing learners to analyze and understand language patterns within authentic texts, concordancers facilitated a more self-directed approach to language learning. This shift towards learner autonomy was a fundamental change in the pedagogical landscape of EFL education.

The continuous integration of computer technology into EFL classrooms demonstrated its substantial advantages over the years, leading to constant enhancement and development of educational technology. As educators and learners experienced the benefits of technology in improving language acquisition, the field witnessed a commitment to refining and expanding the role of digital tools in language education. The dynamic interplay between technology and EFL education showcases a continuous endeavor to leverage digital resources for creating impactful language learning opportunities.

In the current context of EFL education, learners need to be more independent and autonomous withing and beyond the classroom environment. This transformation is linked to digital tools that are readily accessible to students, providing them with unprecedented opportunities to assume more significant responsibility for their language learning journey. Alsied and Pathan (2013) summarized the role of educational technology in FL classrooms by saying that it, "*can offer the delivery of a wide variety of multimedia content, with pedantic and authentic models, accessed with individual control*" (p. 45). In other words, educational technology in EFL classrooms has become extremely diverse, offering learners an idependent access and utilization of digital tools.

The digital technology has revolutionized the learning experience by empowering learners to practice the language independentely. The use of language is not bound by restrictions related to time and place (Taj, 2016). Thus, one of the benefits of technology lies in the flexibility and accessibility of these tools, enabling learners to tailor their language learning experience to their individual needs and preferences. As a result, learners are no longer seen as students that simply obtain the information from teachers, but active learners who are responsible for their language acquisition process.

The effects of digital tools on language skills is one of a central concern in current EFL education discourse. In terms of listening skills, learners can access a plethora of authentic audio materials, ranging from podcasts and videos to interactive language learning platforms. These resources not only expose learners to diverse accents and speech patterns but also allow for repeated listening practice, enhancing comprehension and fluency.

Speaking skills benefit from the interactive nature of digital tools. Virtual classrooms, video conferencing platforms, and language exchange apps enable learners to engage in real-time conversations with native speakers or fellow learners, providing invaluable opportunities for oral communication practice. Additionally, speech recognition software allows learners to receive instant feedback on their pronunciation, contributing to improved speaking proficiency.

Reading skills are honed through digital platforms that offer a wide variety of texts, from articles and e-books to news websites. Interactive features, such as highlighting, annotation, and multimedia supplements, enhance comprehension and engagement. Digital tools also facilitate writing practice through word processors, blogging platforms, and collaborative writing tools, enabling learners to receive feedback and refine their writing skills.

In essence, the integration of digital tools in EFL education has elevated the level of learner engagement and autonomy, providing a rich and interactive environment for language practice. The ongoing exploration of how these tools are utilized and their effects on language skills underscores the dynamic nature of technology's role in shaping the future of EFL education. As the field continues to evolve, educators and researchers will likely delve deeper into optimizing the use of digital tools to maximize their impact on language acquisition across all language skills.

The problem this paper attempts to tackle is the lack of comprehensive meta-analytical research that would summarize the impact of technological tools on all language skills. In an increasingly digital age, understanding the effects that digital tools have on the development of language skills is paramount. The empirical evidence that summarizes the growing number of research in this field offers guidance for educators, researchers, and policy makers (Chang & Hung 2019). This investigation seeks to explore the existing body of research to assess the efficacy and influence of digital tools in enhancing language skills within the EFL context. The primary concern revolves around the need to determine whether digital tools, such as language learning apps, online resources, or multimedia content, have a discernible effect on students' language acquisition, comprehension, and proficiency. By analyzing and synthesizing relevant studies, this meta-analysis seeks to clarify the potential benefits or drawbacks of integration of technology in EFL education, ultimately guiding educators and policymakers in optimizing language learning strategies for the digital era.

1.2 The Purpose of the Research

The aim of this study is to synthesize the results of research on technology conducted in the EFL education field specifically by investigating the effectiveness of digital tools on the advancement of the four language skills. Also, this study will aim to identify digital tools used to develop specific language skills and student-related variables that moderate the effectiveness of digital tools.

This meta-analysis will use previous findings and data to investigate the effectiveness of digital tools in relation to language skills in EFL context. This study will answer three research questions, specifically:

1. What are digital tools used to develop each language skill?

2. What is the overall impact of the digital tools on students' language skills, namely, listening, speaking, reading, and writing?

3. How is the development of language skills affected by digital tools in terms of student-related factors, specifically:

a) leaners' age?

b) learners' proficiency level?

1.3 Significance of the Study

English is a *lingua franca* and as such is taught across the world. However, teaching EFL remains questionable to this day. In fact, according to English Proficiency Index (EF EPI), which is a ranking of countries and regions based on their English skills, the data from 2023 showed that Turkey's population is ranked as thirty-third country out of thirty-four countries in Europe (EF EPI, 2023). As a result, finding any ways to improve EFL education are crucial to every learner. As many researchers pointed out, using digital tools is becoming an increasingly prevalent part of EFL education due to its vast advantages when it comes to improving language skills (Akyuz & Yavuz, 2015; Shafaei, 2012; Tafazoli & Golshan, 2014; Pesut, 2014). Moreover, after conducting a meta-analysis of teachers' attitudes towards digital tools for EFL learners, Alaref (2022) asserted that, *"implementing technology is necessary"* (p. 3). In this context, this meta-analytical study

will attempt to enhance previous research by combining existing data and shedding light on variables that moderate the effectiveness of digital tools in EFL context. Once the effectiveness of these digital tools is identified, teachers can effectively utilize technology based on their learners' individual needs, improving their achievement in learning EFL.

1.4 Statement of Assumptions

In undertaking this meta-analytical study, several key assumptions have been made regarding the integrity and authenticity of the data derived from prior research endeavors. The fundamental premise guiding this investigation is the belief that the data collected from earlier studies are genuine and accurately reflect the conditions, variables, and outcomes they purport to measure. Implicit in this assumption is the presupposition that the researchers involved in the original studies adhered to rigorous methodological standards, ethical guidelines, and transparency in reporting their findings. Furthermore, it is presumed that potential biases, errors, or inaccuracies in the data collection processes of the previous studies are minimal and unlikely to significantly compromise the overall validity of the synthesized analysis. This assumption serves as a foundational element for the reliability and generalizability of the meta-analytical findings, emphasizing the importance of the quality and trustworthiness of the underlying data in drawing meaningful conclusions.

1.5 Limitations of the Study

First important limitation of the current research is related to the methodology of meta-analysis, i.e., publication bias. Since articles with significant findings are published more often than the ones with non-significant findings (İnce, Ozcimen, & Turan, 2019), there is a risk that the effect size in meta-analysis could be overestimated. Therefore, this research attempted to detect and include scientific papers with varied outcomes. Another notable constraint arises from the the rapid evolution of technology which introduces a risk that this study may not have comprehensively addressed emerging tools which could significantly influence the landscape of EFL education. Also, another limitation stems from the geographic bias in the selected literature, as the included articles predominantly hail from the Asian part of the world rather than the Western hemisphere. As a result, the findings of this study may not be generalized broadly. These limitations should be approached with a critical perspective, recognizing the necessity for continuous research

of this topic in EFL field.

1.6 Definition of Terms

Meta-analysis: *"A kind of scientific review of original studies/articles in a specific subject which is aimed to combine separate statistical results into a single estimation."* (İnce, Ozcimen, & Turan, 2019, p. 1).

Digital tools: software, applications, websites, learning platforms and other online or offline resources used via computers, smartphones, tablets, and other devices that are utilized by teachers and students to facilitate EFL learning.

2. REVIEW OF LITERATURE

This chapter outlines the examined the reviewed literature with regards to digital tools in the context of English language teaching (ELT). The chapter introduces the technology and its usage in teaching foreign languages. The stages of computer-assisted language learning (CALL) are also presented. Finally, the advantages and disadvantages of digital tools in EFL education is introduced.

2.1 Technology in foreign language teaching

Technology has an undeniable role in education. Technology in foreign language teaching particularly has been studied since the initial implementation of the computer to EFL classrooms. Gündüz (2005) claimed that educational technologies were among the most advanced fields in the second half of the 20th century. Since it had significant potential, many educators around the world have welcomed a vast number of innovations that came with technological advancement. Nowadays it might be challenging to envision a modern foreign language classroom that has not been equipped with a computer. This demonstrates how, throughout the last century, educational trends have changed, altering the needs of learners. Further discussion will cover the key terms used in relation to technology use in foreign language instruction and the part it plays in the process.

2.1.1 Related terminology

Technology in ELT is a multidimensional concept and as such has a lot of definitions that may be more or less associated with one another. Terms such as CALL, information and communication technology (ICT), technology-assisted language teaching, technology-enhanced language learning (TELL), web-based learning, mobile-assisted language learning (MALL), digital language learning (DLL), blended learning and similar can be found in the literature. Hubbard (2021) has distinguished the main acronyms of the field as follows:

> CALL - Computer-assisted language learning, sometimes expanded as computer-aided language learning.

CELL - Computer-enhanced language learning; suggests the computer's role is to make learning better.

TELL - Technology-enhanced language learning; this accommodates more than just computers, often bringing in video and seeing the computer as just one part of a larger system. It is popular as a generic term: for instance, while TESOL has a CALL Interest Section, California TESOL has a TELL Interest Group.

TALL - Technology-assisted language learning; variant of CALL and TELL.

CALI - Computer-assisted language instruction; with "instruction" in it, it is more teaching oriented.

CBLT - Computer-based language training; views elements of language learning as "training" and tends to use an approach with definable, measurable objectives.

IT and ICT - Information Technology/Information and Communication Technologies are common acronyms outside of language teaching, particularly in Europe; sometimes this is presented as IT or ICT for LT (Language Teaching);

NBLT - Network-based language teaching; an older term, it focuses on computers linked in networks, both locally and through the Internet, especially for computer-mediated communication

DLL - Digital language learning; a relatively new term encompassing computers and other digital devices;

MALL – Mobile-assisted language learning; learning with mobile devices like smartphones and tablets (sometimes also used for multimedia-assisted language learning);

Technology-mediated language learning – To me, this is probably the most generic and descriptive modern term, but it does not have a memorable acronym. (pp. 2-3).

This terminology showcases the ways and approaches that has changed since the technology was first adapted in ELT classrooms. In this study, the term “digital tools” will be employed to describe software, applications, websites, learning platforms and other online or offline resources used via computers, smartphones, tablets, and other devices that are utilized by teachers and students to facilitate EFL learning.

2.1.2 Theory of educational technology

There are many ways to utilize technology in education. How it is done often depends on the theory of CALL that the teacher or the researcher counts on. Hubbard (2021) claimed that there is no one universal CALL theory but concluded that interaction account (IA), sociocultural theory, and constructivism are the most significant theoretical frameworks in the research of educational technology.

Interaction account (IA) is rooted in Krashen’s interaction hypothesis according to which second language is acquired through input gained during interactions. In CALL, IA is important because it allows researchers to study how technology modifies communication among people as well as human-computer interactions (Hubbard & Levy, 2016). From this perspective, technology can be applied in multiple ways. One of them could be input modification which simplifies the input for learners. For example, computer programs can provide subtitles for listening or offer explanations of vocabulary items.

Another theory, related to CALL, is sociocultural theory (SCT). While the supporters of this theory underscore the primary importance of interlocutors who make meaning through language, they also believe that learning occurs from a solitary effort as a result of a continuous internal dialogue (Chapelle, 2003). According to this theory, cognitive changes can occur only when learners communicate with others and/or use tools because that stimulates learners’ psychological processes (e.g., reasoning, strategic orientation, or problem solving) (Hubbard & Levy, 2016). In other words, learners can modify their experiences and understanding by sharing their knowledge or skills with their peers, asking questions to their teachers, and using educational technology. In the light of SCT, Huong and Hung (2021) noted that tools are significant because they facilitate collaboration among individuals in contemporary world because these tools empower people to collectively shape and transform the world, thereby fulfilling their aspirations.

Subsequently, educational technology can enhance cooperative and collaborative learning, provide meaningful tasks, and promote learning among social groups and communities off-line as well as online.

Constructivism is a theory which states that "*human knowledge – whether it be the bodies of public knowledge known as the various disciplines, or the cognitive structures of individual knowers or learners – is constructed*" (Philips, 1995, p. 5). That is, learners must build their knowledge. Then, the teacher becomes a supporter and facilitator (Shafaie, 2012). He/She bears the responsibility to prepare motivating authentic activities or tasks that would require "*social construction of meaning and of its justification*" (Santosa, 2008, p. 39). In this sense, technology can be used as a tool because it provides varied opportunities to construct activities that would challenge students to investigate, discuss, collaborate, and negotiate.

Although the three theories mentioned above offer some insights into the part that technology plays in FL education, there is no universally applicable theoretical framework. Moreover, when discussing how these theories are applied practically in the educational process one should be mindful that teachers may not follow only one theory. On the contrary, educators usually synthesize several of them (Hubbard & Levy, 2016). The application of digital tools in the educational process can be illustrated via teaching with technology models which are addressed below.

2.1.3 Teaching with technology

In addition to conventional teaching models that included teachers, learners and instructional materials, modern education also involves a new element, technology. The diversity of its usage means that computers can be tools, communication medium or even tutors in EFL classrooms. However, Santosa (2008) claimed learning cannot be guaranteed solely by the presence of tools and features. Therefore, understanding the way teachers employ technology and how that alters the process of teaching and acquiring FL is vital to reap the benefits offered by digital tools.

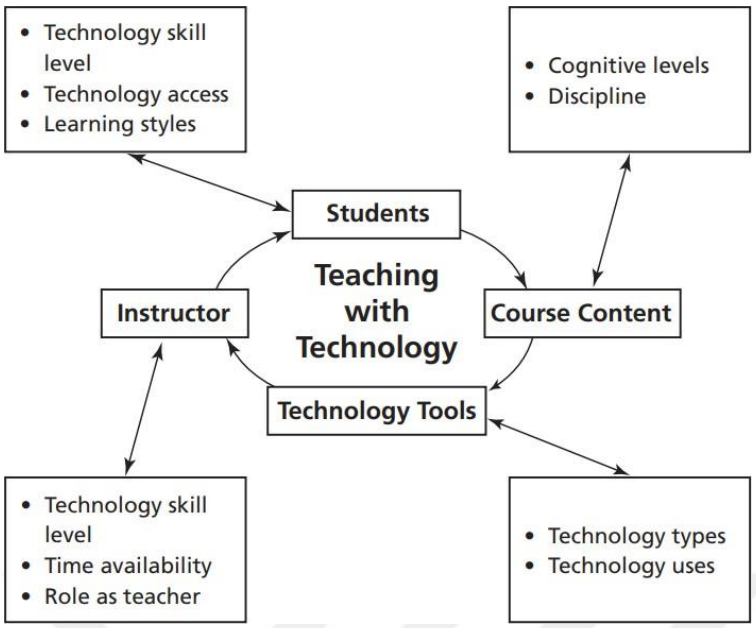


Figure 1. Model of Teaching with Technology (Zhu and Kaplan, 2001, p. 238)

Zhu and Kaplan (2001) presented their model for teaching with technology (see Figure 1). They proposed this model from a systems approach and mentioned that there are four elements involved when teaching with technology, namely, the students, the instructor, course content, and technology tools. Each component is necessary to ensure that technology is integrated efficiently. Firstly, course content refers to the discipline being taught, learning outcomes and ways technology can help learners to learn better as well as teachers to assess student learning. Secondly, the instructor must think of his/her own skills and experience regarding technology, the time needed to plan the course or lesson and his/her role as a teacher (e.g., the source of knowledge, facilitator, guide, etc.). Thirdly, students' technical skills, access to technology and preferred learning styles must be considered. Lastly, analysis of technology regarding its functions and relevance to a lesson needs to be conducted. Based on Figure 1, all four components are inter-related and when one of them changes, the rest needs to be modified as well.

Another model that represents the role technology has in the educational setting was offered by Levy and Hubbard (2005) (see Figure 2). According to him, computers are central in the learning process and are placed in the centre together with learners. He claimed that technology mediated the interactions between the learners, their peers, teachers, and other materials in pursuit of learning objectives (Levy & Hubbard, 2005). That is, when learners use computers to achieve their educational goals, all the elements

adjust their interaction. Hubbard (2021) mentioned a few ways this mediation can occur, including archiving and indexing, transferring, linking, time control, and transforming. For example, when students use speech recognition, the speech is transformed to text by the machine. So, Levy and Hubbard's (2005) suggested model of technology mediation stresses the importance of digital tools for the achievement of learning objectives.

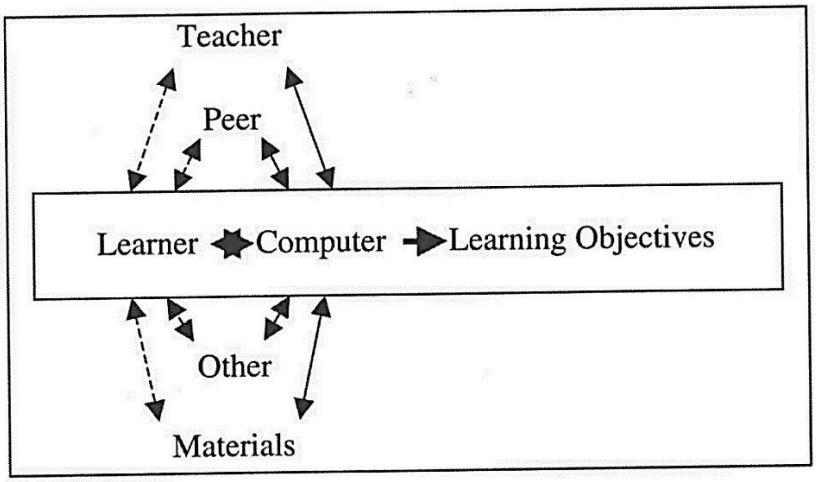


Figure 2. Model of Technology Mediation (Levy & Hubbard, 2005, p. 146)

The two approaches highlight the significant contribution that technology makes to education. Even though these two models showcase some differences, for instance, Zhu and Kaplan (2001) offered more details, both emphasize the significance of interactions among students, teachers, materials, and technology. They showcase that changes in digital tools would result in adjustment of the entire teaching and learning process. Thus, the successful utilization of educational technology unquestionably depends on careful consideration and planning.

2.2 The historical overview of technology in ELT

The integration of technology has shaped our existence for many years. From the moment technology entered the field of FL education, it altered not only the way foreign language is taught but also acquired. It is commonly accepted among language teachers that educational technology surely can be beneficial. That is why technology has become an inseparable part of EFL education. However, the utilization of technology in EFL has evolved throughout the history; therefore, a brief historical background will illustrate the details of this development.

The integration of computer technology into EFL classroom began in 1950s alongside the traditional approach to teaching and it was quite limited when compared to ways that teachers and educators around the world utilize digital tools within educational systems today (Alsied & Pathan, 2013; Pesut, 2014; Akyuz & Yavuz, 2015). In the early days technology was very limited and included projectors to show visuals as well as audio players to practice listening (Pesut, 2014; Shafaei, 2012). These simple tools surely enhanced language learning but they were not sufficient to revolutionize FL education.

The more significant changes came when teachers started to use computers for delivering materials to foreign language learners for them to do activities that involved drills and repetitions in the 1960s and 1970s (Tafazoli & Golshan, 2014). Then the appearance of the first personal computers (Alsied & Pathan, 2013) paired with the growing popularity of Communicative Approach in the 1980s, lead to more technological advancement in EFL classrooms. At this time computers were seen as tools to foster communication. They allowed teachers to use programs for spelling, grammar checks, and text reconstruction, while learners were able to practice their foreign language skills for activities that involved conversations or written texts all the while concordancer software allowed learners to be more independent when learning vocabulary and grammatical items (Tafazoli & Golshan, 2014). The great advantages of computer technology in EFL classrooms felt through the years resulted in constant enhancement and development of educational technology.

Today learners have to actively participate in the learning process. Digital tools that are accessible to students undoubtedly create more opportunities for them to practice foreign language skills by connecting with people around the world. In fact, Alsied and Pathan (2013) summarized the role of educational technology in FL classrooms by saying that it, *"can offer the delivery of a wide variety of multimedia content, with pedantic and authentic models, accessed with individual control"* (p. 45). So, the use of educational technology in the 21st century has been aligned with the shift of the teacher-learner roles, where learners have a chance to learn in accordance with their individual needs and teachers can facilitate this process.

Technology in general and, more specifically, computers, help to accelerate learning in EFL classrooms since the early days of its invention. However, changing trends in

approaches to teaching foreign languages altered the way technology was used throughout the last century. The showcasing of these changes in a comprehensible manner was achieved by authors who created a three-phase history of CALL (Warschauer, 1996; Bax, 2003) and was later expanded by addition of types of technology developed recently by Dudeney and Hockly (2012). More details regarding their work will be presented below.

2.3 The stages of technology integration in ELT

When it comes to the historical perspective of integration of technology in EFL, one of the main terms used for it is CALL. It alludes to the utilization of computers for foreign language acquisition to impove the process. It was proposed by Warschauer (1996) that the history of CALL in EFL has three main stages, namely behavioristic CALL, communicative CALL, and integrative CALL (Warschauer, 1996). The summarization of the three stages of CALL proposed by Warschauer (2000) (see Table 1).

Table 1. The three stages of CALL (Warschauer, 2000, p. 64)

Stage	*Structural CALL 1950s-1970s*	*Communicative CALL 1970s-1980s*	*Integrative CALL 21st century*
Technology	Mainframe	PCs	Multimedia and Internet
English-teaching paradigm	Grammar Translation Audio-lingualism	Communicative Language Teaching	Content-Based ESP/EAP
View of language	Structural (a formal structural system)	Cognitive (a mentally constructed system)	Socio-cognitive (developed in social interaction)
Principal use of computers	Drill and practice	Communicative exercises	Authentic discourse
Principal objective	Accuracy	And fluency	And agency

The first stage, according to Warschauer, is Structural CALL. It is called so due to the underlying learning theory of that time which was Behaviorism and meant that learning is essentially habit formation. Consequentially, the educators saw language as a structural system which could be divided into chunks and learnt through lots of practice and drills. At that time, computers were seen as tutors and were used predominantly to provide students with lots of activities that would offer immediate positive or negative feedback so that good language habits would be formed and reinforced. As an example of tools at this stage of CALL, Warschauer (1996) mentioned PLATO software that was created specifically for FL students. It included vocabulary drills, brief grammar explanations alongside repetitive drilling exercises, and translation tests. The end of this phase started when a new learning theory, called Cognitivism, which focused on mental processes, gained more attention. A growing number of educators rejected the notion that learning is simply a response to the environment. Therefore, drills and spaced practice activities lost their importance. Moreover, at that time new technology, called microcomputers, which later were re-called personal computers, or PCs, was created, offering new

opportunities for education.

Communicative CALL started in the late 1970s when Audio-lingualism gave way to Communicative Language Teaching (CLT) in EFL classrooms. The proponents of this method believed that engagement in genuine, meaningful, and contextually relevant conversations lead to proficiency in FL (Haswani, 2014). As a result, increasing learners' intrinsic motivation and focusing on interactivity in FL classrooms gained importance at this time (Warschauer, 1996). Subsequentially, the role of computers expanded from being only a tutor for students to also being a stimulus for interaction or tool that helped learners with the comprehension of the language (Dudeney & Hockly, 2012). Warschauer (1996) listed a few computer programs that illustrated how teachers used them. For example, paced reading, text reconstruction, and language games were used to provide learners with practice and provided them with feedback but contrastingly to the behavioristic CALL, now learners had more freedom to explore and interact with language to get to the right answer. Similarly, while games such as Sim City were used as a trigger for communication, concordances or spelling and grammar checkers helped learners to experiment with the language (Warschauer, 1998). Although Communicative CALL was an important step forward to utilizing computer technology for the benefit of EFL learners, it received some criticism. For instance, Bax (2003) claimed that although computers were used to prompt communication among students and could offer limited student-computer interactions, technology remained primarily as a tool for analyzing language. This led to a more integrative view of EFL education and a new stage in the history of CALL emerged.

Integrative CALL, which is still taking place today, stresses that learning a FL is a process that involves communication in authentic social contexts and computers can provide learners with such opportunities (Warschauer & Healey, 1998). At this stage, authentic social interaction among learners and computer-mediated communication became crucial (Dudeney & Hockly, 2012). Warschauer and Healey (1998) suggested that learning a FL could be integrative when Content-based, ESP (English for Specific Purposes) and EAP (English for Academic Purposes) approaches are employed. Moreover, he praised Multimedia and the Internet since they had a potential to create a more authentic context for learners leading to individualized learning experiences (Warschauer, 1996). For

example, students could have video conferences with other learners or even natives which would allow them not only to hear but also see speakers. Also, when using Multimedia, learners could follow their own pace by rewinding, stopping or even discovering aspects of FL.

The taxonomy of CALL proposed by Warschauer (2000) is viewed as a comprehensive study of the history of CALL. However, Bax (2003) saw some flaws in Warschauer's three stages of CALL and proposed some adjustments. His outline for the three stages of CALL is illustrated in Table 2. Although Bax (2003) followed the example of Warschauer (1996) by dividing the history of CALL into three stages, he re-named them as Restricted, Open, and Integrated CALL. The first stage, or Restricted CALL, is quite like Warschauer's (2000) taxonomy but, as Bax (2003) claimed it referred "*to the actual software and activity types in use at the time, to the teachers' role, to the feedback offered to students and to other dimensions*" (p. 20) which were rather restricted and not always behavioristic. For example, the role of a teacher was restricted to monitoring the students. The second phase in Bax's (2003) taxonomy is called Open CALL and it is so since all areas of this stage are much more varied when compared to Restricted CALL. For instance, the type of feedback changed from oversimplified correct/incorrect to a more adaptable approach, concentrating on the enhancement of linguistic skills. In comparison to Warschauer's (2000) Communicative CALL, Bax (2003) eluded the connection to learning theory, mentioning interaction as a more general part of this phase. The last phase, called 'Integrated CALL', is drastically different from Warschauer's (2000) taxonomy because it represents the direction towards which CALL is expected to move. In other words, Integrated CALL does not exist now, but the author believed, will come to existence in the future.

Bax (2003) suggested this alternative history of CALL as an extension of Warschauer's (2000) taxonomy which he thought to be flawed. Bax's (2003) main criticism of Warschauer's work was related to three issues. Firstly, Bax (2003) noticed unclear connection to historical periods in relation to each stage. Secondly, the term 'Communicative CALL' was not appropriate as it lacked connection to the teaching approach. Lastly, Bax (2003) claimed that Integrative CALL stage was not clearly distinguished from the second phase. Moreover, he saw the need to represent not only the

past but also the future of CALL. By looking at the overview of CALL, created by Bax (2003), it is clear that the author tried to create a more general, comprehensive and accurate version of CALL history.

Table 2. Restricted, Open and Integrated CALL: an outline (Bax, 2003, p. 21.)

Content	*Type of task*	*Type of student activity*	*Type of feedback*	*Teacher rolesTeacher attitudes*		*Position in curriculum*	*Position in lesson*	*Physical position of computer*
Restricted	Closed drills	Text reconstruction	Correct/	Monitor	Exaggerated	Not integrated in	Whole	Separate lab
CALL	Quizzes	Answering closed	incorrect		fear and/or awe	syllabus-optional extra	CALL	Physical
Language system		questions Minimal interaction with other students				Technology precedes syllabus and learners needs	lesson	position of computer
Open CALL	Simulations	Interacting with the	Focus on	Monitor/	Exaggerated	Toy	Whole	Separate lab-
System and skills	Games CMC	computer Occasional	linguistic skills development	facilitator	fear and/or awe	Not integrated in syllabus-optional extra	CALL lesson	perhaps devoted to languages
		interaction with other students	Open, flexible			Technology precedes syllabus and learners needs		
Integrated	CMC	Frequent interaction	Interpreting,	Facilitator	Normal part of	Tool for learning	Smaller	In every
CALL Integrated	WP e-mail	with other students Some interaction	evaluating, commenting,	Manager	teaching - normalised	Normalised Integrate into syllabus,	part of every	classroom, on every desk, in
language skills work Mixed skills and system	Any, as appropriate to the immediate needs	with computer through the lesson	stimulating, thought			adapted to learners'needs Analysis of needs and context precedes decisions about technology	lesson	every bag

Another version of Warschauer's three stages of CALL was offered by Chun (2019). She updated the first version by adding another stage, called Ecological CALL which began in 2010s (see Table 3). It can be seen that the devices used in EFL classrooms have evolved and easily portable gadgets like smartphones have gained more attention. Also, English teaching paradigm has changed giving rise to new concepts, namely, digital literacies or multiliteracies. The first term is related to one's ability to use digital tools effectively while the second refers to person's ability to successfully communicate in multiple languages in new multilingual contexts through various modes, including visual, aural, and textual (Chun, 2019). The author also drew some insight into the fact that recently language has been seen in a broader view and underlined that culture is an inseparable component of knowing a language much like grammar and vocabulary (Chun, 2019). Overall, during the period of 2000s to 2010s, the technology helped to connect more communities and global communication certainly altered EFL education.

Table 3. Stages of CALL (Chun, 2019, p. 14)

Stage	*1970s-1980s Structural CALL*	*1980s-1990s Communicative CALL*	*2000s Integrative CALL*	*2010s Ecological CALL*
Technology	Mainframe	PCs	Multimedia and Internet	Mobile and wearable devices
English teaching paradigm	Grammar translation and audiolingual	Communicative language teaching	Content-based, English for Specific Purposes	Digital literacies, multiliteracies
View of language	Structural (a formal structural system)	Cognitive (a mentally constructed system)	Sociocognitive (developed in social interaction)	Symbolic and intercultural competence
Principle use of computers	Drill and practice	Communicative exercises	Authentic discourse	Global communication
Principle objective	Accuracy	Fluency	Agency	Identity as global citizens

Despite a few differences, all taxonomies that represent the history of CALL offer somewhat coinciding trends in EFL education. However, they were created in the early 2000's, at the time when technological development was experiencing a boom. The detailed explanation as to what happened in ELT classrooms when the internet access as well as rapid diffusion of networks consolidated in day to day lives has been discussed by a few authors (Hubbard, 2021; Chun, 2019; Dudeney and Hockly; 2012) and will be discussed further.

2.4 Advancement and future of digital tools

Since the early 2000s new tools which both teachers as well as students could use were created. The new resources mentioned by Dudeney and Hockly (2012) is detailed in Table 4. Since the year 2000, the number of types of digital tools has expanded widely. From communication programs to teacher support groups, the Internet has opened a gate where almost an inexhaustible number of tools are available to students and teachers. To start with, Internet exchanges allowed students to share their cultures through text-based chats, emails and voice chat programs that had more collaborative features such as screen or application sharing. Webquests, which provide learners with rich research experience as well as opportunities to create products based on their learning (Dudeney & Hockly, 2012), also grew in popularity. New websites and resources for teachers that helped the professionals to share their experiences were founded and led to the creation of classroom-friendly materials.

Table 4. The expansion of digital tools since 2000s based on Dudeney and Hockly (2012)

Tool	*Audience*	*Predominant usage*	*Examples of digital tools*
Internet exchanges	Students	Development of communicative skills through culture sharing	Skype
Webquests	Students	Development of communicative skills through creating a product while doing Internet research	Google
Resource websites	Teachers	Sharing experiences and teaching materials	Dave's ESL Cafe
Online discussion groups	Teachers	Discussing and solving teaching problems as well as professional development	Webheads in Action Moodle (VLE)
Web 2.0	Students	Development of communicative skills using creativity	Xtranormal
IWBs	Teachers	Sharing coursebook content on the screen with enhanced audio and video materials	New Cutting Edge Digital (Cunningham and Moor 2007)
Social networks	Teachers	Communication, sharing and professional development through microblogging	LinkedIn
Mobile and blended learning	Students	Blended learning (part online, part face to face)	LearnEnglish Grammar by British Council
AR	Students	Integration of language learning into daily life by enhancing it through added virtual information	Catchy Words AR
Game-based learning	Students	Increasing motivation and engagement of learners in language learning through play	Second Life (adult learners); Pearson's Pop Tropica (young learners)

Likewise, teachers adopted online discussion groups, and professional development sessions emerged among teachers as a way to discuss teaching methods and address challenges associated with the integration of new technology. This ultimately developed virtual learning environments (VLEs) like Moodle.

The invention of Web 2.0 tools meant that ready-made materials would be largely replaced with creative, consumer-driven spaces where teachers could invite their learners to produce animated cartoons or podcasts. Interactive whiteboards (IWBs) that were first welcomed in British Council teaching centers gained popularity which led to the development of many IWB software versions and increased the number of easily available resources to teachers. Moreover, social networks which gave rise to microblogging sites such as Twitter had a major impact on teachers and their professional development since they reached more colleagues around the world and often for no charge.

Mobile and blended learning popularity goes to show that schools are more invested in portable devices such as netbooks or tablets rather than fixed desktop computers as it extends the classroom to home environment setting up a blended learning component in EFL since mobile phones or similar gadgets create an easy access to VLE. Finally, Augmented Reality (AR) which adds "*a virtual layer of information (in the form of text, images, or video) on to the real world*" (Dudeney & Hockly, 2012, p. 540) is used to add the element of surprise to increase students' engagement and motivation.

Game-based learning works similarly in that it involves learners more than traditional teaching approaches. Particularly, the so-called 'serious' or educational games that offer an immersive experience such as Second Life for older learners or Pearson's Pop Tropica for the youngsters are created which intend to better the process of learning English by building up on their autonomy. To sum up, Dudeney and Hockly (2012) summarized the most important digital tools that have appeared in the years since early 2000s.

In addition to technologies such as mobile and blended learning, Web 2.0, social networks, augmented reality, and gaming that were mentioned by Dudeney and Hockly (2012), Hubbard (2021) reviewed a few other digital tools that have become particularly important. To begin with, the author talked about concordancing which has remained a

significant part of data-driven language learning since the 1980s. Lately, tools that aid formative or summative assessment have also been used to facilitate the education of EFL. Dudeney and Hockley (2012) already mentioned blended learning; however, as Hubbard (2021) correctly noticed, online learning and flipped classrooms were the only option for many students during the Covid pandemic. Hubbard (2021) also discussed virtual worlds, which he described as "*3-dimensional online environments where students in the form of projected avatars interact with one another and native speakers as well as with "physical" objects and spaces within the world*" (p. 76) and virtual reality (VR), which requires students to wear a special headset to become immersed into a virtual environment. However, this technology remains limited. Lastly, Hubbard (2021) stated that learning in digital wilds, or digitally mediated informal language learning, is and should be explored among teachers and students.

The future of digital tools was brought up by Chun (2019). Being the editor of Language Learning & Technology journal, she presented the cutting-edge trends in the application of educational technology. She believed that L2 writing and automated writing evaluation will gain more attention in the coming years, leading to the improvement of such programs. She also mentioned telecollaboration which allows learners to interact with speakers of English in instructed settings through Internet and then possible in individually chosen contexts. Chun (2019) also believed that augmented reality and virtual reality have the potential to facilitate FL learning and, therefore, will be utilized in EFL classrooms more often. The final technological advancement that the author mentioned was automatic speech technologies like automatic speech recognition (ASR), text-to-speech (TTS) and speech synthesis, that are expected to be applied more frequently in pedagogical settings.

2.5 The advantages of digital tools in ELT

Digital tools in EFL have been researched widely. As a result, many advantages have been attributed to the use of technology in foreign language teaching and learning. This chapter is going to explain the many ways that digital tools enhance FL education.

2.5.1 Learner-related factors

Using technology in EFL classrooms caters to the individual needs of every learner. While learners must be active to complete their tasks, it is up to an individual to choose the pace that works best for them instead of following the speed that the teacher sets (Alsied & Patham, 2013; Stroia, 2012; Gündüz, 2005). For example, while using audio recordings and videos, learners have a chance to manipulate the sequences meaning that they could skip parts that are clear and re-play or slow the parts that are more difficult to understand. The utilization of videos and audio has another advantage. Students in traditional classrooms are quite limited in terms of input that they receive. Technology, on the other hand, offers multimodal and multisensory input. Thus, the students receive information through auditory, visual and at times kinesthetic channels, which demonstrates that the technology-enhanced education has the potential to adapt to individual learning and cognitive styles (Hidalgo, 2020; Alsied & Patham, 2013; Stroia, 2012; Warschauer & Healey, 1998).

Individualization of language learning process can be witnessed by lots of available resources online. When students or their teachers notice that extra practice is needed, it is quite easy to find digital tools that can help. The abundance of materials encourages autonomous learning through independent work and self-discovery as well as fosters an individualized learning process (Hafifah, 2019; Alsied & Patham, 2013; Warschauer & Healey, 1998). Besides, it teaches learners real-life digital literacy skills that cannot be separated from the work life in the 21st century (Hafifah, 2019; Gündüz, 2005; Warschauer & Healey, 1998). Lastly, using digital tools, teachers can set tasks that would work best for students with different temperaments. Students who are shy would feel more comfortable when performing activities in front of a computer since there is no element of judgment (Santosa, 2008; Stroia, 2012). Hence, language anxiety, which is known to hinder FL learning, would decrease. Similarly, extroverts would benefit from project-type tasks where they could work in groups (Warschauer & Healey, 1998). The flexibility and efficiency of technology illustrates the simplicity of establishing a learner- centered language learning process.

2.5.2 Motivation and attitudes

Learning FL is a slow process, which requires dedication. Thus, students must have enough motivation to accomplish this difficult task. Motivation represents one's positive attitudes in particular aspects of his or her environment (Seven, 2020). Motivated people find it easier to achieve their goals. On the contrary, Seven (2020) stated that "*if a student does not want to learn, it is unlikely that learning will occur*" (p. 70). So, in the context of education, motivation is one of the most important elements for success. It follows that FL teachers can amplify students' motivation. For example, they can create stimulating activities that would be interesting for learners, thus promoting their motivation (Seven, 2020). To do that, teachers can benefit from dynamic instructional designs offered by technology. Digital tools offer variation and entertainment that bring the fun factor into the learning process (Hafifah, 2019; Stroia, 2012; Gündüz, 2005; Warschauer & Healey, 1998). Drills that were previously used in a traditional sense can now be turned into games, too. This creates a more relaxed and enjoyable environment for the students. The added factor of competition in game-based learning can also be motivating for some learners (Gündüz, 2005). Working towards a specific goal can be another way to increase students' motivation. For instance, webquests offer an opportunity for students to research topics online which is necessary to finish the assignment. Akyuz and Yavuz (2015) reported on a study by Tsai (2006), where webquests were associated with higher levels of motivation in learning new vocabulary items and practice of reading skills. It serves as one of the examples demonstrating how diverse digital tools can encourage teachers to take advantage of individualized instruction and create entertaining materials, tasks, and activities to promote their students' motivation in learning FL.

2.5.3 Feedback and progress report

More sophisticated programs are created alongside the improvement of technology. This allows for students to get immediate feedback, eliminating the need for a human agent (Stroia, 2012). Playing games could illustrate how relatively easy it is for students to check their knowledge. Furthermore, some programs can help students to identify and correct the mistakes they made, provide explanations, direct learners to resources for more practice or advance them to a higher level (Gündüz, 2005). In contrast, students would need to wait for others to complete the activity to get the correct/incorrect feedback and

students with lower levels of willingness to communicate in FL might not ask questions to teachers even when they cannot understand some concepts. Whereas any student can easily access information via technology to clarify any points.

Following up with individual progress is another advantage of technology-enhanced education. Previously, it was teachers' responsibility to keep track of their students' achievements, strengths, and weaknesses. Nowadays computers enable learners to follow up with their performance (Alsied & Patham, 2013). Students can observe their progress, test themselves and plan their own learning based on their results. Teachers can also benefit from technology in that keeping the records of their students is much more practical in the digital space rather than in the physical environment. Learning management systems such as Google Classroom allow teachers to access or update students' progress information instantly.

2.5.4 Co-operative learning and communication

Digital tools can also be utilized in a project-based or task-based learning environment where students work together towards a shared goal. Such cooperation can be encouraged by using digital tools like simulation games, for example, Minecraft. Additionally, teachers could set up a task where students would need to work together and prepare a product as in the case of WebQuests. This way students would be encouraged to use the target language for communication in an authentic situation (Alsied & Patham, 2013). This way, students have to interact to overcome challenges. Such co-operative learning while using digital tools means that the level of interaction is higher than in traditional teacher-centered classroom. For example, tools like Padlet or GoogleDocs allow learners to answer to a prompt provided by a teacher instantly, simultaneously, and anonymously which is seen to increase participation and create a collective ownership over the combined work (Moorehouse & Yan, 2023). Finally, co-operative learning in technology-enhanced FL classrooms can be achieved by computer programs that stimulate discussions among students (Gündüz, 2005). The ability to express one's opinion is a genuine reason why people learn languages. Technology provides opportunities for learners to experience authentic communication situations (Hidalgo, 2020). Simple activities like watching and discussing videos can give students enough motivation to use English to express themselves. Moreover, videos and audio records in FL classrooms can

illustrate authentic communication among native speakers (Stroia, 2012). In other words, thanks to technology, learners are modelled real ways speakers of English talk to each other. This is quite important since it is no secret that the majority of EFL students never get a chance to learn from native teachers. On top of that, instant chatting, microblogging or even video chatting programs allow EFL learners to communicate with native speakers (Stroia, 2012). This way the learners are not only modelled the target language, but also get an opportunity to use their language knowledge and skills in authentic communication situations. So, from working on projects in groups to speaking TL with natives, technology in EFL classrooms offer a great variety of how interaction can be boosted, and students are active in their learning.

2.5.5 Access to information and cultures

The invention of the Internet changed the way technology worked forever. Students needed to travel in order to find publications that would give them information on topics of their interest. However, the Internet allowed people to reach any piece of information with one click. Typing key words in search engines such as Google results in thousands of pages related to the topic. For EFL teachers it means that they get access to high amounts of ready-made materials they can use for their classrooms (Hafifah, 2019). For learners this implies the chance to independently delve into the language and glean knowledge from extensive datasets (Warschauer & Healey, 1998). Because technology is becoming a more natural part of education, the number of is rising. A lot of teachers choose to use digital tools to create their own materials in line with their learners' needs too. So, digital materials are constantly kept up to date (Stroia, 2012). It is possible to access files and other digital tools that explain and give opportunities to practice almost any vocabulary item or grammatical structure in English. Moreover, a lot of resources do not require payments so learners who are financially less sufficient can benefit too. The almost limitless opportunities to practice English using technology also means that learners get a "*much needed exposure of target language in various forms*" (Alsied & Patham, 2013, p. 49). Learners cannot learn a new structure or word from seeing it or hearing it only once. Technology helps learners to get illustrations of dynamic linguistic phenomena (Stroia, 2012). Experimenting with concordancers, for example, allows learners to see the diversity in ways a linguistic item is used. Adding to this, the multimodality that technology offers helps the learners to see, hear and sometimes use

new concepts in different ways which enhance the whole learning process. Lastly, thanks to high volumes of multimodal information learners are able to experience other cultures. Not only do the students learn from authentic communication models presented by native speakers, but also, they can better understand the lifestyles people in the target culture have. This can lead students to have a positive attitude when it comes to learning the target language (Hidalgo, 2020). Consequently, such exposure might lead to better overall learning outcomes.

2.5.6 Learning environment

Technology has certainly altered some aspects of the learning environment. In the early days, computer labs were created for students to practice the language. However, the development of technology meant that language labs were not necessary anymore. Personal computers and later mobile phones took over. These relatively small devices extended the walls of EFL classrooms. Now the learners have the luxury to choose the time and location of their learning (Hafifah, 2019; Stroia, 2012). The portability of mobile phones, tablets or laptops enable learners to study anywhere, including home, office, café, or park. It also allows learners to select the time that works with their schedule in order to study English. It is not needed to schedule time for a class by setting time aside for commute. Learners can allocate just a few minutes to practice the FL. Especially learners who need more practice can use various programs to target specific skills outside the regular class hours (Gündüz, 2005). Moreover, teachers can set assignments for students using digital tools. This way a component of blended learning or, in other words, learning that occurs partly in an online environment and partly face-to-face (Dudeney & Hockly, 2012), is added to EFL classrooms. Apart from offering lots of practice without the limits of time and place, technology today allows virtual transportation. Technological tools can virtually transfer students to another country (Akyuz & Yavuz, 2015; Stroia, 2012). With the help of VR glasses, learners can easily experience the culture of TL without the need of travelling physically. All of these aspects of digital tools show the versatility and flexibility they give to EFL learning and teaching.

2.6 The limitations of digital tools in EFL

Although there are many benefits that digital tools can offer to EFL teachers and learners, they have some demerits. High cost, negative teachers' attitudes, lack of training,

limitations of hardware along with software and primitive feedback as well as evaluation programs are going to be explored further.

2.6.1 Cost

The cost of technology in education can be understood in two ways, i.e., the financial price and the time cost. The former refers to the money that educational institutions are required to spend in order to use the technology. The latter is related to the time required to prepare educational materials and developing programs.

When it comes to the finances of technology, it is clear that some countries have more opportunities than others. While digital tools are used widely in wealthy countries, the cost of computers and related equipment remains a problem among underprivileged communities (Gündüz, 2005). In other words, teachers and learners in developing countries have a limited access to tools like computers or the Internet which constitute the core of information technology in education. This creates unfair educational conditions and leads to an abyss between rich and poor students (AbuSeileek & Abu Sa'aleek, 2012). However, the fast development of technology creates more opportunities even for under-funded schools. Bahari (2022) noticed that there are more and more cost- effective educational technologies appearing which can be used in impoverished areas. Also, some governments show attempts to overcome the financial issues of technology. For instance, the Fatih project in Turkey aimed at providing the necessary hardware to every classroom, connecting them to the Internet, developing e-materials for the learners and more. Such projects could create equal opportunities among all students, regardless of the finances.

The preparation time needed for the utilization of digital tools is another issue. Usually, the responsibility of material preparation and evaluation falls on the teacher who has to put in more hours in order to benefit from technology (Hafifah, 2019). Nonetheless, creating digital materials is not an easy process. As Gündüz (2005) noticed, *"it can take longer to learn a piece of CALL software than handle a textbook, because s/he has to work through it, rather than just skimming through it"* (Gündüz, 2005, p. 207). So, preparation of a lesson becomes time consuming. However, even though time cost maybe a challenge for overloaded teachers, the extra preparation may help them to implement the lesson better (Moorhouse & Yun, 2023). Overall, the cost of technology cannot be

forgotten when decisions about utilization of educational technology are made.

2.6.2 Teachers' attitudes

The attitudes of teachers can affect the way they use technology in their lessons. If the teacher believes in the benefits of digital tools, then it may help them invest more in material preparation and successful conduct of a lesson. Gündüz (2005) noticed that the effectiveness of technology utilization is dependent on the way the teacher feels about his/her abilities to use it. Akyuz and Yavuz (2015) agreed by stating that teachers' perceptions towards educational technology are of great importance. Therefore, teachers should be supported when using digital tools and the level of their confidence should be improved. It is worth noting that nowadays when technology is so intertwined in our daily lives, it is easier for the teachers to have more faith in themselves when using various digital tools. For example, after conducting a meta-analysis on teachers' perceptions towards technology in Turkey, Alaaref (2022) concluded that teachers had positive attitude when it comes to the benefits of technology and their ability to use them effectively. So, it is a higher chance that such teachers would be more effective at technology utilization in the educational process.

2.6.3 Training

Related to perception of technology is the issue of teachers' skills to use computers. Many scientists agree that teachers should have more training in this area (Alaaref, 2022; Bahari, 2022; Hafifah, 2019; Akyuz & Yavuz, 2015; AbuSeileek & Abu Sa'aleek, 2012). To this day, many training programs for EFL teachers are restricted regarding computer literacy. Therefore, teachers who graduate from such programs may face challenges in their teaching practices. Consequently, some studies concluded that teachers described the lack of ICT skills. For example, Bahari (2022) found that nearly a third of teachers reported having low digital literacy skills which caused them issues with CALL. Alaaref (2022) also stated that some teachers expressed the need for more training specifically in the field of ELT when it comes to digital literacy skills. Another issue with training is the need to keep up to date with the fast-developing and changing digital tools which can be challenging for teachers who are already overloaded. For instance, designing materials for MALL or virtual worlds remains difficult for many EFL teachers (Bahari, 2022). To overcome this drawback, professional development programs should be prepared, and

language teaching principles should be innovated constantly (Hafifah, 2019; Akyuz & Yavuz, 2015).

2.6.4 Hardware and software

The hardware of information and communications technology (ICT) is related to physical equipment and components, such computers, mobile phones, interactive white boards, and others. Apart from being expensive, the hardware of ICT can also be unreliable. For instance, power cuts or technical failures can lead to the wrecking of the whole lesson (Gündüz, 2005). If a teacher prepared materials that are solely based on digital tools and suddenly, they do not work, the lesson objectives cannot be achieved. The slow internet connection can also affect the lesson negatively (Praveen Sam & Shalini, 2021). Similarly, student's autonomous work can be affected negatively if the breakdown of hardware results in the loss of data (AbuSeileek & Abu Sa'aleek, 2012). This is especially significant for students who are less skillful with ICT. Also, Bahari (2022) stated that usability challenges of new technologies such as MALL or TALL result in cognitive overload which hinders learning.

Software are programs that help run computers. Praveen Sam and Sahili (2021) noticed that not every learner has an opportunity to hold a software that is needed for educational purposes. This can affect how the teachers plan their lessons, causing restrictions. Moreover, language-learning specific programs have to be refined. For example, Bahari (2022) reported that robot-assisted language learning (RALL) lacked instructional designs which is a major issue when implementing the technology in the field of EFL. Although software has made tremendous progress, the technology is not yet perfect for classroom application.

2.6.5 Feedback and evaluation

Computer-generated feedback can be valuable since it helps students notice their mistakes; however, such programs have some limitations. Computers are machines that cannot communicate effectively and adapt to the ever-changing nature of learning arising from individual learner differences. Thus, the feedback that is given to learners may seem fallible, non-dialogic and generic (Bahari, 2022). Moreover, software that is specifically created to support students by giving them feedback is often created to guide learners in

finding their mistakes instead of giving the correct/incorrect assessment. Taşkıran (2022) conducted research about AI-based automated writing feedback and found that such comments can be difficult to comprehend, and AI technology should be limited to addressing lower-level skills like grammar. In short, programs that provide learners with feedback have potential but at the moment this technology is not developed enough to make the feedback given by teachers obsolete.

2.7 Language skills and digital tools

Knowing a language is often understood as a person's ability to communicate successfully using the four language skills, namely, listening, speaking, reading, and writing. Although nowadays scientists claim that knowing a language is more complex, involving pragmatic, sociolinguistic, and multicultural competencies (Blake, 2016), EFL teachers are still concerned with the practical application of tools in order to develop more tangible language skills. Hubbard (2021) stated that "*skills-oriented language teaching remains a common approach for many curricula as well as for self-learning, and it is true of CALL as well*" (p. 32). Therefore, the four language skills and the way digital tools affect their development will be addressed below.

2.7.1 Listening

Listening is essential for successful oral interactions. Moreover, having good FL listening skills is necessary for academic achievement (Khashan & AbuSeileek, 2023; Najmi & Lavasani, 2021). It is a difficult process which requires a person not only to recognize sounds, but also attach meaning to the words and messages through interpretation of contextual clues and prior-knowledge or experiences. Nevertheless, teaching this skill has often been neglected because listening was categorized as a passive skill that improves without additional help (Akdamar & Sütçü, 2021). Nowadays, teaching listening has gained more attention, and the ways digital tools can facilitate this process has been studied extensively (Khashan & AbuSeileek, 2023; Akdamar & Sütçü, 2021; Najmi & Lavasani, 2021; Kılıç, 2020). This is because educational technology has created new opportunities for authentic listening practice that could be hardly achieved in traditional classroom settings. For example, integration of glossaries or translations that can be hyperlinked within audios and videos are new trends that offer additional support to learners (Hubbard, 2021). Moreover, technology in FL education caters to multiple

senses, provides fun as well as authentic materials, allows manipulation of audio and video sequences, and can even take learners to various environments (Stroia, 2012). In other words, digital tools can benefit EFL learners in many ways.

The research from this area also showed the benefits of digital tools. Khashan and AbuSeileed (2023) investigated the effect of using BBC Learning English Application on improving 10th graders' listening and speaking skills and their attitudes towards this technology and found significant changes. Akdamar and Sütçü (2021) explored the benefits of digital story telling for listening skill development among secondary school pupils and discovered that the utilization of this tool lead to higher competency in listening. Similarly, Kılıç (2020) concluded that resources from EBA platform, which is an online social education platform utilized in Turkey, resulted in higher listening achievement among secondary school students. Najmi and Lavasani (2021) conducted a study among 30 adult females and found that using audio files such as podcasts had a significant positive impact on their listening skill. All these findings mean that the importance of educational technology for listening skill cannot be denied.

When it comes to the practicality of the utilization of digital tools, Blake (2016) mentioned Youtube as a great source of authentic communication on varied topics. Certainly, the Internet offers a lot of websites and applications that can benefit FL learners. However, after selecting the most appropriate digital tool, teachers must consider some factors like key vocabulary items, pragmatic, sociolinguistic and cultural knowledge necessary to understand the videos (Blake, 2016). The burden of creating follow up activities to further facilitate FL learning falls on the teacher, too.

2.7.2 Speaking

The ability to express one's feelings, needs, and ideas is certainly among EFL learners' goals. Alongside writing, speaking is a productive skill that, when mastered, allows learners to communicate effectively (Hamad, Metwally, & Alfaruque, 2019). Speaking effectively involves a lot elements, varying from the ability to use vocabulary items or grammar structures accurately and fluently to appropriate intonation, stress, and comprehensible pronunciation. That is why the complexity of teaching and evaluation of the ability to speak in FL cannot be underestimated. Nevertheless, digital tools offer

teachers as well as learners some assistance.

Speaking skill can be improved through educational technology in a few ways. Firstly, digital tools can be a trigger to include simulations, prepare role-plays or raise discussions among learners (Hubbard, 2021; Pesut, 2014; Gündüz, 2005). One way to utilize technology for such purposes would be to watch videos or surf the internet to find information and then ask students to complete follow-up activities. Nonetheless, more sophisticated and varied tasks and activities can be prepared and completed due to recent developments in digital tools. That is where utilization of technology as a tool and communication medium comes in place. Speaking can be practiced in real time, when learners can interact with teachers, their peers, or speakers of English instantaneously, and asynchronously, which requires recording and sending of audio files. Both means of speaking practice are offered by many programs, including applications such as Skype, WhatsApp, or Facebook Messenger (Hubbard, 2021). Producing and posting podcasts and videos are another way to improve learners' speaking skills, especially when collaboration with other speakers of the FL is included in the process.

Although posting videos or podcasts is another beneficial type of speaking practice, Blake (2016) stated that automatic speech recognition programs offer more feedback. Hubbard (2021) added that intelligent assistance like Siri could benefit students' pronunciation. Pronunciation can also be improved through dictation exercises (Blake, 2016). To sum up, there are many digital tools that develop different components of speaking skill.

The diversity of educational technology meant to improve speaking is unquestionable. However, the inclusion of digital tools in the EFL speaking education has been proven to be beneficial time and time again (Ilyas & Putri, 2020; Junaidi et al, 2020; Hamad, Metwally, & Alfaruque, 2019; Xodabande, 2017; Yanar, 2013). Thus, every EFL teacher and learner should strongly consider the utilization of these tools.

2.7.3 Reading

Becoming a fluent reader for EFL students is a major goal. The ability to read and understand texts is allows people to obtain a better education or a promising job, but also to develop oneself. Chastain (1988) described reading as "*a process involving the activation of relevant knowledge and related language skills to accomplish an exchange*

of information from one person to another" (Chastain, 1988, as cited in Shafiee, Akbari, & Hajijalili, 2019, p 34). It follows that reading requires a lot of sub-skills, such as automatic decoding, word recognition, and interpretation. Thus, there are many ways that reading can be improved.

With the appearance of digital materials, EFL learners are offered a variety of text formats and devices to help them advance their reading skills. Digital books, web pages, text messages, and online posts are all examples of digital texts. Sidabutar et el (2022) stated that the advantage of digital texts over printed ones is their multifunctionality, i.e., the fact that text is blended in with images, audios, videos, and hyperlinks. Therefore, the students can easily access more information if s/he feels that it is necessary. For example, learners can access glosses or look up digital dictionaries for unknown words to facilitate text comprehension. In the EFL education, research has shown that multimedia glossaries enhance both comprehension and vocabulary acquisition (Hubbard, 2021). Another advantage of digital texts is their updatability when compared to printed materials. Pesut (2014) claimed that digital reading materials used in EFL classes are current while texts in traditional coursebooks can be seen as dated. The up-to-date materials might positively affect students' motivation since they have easy access to passages that interest them.

The research concerning utilization of digital tools for the improvement of reading has been extensive and diverse, ranging from investigating the effect digital texts have on reading (Sidabutar et al, 2022; Saqr, 2021; Shafiee, Akbari, Hajijalili, 2019) to utilization of digital tools for the development of reading skills (Gao, Namaziandost, & Abdulaal, 2021; Ahmad, 2019). Digital texts in comparison to printed passages have been shown to be more significant for EFL learners' reading skills across cultures (Sidabutar et al, 2022; Saqr, 2021; Shafiee, Akbari, Hajijalili, 2019). When it comes to different digital tools, no overall findings can be reported due to the variation of technology. However, there are a few papers that illustrate how digital tools can be used in EFL classrooms. For instant, Gao, Namaziandost, and Abdulaal (2021) investigated how visual-syntactic text formation (VSTF) affected EFL learners' reading fluency in the EFL context. VSTF is technology that breaks sentences into meaningful chunks on a two-dimensional display. They found that VSTF could be used as a syntactic enhancement. Ahmad (2019) investigated the effect of digital posters created via GlogsterEdu website on reading

comprehension. The treatment included six steps, i.e., orientation, preparation, production, presentation, evaluation, and reflection. She found that digital posters significantly enhanced reading comprehension and improved the engagement of EFL learners. Overall, the research has shown the many benefits of digital tools, from tackling reading sub-skills, to the improvement of overall comprehension or fluency.

2.7.4 Writing

The last skill to be discussed is writing. Much like speaking, writing requires learners to produce language in order to express themselves, which can be difficult. Gayed et al (2022) claimed that FL writing is especially demanding because learners experience "*considerable cognitive stress*" (p. 1), for instance, while translating from their L1 to L2. Thus, learning to write in English is thought of as an arduous and dreadful process (Alqasham & Al-Ahdal, 2021). Despite the difficulties experienced by learners, the skill of writing in English is certainly a necessity in the modern world.

The opinions on the potential benefits of digital tools used for the improvement of EFL writing differ. While some researchers stress the positive effect that educational technology has on writing, others claim that digital tools hinder the learning process (Xu, 2023; Zaini & Mazdayasna, 2015). In particular, writing could be seen as a separate linguistic skill and as such should be taught only by exposing learners to solely FL linguistic input (Xu, 2023). Therefore, digital technologies that provide multimodal learning experiences would be viewed as distracting to FL students. However, other educators believe that educational technology improves the quality of written texts produced by learners (Zaini & Mazdayasna, 2015).

The potential of digital tools for teaching writing is indisputable. The asynchronous nature of writing means that this skill can be taught online (Hubbard, 2021). A few ways technology can be incorporated into teaching writing were discussed by Hubbard (2021) and included emails and discussion boards, online writing resources, collaborative writing tasks, writing support practices, and publication opportunities. Tools such as digital storytelling, corpora, word processing and automated writing evaluation can be added to this list (Blake, 2016). Collaborative writing is of particular importance because the learners are able to create texts using Web 2.0 tools such as blogs and receive feedback

from their peers and/or teachers (Chun, 2019; Blake, 2016). Such so-called social writing would prove highly challenging within an in-person setting.

The growing interest in this field among researchers has been acknowledged by Chun (2019). In fact, she claimed that the potential digital tools have on the development of FL writing has been one of the most investigated topics (Chun, 2019). There are many researchers who have found digital tools to be beneficial for the EFL students (Xu, 2023; Gayed et al, 2022; Alqasham & Al-Adhal, 2021; Zaini & Mazdayasna, 2015). Nevertheless, further research is needed to gain deeper understanding of how digital tools affect the development of EFL writing.

3. RESEARCH METHOD

This chapter introduces the research methodology, starting with an overview of the study's design. Following that, the third section elaborates on the literature search, while the fourth section provides details on the inclusion and exclusion criteria. The last section provides information about the data analysis.

3.1 Research Design

This study is designed as meta-analysis. Therefore, it is crucial to describe what meta-analysis is. İnce, Ozcimen, & Turan (2019) claimed meta-analysis to be "*a kind of scientific review of original studies/articles in a specific subject which is aimed to combine separate statistical results into a single estimation*" (p. 1). Meta-analysis uses the results of previously conducted research when its results are re-analysed and a summary is presented (Lodigo, Spaulding, & Voegtle, 2006; Cooper, 2010). Therefore, rather than primary data found in other designs, meta-analysis utilizes secondary data. The existing data is collected, and quantitative procedures are employed to generate a statistical estimate of effect.

The method of combining results from previous studies has been first employed by Pearson in 1904 (Pigott & Polanin, 2020). However, this research design did not gain widespread acceptance until the later part of the 1900s. Then the need for meta-analysis grew due to the development of social sciences. As Cooper (2010) noted, especially in the period between 1960s and 1970s, when there was more research in social and behavioural phenomena, the demand for reliable methods that would integrate research findings increased dramatically. Consequentially, Gene Glass used the term meta-analysis for the first time in 1976 when reporting findings in the field of health sciences (Pigott & Polanin, 2020). Nowadays, meta-analysis is also important in other scientific research areas, such as education. Tight (2019) suggested that this research design has gained popularity in the field of higher education. In summary, the use of meta-analysis has been increasing since its introduction, encompassing diverse fields of scientific inquiry.

There are other terms that are sometimes used synonymously with meta-analysis. One of such terms is systematic review (Cooper, 2010). However, while systematic review is used to synthesize existing literature in a non-numerical way, meta-analysis employs statistical techniques to analyse the data available in previous research (Tight, 2019; Pigott & Polanin, 2020). In other words, systematic review can provide practitioners with a summary of qualitative data, but meta-analysis is designed to investigate data in terms of mathematical measurement.

The meta-analytical design of this study has been chosen because the topic of this research, namely, digital tools, has been studied widely. Moreover, the nature of meta-analysis allowed the researcher to clearly reveal the effectiveness of digital tools in teaching and learning EFL. Specific variables that are of an interest in the current study provided more details regarding particular situations in which digital tools are used more effectively while learning English.

3.2 Literature Search

To find the effectiveness of digital tools on EFL learners' development of language skills, literature search was conducted. The search of the literature is particularly important when collecting data for meta-analysis because it is crucial in finding all eligible articles. This step requires a researcher to identify databases, terms, and limiters such as publication date or language (Cooper, 2010; İnce, Ozcimen, & Turan, 2019; Pigott & Polanin, 2020). In the current research, there were a few databases that were used for conducting the search of literature, including, ERIC, Google Scholar, and Web of Science. The current research attempted to minimize publication bias by including unpublished literature such as dissertations or thesis, as suggested by Pigott and Polanin (2020). This was achieved by exploring relevant studies using Turkish National Thesis Center database.

To access studies, the keywords included in the initial search were as follows: EFL, listening, speaking, reading, writing, computer, mobile, digital, technology, tool, TELL, CALL, MALL, application, website, social media. There were many studies found, related to the topic of interest; however, only those that met the inclusion criteria, which are discussed below, were selected.

3.3 Inclusion and Exclusion Criteria

When searching for appropriate articles, it is important to identify limiters, also known as inclusion and exclusion criteria. These criteria show whether studies are eligible for meta-analysis based on their characteristics (Cooper, 2010). In the context of this research, the inclusion and exclusion criteria were meticulously established to ensure the selection of studies aligning with the research objectives and methodological rigor. The inclusion criteria were designed to identify studies meeting specific characteristics favorable to a comprehensive meta-analysis.

In this current research, inclusion criteria were as follows:

- The study was conducted between 2013 and 2023.
- The study employed quasi-experimental or true experiment design.
- The study included one control and one experimental group.
- The study presented enough statistical information to calculate effect size.
- The dependent variable was a skill, rather than its sub-skill(s).
- The study included EFL learners.
- The language of the article was English.

The exclusion criteria were set as follows:

- The study was conducted outside the 10-year period.
- The studies that contained insufficient data necessary for data analysis.
- The studies that were published in different languages and/or duplicating.

After the initial search, each paper that investigated the impact of a digital tool on a particular skill was examined in terms of inclusion and exclusion criteria. As a results, a total of 56 articles were included in this meta-analysis. Specifically, in terms of receptive skills, there were 24 studies found in relation to listening skill, followed by 11 studies related to reading. When it comes to productive skills, a total of 13 studies investigating speaking skill and 11 studies regarding writing skill were included in this meta-analysis.

3.4 Data Analysis

The analysis of data was conducted in three primary stages, aligning with the three research questions. Initially, the first research question was addressed by summarizing the diverse digital tools employed for the development of each language skill, meticulously extracted from the reviewed papers. Tables were then crafted, illustrating the specific digital tools and their frequency of usage associated to each distinct skill.

Subsequently, for the exploration of the second research question, Stata 17, a statistical data analysis software, was utilized. This facilitated an investigation into the relationship between digital tools (considered as independent variables) and language skills (deemed as dependent variables). Cohen's *d* effect size for each study was computed by analyzing mean, standard deviation and number of participants across experimental and comparison groups. Cohen's *d* value is used to show the effect size which represents the impact made by the treatment and is calculated "… *on the basis of mean scores of the treatment and control groups and pooled standard deviation*" (Taj et al., 2016, p. 80). The values of Cohen's *d* represent the effect size observed and can be as small ranging from 0.2 to 0.5, medium with values between 0.5 to 0.8, and large effect size starting at 0.8 and above (Cooper, 2010). This step gave a general idea of how much each digital tool benefited the development of a language skill. Stata's specialization in meta-analysis of quantitative data was instrumental in estimating an overall effect (theta) of digital tools on each language skill. This estimate was crucial in understanding the role of digital tools in modern day EFL education.

Moreover, in relation to the third research question, Stata 17 software allowed to explore the moderating roles of age and level of proficiency. Meta-regression, as said by Cooper (2010) is a "*statistical approach to testing multiple moderators of effect sizes simultaneously or sequentially*" (p. 137). To elaborate, meta-regression serves as a powerful analytical tool that enables researchers to systematically investigate and understand the factors contributing to the variability observed in effect sizes across different studies. By employing this method, the study aimed to uncover nuanced insights into how age and proficiency levels might interact with the impact of digital tools on language proficiency, offering a comprehensive understanding of the multifaceted dynamics within the educational context.

Additionally, to quantify and measure the extent of the variability of effect sizes, heterogeneity tests, including the Q-statistic and the I-Squared (I^2) statistic, were estimated. Heterogeneity serves as a formal method to assess the observed variance in comparison to what would be expected due to sampling error (Cooper, 2010). While the Q-statistic assesses whether the observed differences in effect sizes are beyond what would be expected by chance alone, the I-Squared statistic quantifies the proportion of total variability that is due to true heterogeneity rather than chance (Cooper, 2010). It is also important to mention that since the heterogeneity tests all showed statistically significant heterogeneity among the included studies, random-effects model was employed for the meta-analysis. As noted by Pigott and Polanin (2020), the use of a random-effects model is deemed acceptable in situations where there is substantial variation in the characteristics of the treatments, samples, and settings among the included studies. By acknowledging this variability, the random-effects model ensures that the synthesized results are more reflective of the inherent diversity in the literature and provides a more realistic estimation of the overall effect size of included studies.

Moreover, Stata 17 facilitated the examination of moderator effects, specifically investigating how age and proficiency level impact EFL students through meta-regression tests. Consequently, this analysis surpassed the assessment of the overall effect size, aiming to reveal subtle variations in the relationship between digital tools and language skills based on participants' characteristics. This detailed exploration enhances the depth of the findings, offering a more comprehensive insight into factors that impact the effectiveness of digital tools in educational settings.

Lastly, the reliability of the meta-analysis results was ensured by evaluating potential publication bias. This was achieved through the generation of a funnel plot and employing the trim and fill test in relation to each language skill. The funnel plot visually depicts the distribution of effect sizes against their standard errors, helping to identify any asymmetry that may indicate publication bias. Subsequently, the trim and fill test were employed to estimate and adjust for potential missing studies, further refining the analysis. This rigorous approach ensures that the synthesized findings are not unduly influenced by the selective publication of studies and enhances the credibility and validity of the meta-analysis results across all language skills considered.

4. FINDINGS AND DISCUSSION

This chapter details the findings to the three research questions, mentioned earlier. Each skill is presented separately, detailing the studies included in the meta-analysis as well as describing how each research question was answered. Lastly, the results as well as implications of the study's findings are addressed.

4.1 Listening Skill

Related to listening skill, a total of 24 studies, meeting the inclusion criteria, were included in the data analysis. The summary of these articles, including the authors, titles of the papers, types and years of publications, the database source and the number of the participants are presented in Table 5. The detailed descriptions of each article are presented later in this chapter.

Table 5. Classification of the Studies Used for Meta-analysis: listening

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Demir Deveci, D. M., & Tavil, M.Z	The effect of technology-based materials on vocational high school students' listening skill	Article	2021	ERIC
Dizon, G.	Evaluating intelligent personal assistants for L2 listening and speaking development	Article	2020	ERIC

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Al-Shamsi, A., Al-Mekhlafi, A. M., Al Busaidi, S. & Hilal, M. M.	The effects of mobile learning on listening comprehension skills and attitudes of Omani EFL adult learners	Article	2020	Google Scholar
Quyen, T. T. Q., & Hien, L. D. T.	Implementing mobile applications: EFL students' perceptions and listening skill improvement	Article	2021	Google Scholar
Shiri, S.	The application of podcasting as a motivational strategy to Iranian EFL learners of English: A view toward listening comprehension	Article	2015	Google Scholar
Meihami, H., Meihami, B., & Varmaghani, Z.	The effect of Computer-Assisted Language Learning on Iranian EFL students listening comprehension	Article	2013	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Akdamar, N. S., & Sütçü, S. S.	Effects of digital stories on the development of EFL learners' listening skill	Article	2021	Google Scholar
El-Desouky Gaber, M.	Utilizing Mobile Assisted Language Learning (MALL) to develop EFL listening skills and learner autonomy	MA Thesis	2015	Google Scholar
Khoshsima, H., & Mozakka, Z.	The effect of Computer-Assisted Language Learning on Iranian upper-intermediate EFL learners' listening skill	Article	2017	Google Scholar
Salehpour, F.	The effect of using Telegram Instant Messaging application on listening comprehension skill among Iranian intermediate EFL students	Article	2018	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Nabilou, M., Aboutalebi, M., & Soltani, S.	The effect of using mobile listening applications on listening skills of Iranian intermediate EFL learners	Article	2021	Google Scholar
Diab, A. A. M.	Using the ubiquitous learning tools for developing EFL prospective teachers' listening comprehension and digital literacy skills	Article	2022	Google Scholar
Khashan, H. S., & AbuSeileek, A. F.	The effect of using British Council BBC Learning English application on the tenth grade EFL students' listening and speaking skills and their attitudes toward it	Article	2023	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Abbasian, G. R., & Movahedfar, S.	The effect of Multimedia Computer Assisted Language Learning (MCALL) on Iranian EFL learners' L2 listening comprehension	Article	2016	Google Scholar
El-Sayed, M. M., Qoura, A. A. S., & El-Hadidy, M. M. S.	Enhancing EFL secondary stage students' listening and reading comprehension skills through a CALL program	Article	2017	Google Scholar
Ayatfard, F.	Effect of digital audio files on EFL learners' listening skill	Article	2022	Google Scholar
Bouzidi, A.	Integrating mobile-based activities in teaching listening and speaking skills to EFL degree students at Algiers 2 University: A multimodal approach	MA Thesis	2021	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Kazemnia, D.	The effect of using the Quizizz as an online game-based learning platform on primary Turkish EFL learners' listening skills improvement	MA Thesis	2022	National Thesis Center of the Council of Higher Education
Bal, S.	The integration of ICT tools into listening skill classes to improve listening comprehension skills of EFL learners	MA Thesis	2019	National Thesis Center of the Council of Higher Education
Nozad, N.	The effect of authentic audiovisual materials on listening skills development and listening anxiety of EFL students	MA Thesis	2021	National Thesis Center of the Council of Higher Education

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Khodashenas, M. R., & Amouzegar, E.	The effect of using CALL on the improvement of the listening comprehension of the intermediate EFL learners	Article	2013	Web of Science
Jia, C., & Hew, K. F. T.	Supporting lower-level processes in EFL listening: the effect on learners' listening proficiency of a dictation program supported by a mobile instant messaging app	Article	2022	Web of Science
Yang, C. T. Y., Lai, S. L., & Chen, H. H. J.	The impact of intelligent personal assistants on learners' autonomous learning of second language listening and speaking	Article	2022	Web of Science

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Hwang, W. Y., Shih, T. K., Ma, Z. H., Shadiev, R., & Chen, S. Y.	Evaluating listening and speaking skills in a mobile game-based learning environment with situational contexts	Article	2016	Web of Science

It can be seen from Table 5, that 15 of the research papers incorporated in this meta-analysis were published articles, amounting to 75% of all studies included. The other 25% of the study papers were MA theses. Also, a third of all studies were published in 2021. Three studies were published in 2022. Between the years 2013-2020 and in the year 2023 there were only 1 or 2 studies, included in this meta-analysis. When it comes to database sources, it is worth noting that three quarters (75%) of papers were found in Google Scholar, while ERIC provided two appropriate articles and National Thesis Center of the Council of Higher Education gave access to three MA thesis papers that met the inclusion criteria.

Table 6. Characteristics of the Included Studies: Listening

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
1. Demir Deveci, D. M., & Tavil, M.Z, 2021	168	No information	B2	Web 2.0 tools: Youtube, Voscreen, Lyrics Training	positive
2. Dizon, G., 2020	28	18-20	A1-B1	Intelligent personal assistant (IPA)	no effect

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
3. Al-Shamsi, A., Al-Mekhlafi, A. M., Al Busaidi, S. & Hilal, M. M., 2020	32	20-23	No information	Google Classroom App via mobile phone	positive
4. Quyen, T. T. Q., & Hien, L. D. T., 2021	101	No information	A2	Two Minute English, Learning English BBC News, Google Docs, etc.	positive
5. Shiri, S., 2015	55	No information	B1	Podcast-based materials	positive
6. Meihami, H., Meihami, B., & Varmaghani, Z., 2013	74	20-22	C1	The Four Corners One program	positive
7. Akdamar, N. S., and Sütçü, S. S., 2021	64	11-14	No information	Digital storytelling	positive

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
8. El-Desouky Gaber, M., 2015	80	16-17	No information	Researcher-developed Android program	positive
9. Khoshsima, H., and Mozakka, Z., 2017	30	No information	B2	CALL	positive
10. Salehpour, F., 2018	40	14-17	B1	Telegram	positive
11. Nabilou, M., Aboutalebi, M., and Soltani, S., 2021	50	15-20	B1	Miracle English	positive
12. Diab, A. A. M., 2022	74	20-22	No information	Podcasts and TED talks	positive
13. Khashan, H. S., and AbuSeileek, A. F., 2023	46	15-16	No information	British Council BBC Learning English app	positive

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
14. Abbasian, G. R., and Movahedfar, S., 2016	30	16-23	B1	Website Talk2me English	positive
15. El-Sayed, M. M., Qoura, A. A. S., and El-Hadidy, M. M. S., 2017	60	14-16	No information	CALL	positive
16. Ayatfard, F., 2021	80	No information	B2	iPod audio files	positive
17. Bouzidi, A., 2021	78	17-29	C1	TED Talks via mobile phone	positive
18. Kazemnia, D., 2022	44	8-9	No information	Quizizz app	positive
19. Bal, S., 2019	50	19-21	B1	Edpuzzle and Vocscreen websites	positive
20. Nozad, N., 2022	88	12-13	No information	TED Talks and TED-ED videos	positive

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
21. Khodashenas, M. R., & Amouzegar, E., 2013	44	13-18	A1	Rosetta Stone software	positive
22. Jia, C., & Hew, K. F. T., 2022	70	18-20	B1	WeChat app	positive
23. Yang, C. T. Y., Lai, S. L., & Chen, H. H. J., 2022	34	18-21	A2-B2	IPA	no effect
24. Hwang, W. Y., Shih, T. K., Ma, Z. H., Shadiev, R., & Chen, S. Y., 2016	40	No information	No information	Researcher-developed game-based and context-situated learning mobile system	positive

Table 6 illustrates some characteristics of the studies that were incorporated in this meta-analysis, specifically, the author and year of publication, sample size, age and the level of English of the participants, the type of treatment the experimental group received, and the overall effect type it had. The size of the sample in each study was over 20. Overall, the authors did not provide any information regarding participants' age in 5 research papers,

amounting to 25%. The other three quarters of studies were grouped according to age into three groups, namely, young learners, aged 8-9, teenagers, aged 11-17, and young adults, aged 18-29. There was only 1 research paper, whose participants were young learners. Meanwhile, 8 papers, or 40%, included teenagers in their sample, and young adults were of interest in 6 studies, or 30%. When it comes to level of English, there was no information in 8 papers, or 40%. The other 60% of articles' subjects were A2 (5%), B1 (25%), B2 (15%), C1 (10%) or mixed group A1-B1 (5%). The treatment applied was not detailed in 10% of research papers, rather depending on a general CALL term. 40% of articles dealt with digital tools that were specifically designed for educational purposes, while 60% of papers measured the effectiveness of non-educational technology. Finally, this table shows that the overwhelming majority of 95% of experiments reported positive effect type of the treatment. The detailed descriptions of each research paper included in this meta-analysis will be discussed below.

1. Study by Demir Deveci, D. M., & Tavil, M.Z in 2021. This study aimed to examine the effect of technology-based materials on the student's listening ability in EFL classes and investigate the students' and teachers' attitudes towards such practice. This study employed a mixed-methods with two groups research design where quantitative data was gathered through researcher-made pre- and post-tests. There were 168 B2 level participants studying in a vocational high school in Turkey. In the duration of 12 weeks, the experimental group (N=84) complete activities using digital tools, namely, YouTube, Voscreen, and Lyrics Training. Meanwhile, the control group (N=84) received textbook-based materials. The data showed similar achievement by both groups, thus, the technology-based materials' effect on developing listening skill was very low.

2. Study by Dizon, G. in 2020. This study examined the in-class use of the intelligent personal assistant (IPA), Alexa, among second language (L2) English students to develop listening and speaking skills. It was a mixed-methods research with a quasi-experimental two-group design. Pre- and post- researcher-made listening tests were applied to gather the quantitative data. The participants included 28 first and second year EFL students aged 18 to 20 at a Japanese university. They were a mixed-ability group, ranging from A1 to B2 levels. The experimental group (n = 13) took part in a 10-week treatment of individual or dyadic student-IPA interaction during the lesson time and a control group

(n = 15) did not. The results showed that Alexa was considered to not have a major impact on the development of listening skill.

3. The study by Al-Shamsi, A., Al-Mekhlafi, A. M., Al Busaidi, S. & Hilal, M. M. in 2020. This research explored the effect of using mobile learning on improving adult learners' listening skills in Oman, investigated their attitudes, and explored the factors that stand as barriers to its implementation. It was a mixed-methods research with a quasi-experimental design where quantitative data was gathered through researcher-made pre- and post-tests. The participants included 48 level one students, aged 20 to 23, from the foundation program at a Military Educational Institute (MEI), Oman. The control group (N=16) students received the English listening materials lessons following a conventional way of teaching, i.e., a paper and pencil. In contrast, the experimental group (N=15) worked with the same listening materials through mobile devices using the mobile application (Google Classroom App) for the duration of 8 weeks. The results showed that m-learning was more effective in developing listening skills than traditional teaching.

4. The study by Quyen, T. T. Q., & Hien, L. D. T. in 2021**.** This research investigated the EFL students' perceptions and the effects of mobile applications on their listening improvement. This study adopted a mixed-methods design involving two phases: quantitative data collection, where a quasi-experiment took place and pre and post-tests were applied. The participants included 101 non-English - majored A2 level students at their elementary level in four General English 2 courses of Can Tho University, Vietnam. The treatment of the experimental group (N=51) included the use of mobile applications such as Two Minute English, Learning English BBC News, etc. and reporting of listening practices in Google Docs. During thirteen weeks, the experimental students listened to any video/ audio files from the mobile apps at least five times per week through mobile devices while the control group participants (N=50) just practiced listening with audio files in their course-book only. The results indicated the that digital tools improved students' listening skill.

5. The study by Shiri, S. in 2015. This research aimed at inspecting the impact of podcasts as learning and teaching tools on Iranian EFL learners' motivation for listening as well as on their listening comprehension ability. The present study followed a mixed methods approach. The quantitative section analysed the data from the two tests, collected before

and after the quasi-experiment. The qualitative section includes the part which deals with students' perceptions about the effect of using podcasts as a learning tool and their perceptions about the podcast program. The participants included B1 55 EFL learners at an English institute. Then during ten successive sessions some units of podcast-based materials were given to the experimental group (N=17) as the treatment. Meanwhile, the control group (N=16) was taught in the institute's conventional way of teaching listening and vocabulary, which was mostly considered to be a modified version of Audiolingualism with a lot of focus on grammar and using different kinds of drills to teach grammar and dialogs with little attention to listening. Quantitative data analysis revealed that podcasts had an effect on improving learners' motivation for listening.

6. The study by Meihami, H., Meihami, B., & Varmaghani, Z. in 2013. This research attempted explore the effect of CALL on listening skill of Iranian EFL learners. A total of 74 Iranian C1 EFL learners aged 20-22 were divided into control (N=37) and experimental (N=37) groups. The first one was taught using traditional teaching method that aimed at developing students' listening skills, while the experimental group received a 16-session treatment based on CALL materials, specifically, The Four Corners One program, developed specifically for the purpose of listening comprehension. There were two tests that helped researchers to collect the data, based on Tactics for Listening and Developing tests. The results indicated that using CALL materials in the listening comprehension classroom can improve EFL students listening comprehension.

7. The study by Akdamar, N. S., and Sütçü, S. S. in 2021. This research investigated the effects of digital storytelling in regard to their listening skills of EFL learners and their attitudes towards this approach. In this research, there were two tests applied before and after the treatment. A total of 64 students aged 11 to 14 who attended 6^{th} and 7^{th} grades in a secondary school in Adana, Turkey participated in the story. No information regarding the students' level of English was provided. Digital storytelling was applied to experimental group (N=32) as treatment and control group (N=32) had the traditional classes, where they learned through the storytelling lessons, i.e., the printed material and the teacher reading the story. The data was collected with the help of researcher-made pre- and post-tests. The results confirmed that digital storytelling affected listening skills development positively.

8. The study by El-Desouky Gaber, M. in 2015. The study researched the effectiveness of using MALL to enhance EFL listening skills and learner autonomy for secondary stage female students. This research adopted quasi-experimental design. The participants consisted of 80 first year secondary stage female students, aged 16 to 17, in Emam Nasef Secondary School for girls, Zarka city, Iran. No information regarding the students' level of English was provided. The experimental group (N=40) was taught using a mixed pattern of the traditional ways of teaching listening in classrooms and the android program which was designed and developed by the researcher to develop the listening skills of first year secondary skills and to foster their learner autonomy. In contrast, the control group (N=40) was taught using the traditional regular methods of teaching listening that depended on EFL textbook. A researcher-made pre-post- test of listening comprehension skills was applied. It was found that digital tools were effective.

9. The study by Khoshsima, H., and Mozakka, Z. in 2017. This study attempted to investigate the effect of Computer-Assisted Language Learning (CALL) as an approach to teaching and learning a foreign language on the improvement of listening skill. This research was quasi-experimental in design. The participants included 30 male B2 level EFL learners in a private English language institute in Shiraz, Iran. No information regarding the participants' age was provided. There were two groups. The treatment lasted for 16 sessions over a two-month period. In the experimental group (N=15), Computer Assisted Language Learning was applied whereas in the control group (N=15), traditional approach to language teaching was followed. The participants took two tests. FCE listening pre- and post- test results were analysed. The results indicated that application of CALL had a significant effect on improvement of learners' listening proficiency.

10. The study by Salehpour, F. in 2018. This quasi-experimental research aimed at investigating the effects of using Telegram application, in comparison with classroom instruction, on listening comprehension ability of Iranian EFL students. There were 40 female B1 level EFL learners, aged 14 to 17, who attended eleventh grade in high school at Pardis and Bentolhoda high schools in Masjed Solayman, Iran. There were two groups, each consisting of 20 students. During the treatment, the experimental group received listening instructions by Telegram. However, there was no instant messaging in teaching listening for the control group. The data was collected by using pre- and post- tests which

were extracted from Preliminary English Tests (PET) exam. The findings revealed that using Telegram application had a significant effect on improving Iranian EFL learners' listening comprehension ability.

11. The study by Nabilou, M., Aboutalebi, M., and Soltani, S. in 2021. The present quasi-experimental study explored the effect of using Mobile listening application on developing listening skills by Iranian intermediate EFL learners. To do so, 50 male B1 EFL learners, aged 15 to 20, studying in Iranian Language Institute in Tehran, Iran, were selected as the participants. The control group was taught the book through traditional method (using DVD/CD-players or any other types of audio players) and the learners in the experimental group had to practice listening through using the intended mobile application Miracle English, which was specifically designed for EFL learners. The experimental group students could listen to and read short stories and conversations for the duration of 8 sessions. There were pre- and post- tests selected from the books published by the authorized centre of Cambridge. The results revealed that employing MALL enhanced listening skills of the Iranian intermediate EFL learners.

12. The study by Diab, A. A. M. in 2022. This quasi-experimental research examined the effectiveness of using the ubiquitous learning tools (Podcast and TED Talks) to develop listening comprehension and digital literacy skills among EFL prospective teachers. There were 74 participants who were third -year prospective teachers, aged 20- 22, enrolled in the English Section at the Faculty of education, Benha University. No information regarding their level of English was mentioned in the article. The participants were divided into control (N=35) group and experimental (N=37) group. The control group were taught without technology, while the experimental group accomplished a training based on the ubiquitous learning tools (Podcast and TED Talks) to develop their EFL listening comprehension and digital literacy skills. The data was collected using researcher-made pre- and post-tests and it was found that digital tools were effective.

13. The study by Khashan, H. S., and AbuSeileek, A. F. in 2023. The research investigated the effect of using BBC Learning English Application on developing 10th grade students' listening and speaking skills and their attitudes toward it. The quasi-experimental design including pre-post-test was used in the study, and the questionnaire was also applied to the experimental group to collect the qualitative data. The participants

of the study consisted of 46 students from the 10th grade students studying at Al-Mashari Secondary School for Boys at the Northern Valley Directorate of Education. The students were divided into two equal groups (N=23). The experimental group received lessons based on the British Council BBC Learning English application method for 8 weeks. The quantitative data was collected via researcher-made pre- and post-tests. The findings of this study, from empirical and theoretical point of view, suggested that the BBC Learning English application method was effective.

14. The study by Abbasian, G. R., and Movahedfar, S. in 2016. This study focused on the effect of MCALL on the listening comprehension of intermediate EFL learners. The participants included 30 Iranian male and female B1 level EFL students, aged 16-23. The control group (N=15) was taught in a traditional way, using the CD and activities in their course books. The experimental group (N=15) was taught listening with the help of an online English learning website called www.talk2meEnglish. The treatment lasted for 10 sessions. The data was collected using pre- and post-tests that were adapted from KET sample tests. The study proved that students using MCALL improved their listening abilities.

15. The study by El-Sayed, M. M., Qoura, A. A. S., and El-Hadidy, M. M. S. in 2017. The researchers looked into the effectiveness of a CALL program in developing listening and reading comprehension skills of first year secondary stage students. The current research adopted the quasi-experimental design. The participants included 60 first year general secondary stage students, aged 14 to 16, in a general secondary school for girls in Egypt. No information regarding students' level of English was provided. The experimental group (N=30) students were taught reading and listening using the CALL program, meanwhile the control group (N=30) students were taught according to the teaching procedures in the Teacher's Guide assigned by the Ministry of Education. Findings showed that digital tools improved listening comprehension and reading comprehension.

16. The study by Ayatfard, F. in 2021. This quasi-experimental study researched how effective using audio files on upper-intermediate learners' listening comprehension was. The participants included 80 B2 level EFL learners in Farhang Aria Language Institute in Shush, Khuzestan, Iran. The experimental group (N=40) attended 12 sessions in six weeks of intervention with the use of iPod audio files. The control group (N=40) received the

listening materials from their textbooks. Researcher prepared and applied two tests. The experimental group had better listening comprehension post-test results.

17. The study by Bouzidi, A. in 2021. This research investigated the effectiveness of MALL in developing listening and speaking skills of first year EFL degree students at Algiers 2 University, Algeria. To achieve the study aims, researchers chose quasi-experimental design for their aim. There were 78 C1 level 1st year EFL undergraduate students, aged 17 to 29, at Algiers 2 University. The control group (N=40) received content via traditional way of teaching, i.e. speaker and paper. Meanwhile, for the 12-week period, the experimental group (N=38) was exposed to the multimodal mobile-based treatment where the researcher provided students with authentic materials, such as TED Talks, through their mobile phones. The quantitative data was collected with the help of pre- and post- tests taken from Cambridge IELTS. Based on the findings, multimodal mobile-based teaching improved students' listening skill.

18. The study by Kazemnia, D. in 2022. This study looked into the effect of Quizizz Game-Based Learning (GBL) platform on listening performance and retention of Turkish EFL learners. A quasi-experimental research design was used with a control group for the pretest and posttest. The participants of the present study were 3rd grade primary students, aged 8 to 9, (n=44) in a private school in Istanbul-Turkey. No information related to their English level was provided in the thesis. The experimental group (N=22) used the Quizizz app for one full session per week over the course of six weeks. The control group (N=22) were exposed to new material through non-gamified methods. The quantitative data was collected through researcher-made pre- and post- tests. The results underscored the positive effect of Quizizz GBL platform in listening learning and retention.

19. The study by Bal, S. in 2019. The research scrutinized ICT tools and how they could help learners to improve their listening skills. The current study used a mixed-method approach with a quasi-experimental design. The participants included 50 B1 English level students, aged 19 to 21, at a state university in Turkey. One group was experimental (N=24). They did listening activities through usage of videos on Edpuzzle.com and Voscreen.com for one hour in a computer lab of the faculty. The control group (N=26) learned through the audios from their main course books and traditional tasks. There were two tests employed and they were taken from Cambridge Preliminary (PET)

examinations. The results showed that digital tools were effective and enhanced listening skills.

20. The study by Nozad, N. in 2022. This quasi-experimental study aimed to investigate the effect of authentic audiovisual materials on listening skills development and listening anxiety level of EFL students in grade 7. Participants of the study consisted of 88 students in grade 7 who were at level B1 of English proficiency and who studied at a private K12 school in Istanbul, Turkey. The experimental group (N=44) received an 8-week treatment which exposed the students to authentic TED Talks and TED-ED videos, while the control group (N=44) was following the routine syllabus using textbook-based materials designed for grade 7. Regarding the pre- and post- tests it should be noted that the researcher chose to use Cambridge PET tests without any adaptations. The results revealed that authentic audiovisual materials have an effective role in developing listening skills.

21. The study by Khodashenas, M. R., and Amouzegar, E. in 2013. The researchers tried to uncover the impact of CALL software on enhancing the listening comprehension abilities of intermediate EFL learners. Participants included 44 B1 EFL learners, aged 13 to 18, from a language school in Mashhad, Iran. The experimental group (N=22) received instruction on the listening skill using computer software, specifically the Rosetta Stone language learning software, while the comparison group (N=22) underwent traditional teaching methods as a placebo. Pre- and post- tests were conducted to collect data. The study's findings produced evidence that the utilization of CALL software has the potential to enhance learners' listening skills.

22. The study by. Jia, C., and Hew, K. F. T. in 2022. This quasi-experiment attempted to evaluate the effect a dictation program had on the development of listening skill. Specifically, a program was devised to incorporate WeChat, the widely used mobile instant messaging application in China, into dictation exercises. Participants, aged 18-20, consisted of students from two classes enrolled in a mandatory university EFL course. The experimental group (N= 37) and the control group (N=33) were selected from these classes. Both groups attended the same weekly in-class listening course, taught by the same instructor, where traditional listening exercises were supplemented with explicit decoding instructions. Members of the EG engaged in daily dictation within a WeChat group comprising 8–10 students, while the CG practiced individually. A listening test was

conducted as both a pre-test and a post-test, and the EG's perceptions of the WeChat dictation program were collected through an open-question survey. The outcomes revealed that the EG demonstrated a significantly greater improvement in listening skills compared to the CG.

23. The study by Yang, C. T. Y., Lai, S. L., and Chen, H. H. J. in 2022. This study aimed at looking at the effect of intelligent personal assistants on EFL learners' listening proficiency. In this investigation, 34 EFL learners, aged (18-21), at the college level were enlisted to utilize IPA within their individual home settings, with subsequent evaluation of their progress in listening and speaking skills. On a weekly basis, participants were provided with emails introducing new commands for them to explore using GA. Notably, half of the participants received additional sustained guidance from a teacher, involving the provision of weekly evaluation forms. The results showed no improvement of listening skills.

24. The study by Hwang, W. Y., Shih, T. K., Ma, Z. H., Shadiev, R., and Chen, S. Y. in 2016. The researchers explored the effect mobile-or game-based learning activities had on EFL learners' listening and speaking skills. A total of 40 students from a senior high school were randomly chosen for the study. No information regarding students' age or level of English was provided by the authors. Both groups received the same learning content during the classes. However, the experimental group (N=20) had to complete extra learning activities that were based on mobile app. Contrastingly, the control group (N=20) practiced English by using paper and pen method. Pre- and post- tests were used to collect data. According to the findings, students benefited from mobile apps in their speaking post-test.

4.1.1 Digital tools: listening

The first research question asked to find the types of digital tools that were used in order to improve listening skill of EFL learners. Table 7 represents the types of digital tools that were chosen in each study to improve EFL learners' listening skill.

Table 7. The Types of Digital Tools Used for Treatments: listening

Type of tool	*Name of tool*	*Study*																							*Total*	
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*Tool*	*Type*
Video-based materials	Youtube	x																								1	5
	TED Talks												x					x			x					3	
	TED-ED videos																				x					1	
Audio-based tools	Podcasts					x							x													2	5
	iPod audio files																x									1	
	Intelligent personal assistant (IPA)		x																					x		2	
EFL-focused tools	Two Minute English				x																					1	
	Learning English BBC News				x																					1	
	BC Learning English BBC app													x												1	
	The Four Corners One						x																			1	

	software																										10
	Miracle English										x															1	
	Rosetta Stone software																				x					1	
	Voscreen	x																	x							2	
	Lyrics Training	x																								1	
	Talk2Me English													x												1	
Education-focused tools	Google Classroom			x																						1	4
	Google Docs				x																					1	
	Edpuzzle																		x							1	
	Quizizz																	x								1	
Teaching	CALL									x					x											2	3

approaches	Digital storytelling							x																			1	
Researcher-developed tools	Android app								x																		1	
	Game-based, context-situated learning mobile system																									x	1	2
Messaging apps	Telegram										x																1	2
	WeChat																							x			1	

Table 7 illustrates various digital tools utilized to improve listening skills in EFL learners. EFL-focused tools such as British Council Learning English apps, Miracle English and others were of choice by most researchers. Video-based tools such as TED Talks and Youtube emerge as a prominent resource, employed by multiple studies, showcasing its significance in enhancing listening proficiency. Additionally, audio-based materials like podcasts, iPod audios, and IPA (Intelligent Personal Assistant) are noteworthy tools, emphasizing their effectiveness in the language learning context. Moreover, the diversity of tools like education-focused tools, i.e. Google Docs, messaging tools such as Telegram, and teaching approaches like digital storytelling underscores the multifaceted approach adopted in these studies. This diversity of digital tools reflects a strategic effort to cater to various learning preferences and styles, ultimately contributing to a more holistic development of EFL listening skills.

4.1.2 The results of meta-analysis: overall effect size on listening

It is essential to compute individual effect sizes prior to determining the overall impact of digital tools. To do so, Cohen's *d* was chosen as the measurement for the individual effect sizes. Figure 3 illustrates the results.

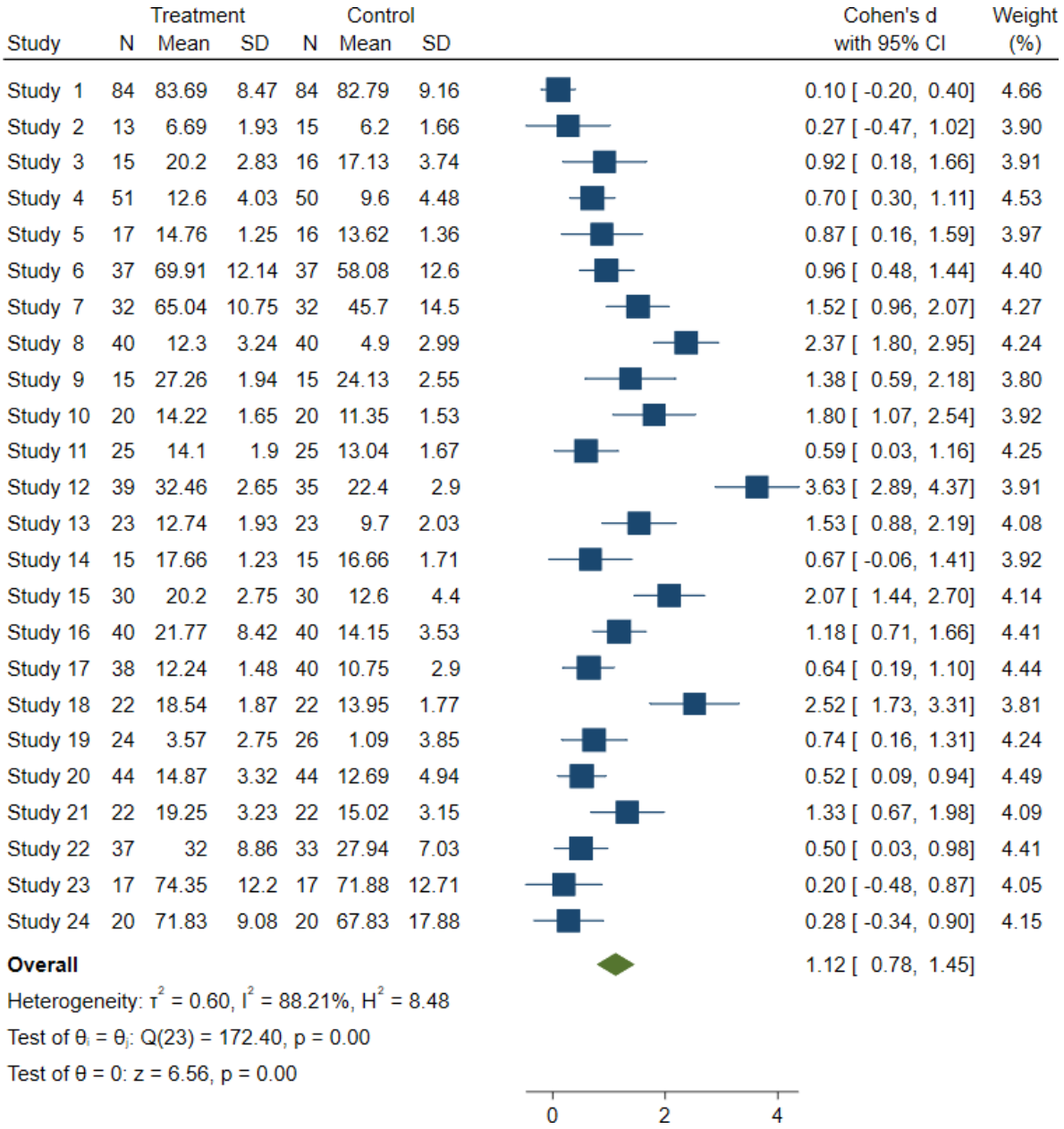


Figure 3. Random-Effects Model Result of Effect Sizes: listening

Based on Figure 3, each study demonstrates a positive impact of technology on listening skill development. However, variation in magnitude is also undeniable. In this case, 11 studies (46%) reported small or moderate 1effect size, ranging from .1 to .87, while most studies (54%) showed a large effect size of .92 and higher. The highest effect sizes were recorded in studies 12, 18, 8, and 15, where the overall effect size was determined to be 3.63, 2.52, 2.37, and 2.07, respectively. These results highlight how important digital tools are when improving listening skills.

Figure 3 also illustrates the results of the overall effect digital tools had on the development of listening skill. The collective evidence yields a theta of 1.118 (95% CI: 0.784 to 1.452), highlighting a substantial positive influence of digital tools on the enhancement of listening skills across diverse study contexts. The narrow confidence interval underscores the precision of this estimate. This substantial effect size signifies a significant difference in listening skill development between the groups exposed to digital tools and those without such exposure. These results not only highlight the effectiveness of digital tools in enhancing listening skills among EFL learners but also provide strong evidence of the positive impact they have on language acquisition.

The evaluation of heterogeneity aimed to measure the degree of variation in the outcomes across each study. Table 8 represents the results of heterogeneity tests.

Table 8. The Results of Heterogeneity Test: listening

Estimates	*Values*
Q	172.4
df(Q)	23
p-value	<0.0001
I-Squared	88.21

The results revealed significant variation in effect sizes across the included studies. Cochran's Q statistic, a measure of heterogeneity, was calculated and found to be Q = 172.4 with 23 degrees of freedom, resulting in a p-value of p = 0.000. The significant p-value (<0.05) proved that there was a substantial heterogeneity in the included studies, which meant that the differences in effect sizes were beyond what would be expected by chance alone. Furthermore, the I^2 statistic, which quantifies the proportion of total variation attributable to heterogeneity (Cooper, 2010), was computed and found to be I^2 = 88.21%. This indicates that approximately 88.21% of the variability in effect sizes is due to genuine heterogeneity rather than chance. Subsequentially, a random-effects model

to calculate the overall effect size. This approach is used when the settings, methods, and samples vary among the studies included in the meta-analysis (Pigott & Polanin, 2020). It takes into account both within-study and between-study variability and provides a more cautious calculation of the summary effect size, accommodating the diversity of the included studies.

4.1.3 The results of meta-regression: listening

The third research question dealt with the significance of the student-related factors, i.e. age and level of English, when using digital tools to develop listening skill. First, the issue of missing information was addressed. Regarding age moderator, 6 studies did not include information about the age of participants. As Pigott and Polanin (2020) suggested, an inference, based on other information presented in the article, can be made to count for the missing data. As the authors of research papers provided either grade level or school type, the missing information regarding the participants' age was filled in based on the average age of the mentioned grade level. This way, 2 studies, namely Study 9 and Study 16, were carried out in language schools; therefore, the average age of participants could not be determined. Lastly, the age was grouped as follows: 1=8-9 y.o, 2=11-17 y.o., 3=18-29 y.o., and the meta-analytical tests were performed (see Table 9).

Table 9. Meta-regression Results for Age Moderator: listening

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
-0.808	0.284	-2.84	0.005	-1.367 to -0.25	27.32	85.69

SE, standard error

The meta-regression analysis, represented in Table 9, reveals a statistically significant negative relationship between participant age and effect size, suggesting that, on average, as age increases, the observed effect size tends to decrease. The coefficient of -0.808 (p= 0.005) indicates a meaningful association. The overall model, encompassing age as a predictor, explains 27.32% of the variation in effect sizes (R^2 = 27.32%). This shows the relevance of age as a contributing factor. However, despite this age-related trend, a

substantial amount of residual heterogeneity remains (I^2 = 85.69%), indicating that other factors beyond age groups contribute to the observed variability in effect sizes.

To investigate any impact of students' level of English on the effectiveness of improving listening skills through the usage of digital tools, meta-regression analysis was caried out selecting the level of English as a moderator. Due to lack of information, only 14 articles were included in this meta-regression test. Table 10 illustrates the findings of this test.

Table 10. Meta-regression Results for Level of Proficiency Moderator: listening

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
0.001	0.117	0.01	*0.989*	*-0.2281 to 0.2313*	0.00	64.62

SE, standard error

Table 10 shows the non-significant coefficient for the proficiency level variable, accompanied by a p-value of 0.989. This indicates that variations in proficiency levels do not have a significant predictive influence on the observed effect sizes. The confidence interval, spanning from -0.2281 to 0.2313, demonstrates that the effect of the interventions remains relatively consistent across different educational levels. The overall model's R-squared of 0.00 suggests that proficiency level contributes minimally, if at all, to the variability in effect sizes. Despite the presence of residual heterogeneity across studies, the results collectively suggest that educational level is not a substantial moderator of the observed effects, emphasizing the robustness of the interventions in impacting listening skills irrespective of educational backgrounds.

4.1.4 Publication bias: listening

The potential reporting bias in smaller studies from this meta-analysis was researched by creating a funnel plot which illustrates the statistical significance of the effect estimates from each research paper. Figure 4 represents the findings.

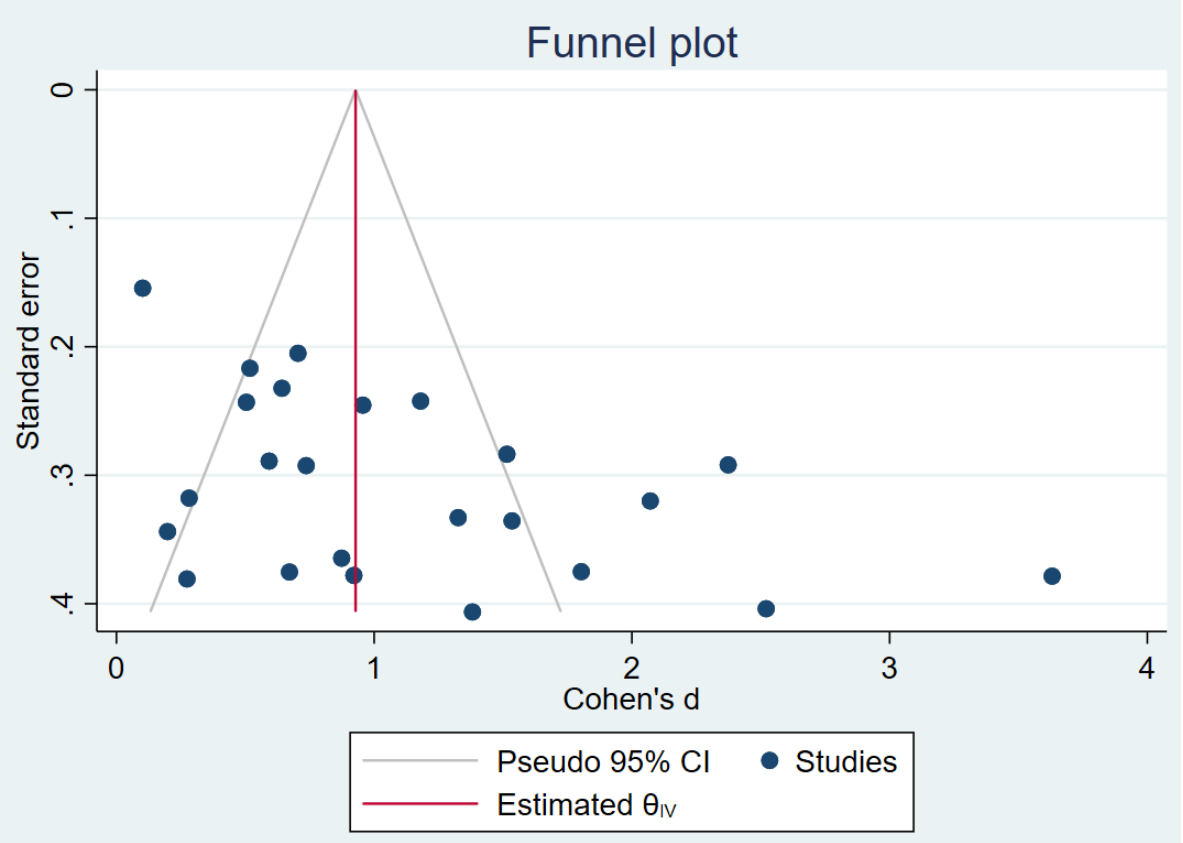


Figure 4. Funnel Plot for Publication Bias Assessment: listening

Figure 4 illustrates an asymmetrical funnel plot. It suggests that smaller studies emphasize the effect size of digital tools. To analyze whether this asymmetry can be explained due to other factors, the Trim and Fill test was conducted (see Table 11).

Table 11. The Result of Trim and Fill test: listening

Studies	*N*	*Cohen's d*	*95% CI*
Observed	24	1.118	0.784 to 1.452
Observed and Imputed	24	1.118	0.784 to 1.452

The analysis of trim-and-fill test, conducted with a nonparametric approach, aims to identify and adjust for potential missing studies that might skew the observed effect size. Notably, the results, represented in Table 11, indicate that the observed effect size of

Cohen's *d* (1.118, 95% CI: 0.784 to 1.452) remains unchanged after the trim-and-fill procedure. The overall effect size remains robust and not significantly influenced by potential publication bias. This stability lends credibility to the observed findings, indicating that digital tools have a positive effect on listening skill development. While acknowledging the inherent limitations of publication bias assessment methods, the trim-and-fill results contribute confidence to the validity of this meta-analysis conclusions.

4.1.5 The overall summary of findings: listening

The overall findings related to listening skills is represented in Table 12. To sum up, when it comes to types of interventions, video-based materials, among which TED Talks showed a particular popularity, as well EFL-focused tools, and audio-based materials were employed most often. The high variability among treatment types suggests that researchers try to cater to the specific context. The high overall effect suggested that digital tools are crucial in developing EFL listening skill in the modern world. Also, age was reported as a significant factor since higher effects were observed among younger learners. On the other hand, level of English proficiency is an insignificant moderator. In other words, digital tools benefit EFL learners regardless of their proficiency level. There was high heterogeneity among the articles; thus, the random-effects size model was employed in the data analysis. Lastly, the funnel plot as well as trim-and-fill tests were conducted to find any potential effect publication bias might have in this meta-analysis. Based on the findings, the effect size was not significantly influenced by publication bias; therefore, the overall effect size of digital tools on listening skill is reliable.

Table 12. The Summary of Findings: listening

Digital tool	*Description of the digital tool*	*Effect size*		*Moderator analysis*	
		Individual	*Overall*	*Age*	*Proficiency Level*
Podcasts and TED talks	Podcasts refer to a digital audio program. TED Talks refer to videos where presenters give speeches on different topics.	3.63	1.12	negative relationship (as age increases, the observed effect size tends to decrease)	no relationship
Quizizz app	Game-based learning app	2.52			
Researcher-developed Android application	Researcher-developed program that includes situations to develop word recognition, dialogues which developed the listening comprehension and long passages of listening to develop critical listening skills.	2.37			
CALL	General term to refer to the usage of computer technology in EFL education.	2.07; 1.38			
Telegram	Messaging app	1.8			
British Council BBC Learning English app	EFL-focused app that offers varied lessons and other activities.	1.53			

Digital storytelling	Researcher-made stories, using MS Power-Point that included visuals and audios.	1.52			
Rosetta Stone language learning software	EFL-focused software that uses images, text, and sound to teach words and structures by spaced repetition.	1.33			
iPod audio files from www.ipods.com	Authentic listening iPod audio files which were downloaded from www.ipods.com website.	1.18			
The Four Corners One program	EFL-focused software specifically designed to improve listening.	0.96			
Google Classroom App	A free blended learning app that helps educators manage classrooms.	0.92			
Podcast-based materials	Podcasts refer to a digital audio program.	0.87			
Edpuzzle and Vocscreen	Edpuzzle is an online tool that helps teachers and students create interactive online videos by adding questions, audio notes, tracks, or comments. Voscreen is an EFL-focused app where students can watch video clips.	0.74			

Two Minute English, Learning English BBC News, Google Docs, etc. via mobile phone	Two minute English is a website offering various EFL lessons. Learning English BBC News app is designed specifically for EFL-learners. Google Docs refers to an online word processor that allows people to work on a project simultaneously.	0.7			
Talk2me English	Online learning website containing various EFL-focused materials, including videos.	0.67			
TED Talks	TED Talks refer to videos where presenters give speeches on different topics.	0.64			
Miracle English	EFL-focused online platform where live lessons can be conducted.	0.59			
TED Talks and TED-ED videos	TED Talks refer to videos where presenters give speeches on different topics. TED-Ed videos refer to short video lessons, aimed at educators and learners.	0.52			

WeChat app	A Chinese-created instant messaging and social media app.	0.5			
Researcher-developed game-based and context- situated learning mobile system	The mobile system that included jigsaw game and interactive learning by cards.	0.28			
Intelligent personal assistant (IPA)	A software agent that can perform tasks or services when a person gives oral commands.	0.27; 0.2			
Web 2.0 tools: Youtube, Voscreen, Lyrics Training	Youtube is a free video sharing website. Voscreen is an EFL-focused app where students can watch video clips. Lyrics Training is a website where students can learn different languages by watching music videos and filling in the lyrics.	0.1			

4.2 Speaking Skill

Concerning speaking skills, a meta-analysis incorporated a total of 13 studies that satisfied the inclusion criteria. Table 13 provides a summary of these articles, encompassing details such as authors, paper titles, publication types and years, database sources, and participant numbers. Further elaborations on each article are provided later in this chapter.

Table 13. Classification of the Studies used for Meta-analysis: speaking

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Hwang, W. Y., Shih, T. K., Ma, Z. H., Shadiev, R., & Chen, S. Y.	Evaluating listening and speaking skills in a mobile game-based learning environment with situational contexts	Article	2016	ERIC
Sarhan, M. I. Y. A. F.	The effectiveness of using computer edutainment activities to develop preparatory stage pupils' EFL speaking skills	Article	2021	Google Scholar
Asratie, M. G., Wale, B. D., & Aylet, Y. T.	Effects of using educational technology tools to enhance EFL students' speaking performance	Article	2022	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Hanafiah, W., Aswad, M., Sahib, H., Yessi, A. H., & Mousavi, M. S.	Impact of CALL on vocabulary learning, speaking skill, and foreign language speaking anxiety: The case study of Indonesian EFL learners	Article	2022	Google Scholar
Bouzidi, A.	Integrating mobile-based activities in teaching listening and speaking skills to EFL degree students at Algiers 2 University: A multimodal approach	MA Thesis	2021	Google Scholar
Mehr, H. S., Zoghi, M, & Assadi, N.	Effects of synchronous computer-mediated communication and face to face interaction on speaking skill development of Iranian EFL learners	Article	2013	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Elghotmy, H. E. A.	Using Instagram and social media engagement techniques-based programme to develop pre-service teachers' EFL speaking skills and intercultural awareness	Article	2022	Google Scholar
Wei, Q., Siriyothin, P., & Lian, A. P.	Improving Chinese university EFL students' speaking skills through digital storytelling	Article	2018	Google Scholar
Khashan, H. S, & AbuSeileek, A. F.	The effect of using British Council Learning English application on the 10th grade EFL students' listening and speaking skills and their attitudes toward it	Article	2023	Google Scholar
Albahiri, M. H., & Alhaj, A. A. M.	Role of visual element in spoken English discourse: Implications for Youtube technology in EFL classrooms	Article	2019	Web of Science

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Dizon, G.	Evaluating intelligent personal assistants for L2 listening and speaking development	rticle	2020	Web of Science
Aliakbari, M., & Mardani, M.	Mobile-assisted language learning and its effects on learners' speaking development	Article	2022	Web of Science
Liu, M.	Changes in and effects of TED Talks on postgraduate students' English speaking performance and speaking anxiety	article	2021	Web of Science

The data in Table 13 reveals a diverse collection of research studies concentrating on the influence of technology and innovative approaches on the speaking skills. The publications cover a span of years, beginning with one article each in 2013, 2016, 2018, 2019, and 2020, followed by an increase to three articles in 2021. The year 2022 demonstrated heightened interest with five articles, while 2023 contributed one article. Regarding the sources of research materials, it is evident that 8 articles originated from Google Scholar, 4 from Web of Science, and 2 from ERIC.

Table 14. Characteristics of the Included Studies: speaking

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
1. Hwang, W. Y., Shih, T. K., Ma, Z. H., Shadiev, R., & Chen, S. Y., 2016	40	No information	No information	Researcher-developed game-based and context-situated learning mobile system	positive
2. Sarhan, M. I. Y. A. F.	60	13	No information	Computer edutainment activities	positive
3. Asratie, M. G., Wale, B. D., & Aylet, Y. T., 2022	82	No information	No information	Speaking digital tools: YouGlish, FORVO, Oxford Advanced Learning Dictionary 8th edition	positive
4. Hanafiah, W., Aswad, M., Sahib, H., Yessi, A. H., & Mousavi, M. S., 2022	103	20-23	B1	CALL (Skype)	positive
5. Bouzidi, A., 2021	78	17-29	C1	TED Talks via mobile phone	positive

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
6. Mehr, H. S., Zoghi, M, & Assadi, N., 2013	30	14-18	B1	ICQ (I seek you) software	positive
7. Elghotmy, H. E. A., 2022	40	No information	No information	Instagram	positive
8. Wei, Q., Siriyothin, P., & Lian, A. P., 2018	100	No information	No information	Digital storytelling	positive
9. Khashan, H. S, & AbuSeileek, A. F., 2023	46	No information	No information	British Council BBC Leaning English app	positive
10. Albahiri, M. H., & Alhaj, A. A. M.	96	No information	No information	Youtube	positive
11. Dizon, G., 2020	28	18-20	A1-B1	Intelligent personal assistant IPA	positive
12. Aliakbari, M., & Mardani, M.	60	18-24	A2	WhatsApp	positive
13. Liu, M.	322	22	C1	TED Talks	no effect

Table 14 presents a summary of key attributes identified in the included studies These characteristics include authorship and publication year, sample size, participants' age, English proficiency level, specifics of the treatment administered to the experimental group, and the overall observed effect. Noteworthy is the consistent participant count across all studies, with each featuring 28 or more participants. Around 46% of the research papers lacked information on participants' age, while the remaining 54% categorized them into two groups: teenagers (14-17 years old) and young adults (18-29 years old). Of these, 92% focused on young adults, and teenagers were the central focus in 8% of the studies. Concerning English proficiency levels, details were absent in 7 studies (54% of the papers), with the remaining 46% distributing subjects across A2 (15%), B1 (23%), and C1 (15%). Importantly, 12 experiments reported a positive effect resulting from the treatment, while 1 article reported no effect. The specific details of each research paper will be expounded upon subsequently.

1. The study by Hwang, W. Y., Shih, T. K., Ma, Z. H., Shadiev, R., and Chen, S. Y. in 2016. The article explored the effect mobile-or game-based learning activities had on EFL learners' listening and speaking skills. A total of 40 students from a senior high school were chosen for the study. No information regarding students' age or level of English was provided by the authors. Both groups received the same learning content during the classes. However, the experimental group (N=20) had to complete extra learning activities that were based on mobile app. Contrastingly, the control group (N=20) practiced English by using paper and pen method. The findings, based on the two administered tests, revealed that students benefited from mobile app in their speaking post-test.

2. The study by Sarhan, M. I. Y. A. F. in 2021. The primary aim of this quasi-experimental study was to describe how incorporating computer edutainment activities in enhancing the EFL speaking skills of preparatory stage pupils. The study involved 60 participants, aged 13, enrolled in the first year of the preparatory stage at El Boughdadi preparatory school, Egypt. The experimental group (N=30) received computer edutainment activities, and the control group (N=30) received regular lessons. The treatment included computer laboratory, where participants could watch videos, play games, and respond to puzzles. They were also able to learn new vocabulary items. There were pre- and post- EFL speaking tests. It was deduced that the integration of computer

edutainment activities improved speaking skills among the targeted sample.

3. The study by Asratie, M. G., Wale, B. D., and Aylet, Y. T. in 2022. Educational speaking technology, a digital proficiency employed to improve speaking proficiency, was the focal point of this study investigating the impact of specific tools—FORVO, YouGlish, and OALD 8th ed.—on EFL students' speaking performance. The research adopted a quasi-experimental design involving two groups, employing a pretest-posttest approach. Data were collected from 82 first-year Information Communication and Technology (IT) university students through a variety of instruments, including tests, questionnaires, interviews, and teacher logs, selected via comprehensive sampling. The experimental group (N=42) utilized educational speaking technology tools for learning, while the control group (N=40) followed conventional methods. Results of data analysis demonstrated a significant difference in speaking performance among the two groups, with learners utilizing educational speaking technology exhibiting enhanced fluency, coherence, accuracy, rich lexical resources, varied grammatical ranges, and improved pronunciation.

4. The study by Hanafiah, W., Aswad, M., Sahib, H., Yessi, A. H., and Mousavi, M. S. in 2022. This quasi-experimental research aimed to investigate the effects of CALL on the vocabulary learning, speaking skill, and speaking anxiety of Indonesian EFL learners. A total of 60 B1 EFL learners, aged 20 to 33, were chosen from English Language Institution in Indonesia. There were two groups, control (N=30) and experimental (N=30). Concerning the intervention, the experimental group participants were instructed in conversations and vocabularies from six lessons sourced from Family and Friends Book 6, employing CALL approach. During each online session, the experimental group received one conversation and new words via the Skype application. The participants were provided with audio files containing the conversation, along with meanings, synonyms, and pronunciations of the vocabularies, and were instructed to practice them. Conversely, the control did not have CALL-based instruction. Pre- and post- tests were chosen as data collection tools. The results demonstrated a positive influence of CALL- based instruction.

4. The study by Bouzidi, A. in 2021. The researcher inquired into the effectiveness of MALL in developing listening and speaking skills of first year EFL degree students at Algiers 2 University, Algeria. There were 78 C1 level 1st year EFL undergraduate students, aged 17 to 29, at Algiers 2 University were chosen to participate in the quasi-

experiment. There were two groups. The control group (N=40) received content via traditional way of teaching, i.e. speaker and paper. Meanwhile, for the 12-week period, the experimental group (N=38) was exposed to the multimodal mobile-based treatment where the researcher provided students with authentic materials, such as TED Talks, through their mobile phones. Through pre- and post- tests taken from Cambridge IELTS data was gathered. The results showed that multimodal mobile-based teaching improved students' speaking skill significantly.

5. The study by Mehr, H. S., Zoghi, M, and Assadi, N. in 2013. This quasi- experimental study aimed to compare the impacts of two instructional approaches: synchronous computer-mediated communication (SCMC) and face-to-face (FTF) interaction. A total of 60 B1 EFL learners, aged 14 to 18, were chosen from a private language institute in Iran. There were two equal groups (n=30). The experimental group used ICQ software which allowed them to see a split screen where a person can view their own and their partner's messages as each letter was typed. A speaking test, developed by Hughes (2003), served as the pretest, before the intervention, and later posttest. The results revealed that participants instructed using SCMC exhibited superior performance compared to those taught through FTF interaction.

6. The study by Elghotmy, H. E. A. in 2022. The researcher explored the impact of employing Instagram and social media engagement techniques on enhancing the speaking skills (accuracy, fluency, pronunciation, and presentation) of EFL students. The participants included 40 students from the Third year Faculty of Education at Shebin Elkom, Menoufia University, Egypt. There were two equal (N=20) groups. The control group had usual classes, while the experimental group used Instagram and social media engagement techniques. Researcher-developed pre-posttests were used to assess the speaking skills of EFL pre-service teachers. The results indicated that the use of a program based on Instagram and social media engagement techniques was effective in enhancing the speaking skills and intercultural awareness of EFL pre-service teachers.

7. The study by Wei, Q., Siriyothin, P., and Lian, A. P. in 2018. The authors described the potential improvement in the speaking skills of Chinese university EFL students through a 12-week digital storytelling (DST) intervention. The study encompassed a total

population of 100 English major undergraduates, divided into two intact classes of EFL students, each class consisting of 50 participants and taught by the same teacher. The experimental group engaged in the DST intervention, involving activities within and outside the classroom, while the control group had traditional whole-class instruction. As for pre- and post- tests, Test for English Majors-Band 4 Oral Test were used. DST was found to be an effective approach.

8. The study by Khashan, H. S, and AbuSeileek, A. F. in 2023. The authors assessed how utilizing the BBC Learning English Application would enhance listening and speaking skills, as well as the attitudes of 10th-grade students. The study involved 46 participants from the 10th grade at Al-Mashari Secondary School for Boys in the Northern Valley Directorate of Education, Jordan. No information related to participants' age 4or level of English was provided in the article. These students were divided into two sections, with the experimental group (N=23) exposed to the BBC Learning English Application, while the control group (N=23) received conventional instruction. It was quasi- experimental research with pre-post-test measures, and a questionnaire for the experimental group. Digital tools were found to be useful to develop EFL learners' speaking skills.

9. The study by Albahiri, M. H., and Alhaj, A. A. M. in 2019. This quasi-experimental study investigated how visual elements developed speaking skill. The participants included 96, 3rd year King Khalid University EFL students. No information was available regarding the participants' age or level of English. Two equal groups (N=48) were in the experiment. While the first group received classes based on conventional method, the experimental group was taught through Youtube videos. The data was collected through two tests which were created by the researcher and given to the participants before and after the experiment. Students' speaking skills were particularly enhanced when Youtube was used for their instruction.

10. Study by Dizon, G. in 2020. This study examined the in-class use of the intelligent personal assistant (IPA), Alexa, among second language (L2) English students to develop listening and speaking skills. It was a mixed-methods research with a quasi-experimental two-group design. Pre- and post- speaking tests that were developed by Payne and Whitney (2002) were applied to gather quantitative data. The participants included 28

first and second year EFL students aged 18 to 20 at a Japanese university. They were a mixed-ability group, ranging from A1 to B2 levels. The experimental group (N=13) took part in a 10-week treatment of individual or dyadic student-IPA interaction during the lesson time and a control group (N=15) did not. Alexa was useful when enhancing speaking skills.

11. The study by Aliakbari, M., and Mardani, M. in 2022. This study assessed the effects of mobile learning classes on the EFL learners' speaking skills and the motivation students felt when engaging in class discussions. The satisfaction level of students with this approach was also explored. Sixty students, aged 18 to 24, from Kish Institute in Ilam, Iran, were purposively sampled and divided into two comparable groups. Control group (N=30) attended traditional face-to-face classes, while the experimental group (N=30) participated in mobile learning classes using WhatsApp. Two Preliminary English Tests (PET) designed by Quintana were chosen as pre- and post- tests were administered to both groups to measure the impact of mobile learning. Based on the findings, the students in the mobile learning classes exhibited better performance compared to those in face-to-face classes.

12. The study by Liu, M. in 2021. This research investigation examined the impact of TED Talks on the English-speaking performance and speaking anxiety of Chinese postgraduate students. A total of 166 students in the experimental group, exposed to TED Talks, and 156 in the control group, using conventional methods, participated in the quasi-experiment. Students delivered eight-minute oral presentations which were assessed and used as pre- and post- tests. TED Talks proved to be an important tool for speaking skills development.

4.2.1 Digital tools: speaking

The primary research question sought to identify the approaches utilized with digital tools to enhance the speaking abilities of learners studying EFL. Table 15 presents what specific digital tools were chosen in each study.

Table 15. The Types of Digital Tools used for Treatments: speaking

Type of tool	*Name of tool*	*Study*													*Total*	
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*Tool*	*Type*
Education-focused tools	Game-based app	x													1	3
	Edutainment activities		x												1	
	Online dictionary			x											1	
EFL-focused tools	YouGlish			x											1	3
	FORVO			x											1	
	British Council BBC Leaning English app									x					1	
Video-based tools	Youtube										x				1	3
	TED Talks					x								x	2	
Social media	Instagram							x							1	1
Teaching approaches	Digital storytelling								x						1	1
Audio-based tools	IPA											x			1	1
Messaging tools	I seek you						x								1	3
	Skype				x										1	
	WhatsApp												x		1	

Table 15 outlines the utilization of various digital tools across 13 studies aimed at enhancing the speaking skills of EFL. The diverse array of digital tools employed in the studies within the meta-analysis reflects a comprehensive approach to enhancing the speaking skills of EFL students. These tools, ranging from game-based apps and edutainment activities to YouGlish, FORVO, online dictionaries, Skype, TED Talks, I seek you, Instagram, digital storytelling, the British Council BBC Learning English app, YouTube, IPA (Intelligent Personal Assistant), and WhatsApp, showcase the versatility of technology in language learning. The utilization of game-based apps and edutainment activities underscores the potential for interactive and engaging platforms, while pronunciation-focused tools like YouGlish and FORVO address specific linguistic challenges. Video platforms such as Skype and TED Talks provide opportunities for real-time communication and exposure to authentic language use. Social media platforms like Instagram contribute to developing intercultural awareness and communication skills. Digital storytelling and educational apps offer creative and interactive methods for language acquisition. This diverse toolset demonstrates the multifaceted role of technology in supporting EFL students' speaking development, catering to various aspects of language proficiency and fostering an enriched learning experience.

4.2.2 The results of meta-analysis: overall effect size on speaking

It is essential to compute individual effect sizes before evaluating the overall impact of technology on the advancement of speaking skills, with Cohen's *d* chosen as the measurement metric (see Figure 5).

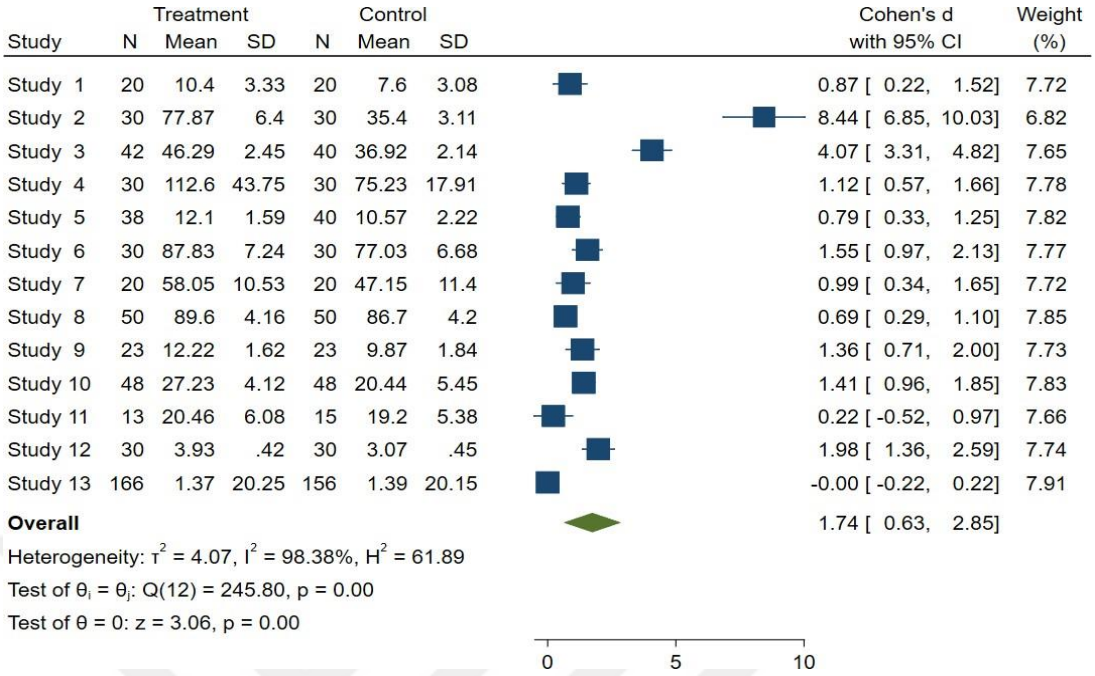


Figure 5. Random-Effects Model Result of Effect Sizes: speaking

As presented in Figure 5, nearly all studies, except one, demonstrate a positive influence of technology on enhancing speaking skills. However, there is noticeable variability in the degree of this impact. Study 13, notably, indicates no effect of technology with a Cohen's *d* of -0.00. Additionally, Study 11 reports a small positive effect of technology on speaking with Cohen's *d* of 0.22. Likewise, 15% of the studies, including Study 2, reveal medium positive effect sizes at 0.69 and 0.79. Moreover, substantial effect sizes exceeding 0.8 were observed in the remaining studies, constituting 23% of the total, with significant positive effects (8.44, 4.07, 1.98). These findings suggest a noteworthy enhancement in speaking skills among the studied populations, emphasizing the diverse impacts of technology across the individual studies.

Furthermore, Figure 5 also represents the result of the overall effect that digital tools had on the development of speaking skill. This meta-analysis of 13 studies scrutinized the impact digital technology had on the speaking skill of EFL students and uncovered a substantial overall effect size (theta) of 1.74, with a 95% confidence interval ranging from

0.63 to 2.85. The effect size, theta, reflects the magnitude of improvement in EFL speaking skills resulting from various interventions. The positive theta value indicates that, on average, the interventions had a notable and beneficial effect on enhancing

speaking proficiency. This finding is statistically significant, as evidenced by the z-test result of 3.06 ($p = 0.00$), supporting the conclusion that the overall impact is not due to random chance. While the studies exhibited considerable heterogeneity, the collective evidence suggests a consistent and positive influence on EFL speaking development, emphasizing the efficacy of the interventions employed in the analyzed research.

Table 16 represents the results of the heterogeneity test. The meta-analysis reveals substantial heterogeneity, as indicated by the I-squared statistic and Q-statistic. The I-squared value of 98.38% signifies a high degree of variability in effect sizes across the studies, suggesting diverse outcomes in the enhancement of speaking skills. The Q-statistic, with a significant value of 245.80 ($p < 0.0001$), further supports the presence of heterogeneity, showing how different interventions affected EFL learners. This considerable heterogeneity emphasize how a careful interpretation of the overall effect size is crucial.

Table 16. The Results of Heterogeneity Test: speaking

Estimates	*Values*
Q	245.8
df(Q)	12
p-value	<0.0001
I-Squared	98.38

4.2.3 The results of meta-regression: speaking

To investigate potential explanations for the observed heterogeneity, student-related variables, specifically age and level of English, were selected as moderators in the meta-regression analysis. The initial focus was on examining the impact of participants' age. To address missing data, a value was imputed through inference, following the approach recommended by Pigott and Polanin (2020). This inference was based on the authors' contextual explanation of the study, which included details about the type of school and participants' grade levels. Subsequently, participants were categorized into two groups:

Group 1 representing ages 12 to 17, and Group 2 representing ages 18 to 35, based on the age brackets provided by the authors. The outcomes of the meta-regression analysis are presented in Table 17.

Table 17. Meta-regression Results for Age Moderator: speaking

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
-1.639	1.209	-1.36	0.175	-4.01 to 0.731	4.84	98.31

SE, standard error

The potential moderating effect of age group was investigated through meta-regression analysis. Based on Table 17, the coefficient for age moderator is -1.639585, suggesting a negative relationship, but this coefficient is not statistically significant with a p-value of 0.175. The results indicate that age group does not play a significant role contributing to the observed heterogeneity in effect sizes. The residual heterogeneity remains high, with an I-Squared percentage of 98.31%, indicating substantial variability in effect sizes not explained by age group. The R-squared value of 4.84% suggests that only a small number of the heterogeneity is accounted for by age group. Overall, the meta-regression suggests that age does not significantly moderate the impact of interventions on speaking skills across the diverse studies included in the analysis.

To investigate the effect that level of English may have on the relationship between the usage of digital tools and improvement of speaking skills, meta-regression was carried out with Level of English as a moderator. Only 5 studies included the necessary information, therefore, they were investigated in this step. The level of English was determined as follows: 1=A1; 2=A2; 2=B1; 4=B4; 5=C1; 6=C2 levels. Table 18 illustrates the results.

Table 18. Meta-regression Results for Level of Proficiency Moderator: speaking

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
-0.853	0.258	-3.30	0.001	-1.359 to -0.347	77.36	69.1

SE, standard error

The meta-regression analysis investigated how the level of English moderated the overall effect sizes (Cohen's *d*) across the five studies since the remaining 8 studies did not provide information about the participants' level of proficiency. Based on Table 18, the results reveal that level of English is a significant moderator for the observed heterogeneity in effect sizes with a p-value of 0.001. The coefficient for level of English is -0.853, signifying a negative relationship. This indicates that the level of English proficiency moderates the impact of interventions on speaking skills, with lower proficiency associated with larger effect sizes. The residual heterogeneity remains present, with an I-Squared percentage of 69.10%, indicating some unexplained variability. The R-squared value of 77.36% implies that a substantial proportion of the overall heterogeneity is accounted for by level of English. In summary, the meta-regression shows that the level of English proficiency significantly moderates the impact of interventions on speaking skills, with lower proficiency associated with larger effect sizes.

4.2.4 Publication bias: speaking

The results of the meta-analysis could be affected by potential publication bias, emphasizing the importance of conducting tests to evaluate such bias. The findings of studies pertaining to speaking in the meta-analysis are detailed in Figure 6.

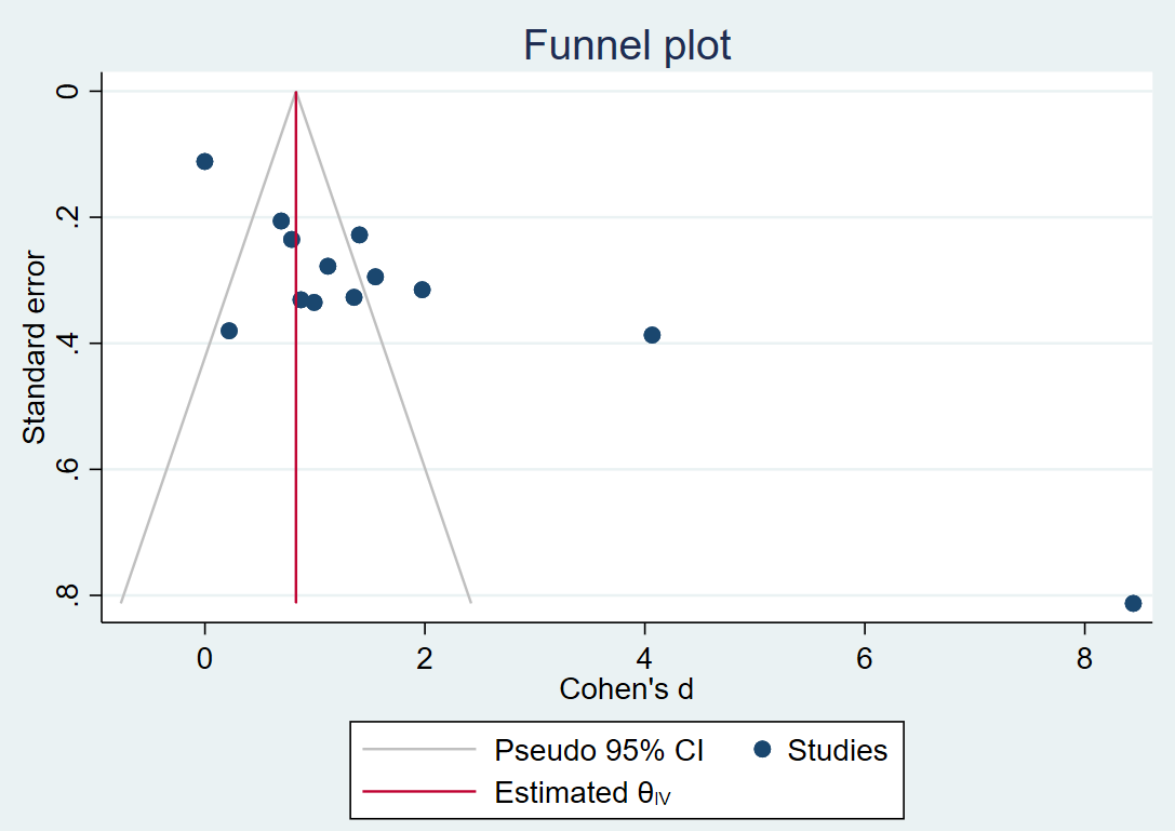


Figure 6. Funnel Plot for Publication Bias Assessment: speaking

As demonstrated by Figure 6, the funnel plot displays an asymmetrical pattern. Based on the Figure 6, an asymmetry in the funnel plot exists which illustrates the potential existence of publication bias or other sources of bias. This asymmetry indicates that smaller studies with less precise estimates may be inclined to report more extreme effect sizes. Caution is warranted in interpreting this asymmetry. To delve deeper into these results, a Trim and Fill test was performed, and the outcomes are detailed in Table 19.

Table 19. The Result of Trim and Fill Test: speaking

Studies	*N*	*Cohen's d*	*95% CI*
Observed	13	1.738	0.626 to 2.852
Observed and Imputed	13	1.739	0.626 to 2.852

Table 19 illustrates Trim and Fill analysis which was performed to assess and adjust for potential publication bias. This meta trim-and-fill analysis did not result in the imputation of any studies. The observed meta-analysis, encompassing data from 13 studies and employing a random-effects model, revealed a Cohen's d effect size of 1.739, with a 95% confidence interval ranging from 0.626 to 2.852. The lack of imputed studies indicates that, in this analysis, the observed effect size remains unchanged even after considering potential publication bias through the trim-and-fill method. While this finding suggests stability in the observed effect size, researchers should exercise caution when interpreting the findings of this research.

4.2.5 The summary of findings: speaking

The overall finding related to speaking skills are shown in Table 20. Shortly, researchers utilized a variety of digital tools to enhance the speaking skills of learners, with EFL-focused tools as the most widely used intervention. The overall impact was determined to be highly significant, emphasizing the crucial role of digital tools in the improvement of EFL speaking skills. Meta-regression analysis revealed that, while age did not significantly affect the development of speaking skills, proficiency level emerged as a significant factor. This suggests that learners with lower proficiency levels may derive greater benefits from digital tools. The test of heterogeneity underscored substantial diversity among the included articles, leading to the adoption of a random-effects size model for data analysis. Finally, both the funnel plot and trim-and-fill tests were employed to evaluate potential publication bias. Based on the results, publication did not have a significant impact on the effect size, ensuring the reliability of the overall impact of digital tools on speaking skills.

Table 20. The Summary of Findings: speaking

Digital tool	*Description of the digital tool*	*Effect size*		*Moderator analysis*	
		Individual	*Overall*	*Age*	*Proficiency Level*
Computer edutainment activities	A video game package that allowed students to learn while playing and develop their communicative abilities.	8.44	1.74	no relationship	negative relationship (learners with lower proficiency levels may have greater benefits from digital tools)
YouGlish, FORVO, Oxford Advanced Learning Dictionary 8th edition	YouGlish is an online tool that helps learners access authentic videos and improve their pronunciation in different languages. Forvo is a website that allows access to and playback of pronunciation clips. Oxford Advanced Learning Dictionary 8th edition is an online dictionary.	4.07			
WhatsApp	Instant messaging app	1.98			
ICQ (I seek you) software	A chat program	1.55			
Youtube	Youtube is a free video sharing website.	1.41			
British Council BBC Leaning English app	EFL-focused app that offers varied lessons and other activities.	1.36			

Skype	An app that allows videoconferencing and video calls.	1.12			
Instagram	A video and photo sharing social networking site.	0.99			
Researcher-developed game-based and context-situated learning mobile system	The mobile system that included jigsaw game and interactive learning by cards.	0.87			
TED Talks	TED Talks refer to videos where presenters give speeches on different topics.	0.79; 0.00			
Digital storytelling	Learners created their own digital stories.	0.69			
Intelligent personal assistant (IPA)	A software agent that can perform tasks or services when a person gives oral commands.	0.22			

4.3 Reading Skill

Related to reading skill, a total of 11 studies, meeting the inclusion criteria, were included in the data analysis. The summary of these articles, including the authors, titles of the papers, types and years of publications, the database source and the number of the participants are presented in Table 21. The detailed descriptions of each article are presented later in this chapter.

Table 21. Classification of the Studies Used for Meta-analysis: reading

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Akyıldız, S. T., & Çelik, V.	Using WhatsApp to support EFL reading comprehension skills with Turkish early secondary learners	Article	2022	ERIC
Taj, I. H., Ali, F., Sipra, M. A., & Ahmad, W.	The effect of technology enhanced language learning on EFL reading comprehension at tertiary level	Article	2017	Google Scholar
Naderi, S., & Akrami, A.	EFL learners' reading comprehension development through MALL: Telegram groups in focus	Article	2017	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Khubyari, L., & Narafshan, M. H.	A study on the impact of MALL (Mobile Assisted Language Learning) on EFL learners' reading comprehension	Article	2016	Google Scholar
Saqr, A. K.	The effect of digital reading on EFL learners' reading comprehension	Article	2021	Google Scholar
Yaghoobi, M., & Razmjoo, S. A.	The potentiality of computer-assisted instruction towards ameliorating Iranian EFL learners' reading level	Article	2013	Google Scholar
Sidabutar, M. N. A., Sayed, B. T., İsmail, S. M., Quispe, J. T., Vincente, J. S. Y., Wekke, I. S., Shanan, A. J., & Nourabadi, S.	Reading digital texts vs. reading printed texts: Which one is more effective in Iranian EFL context?	Article	2022	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Kim, N. Y.	Effects of reading aloud tasks through a mobile phone on EFL vocabulary and reading comprehension skills	Article	2018	Google Scholar
Adel, S. M. R., Davoudi, M., & Pourfarhad	Enhancing reading comprehension and motivation by using a mode of multimedia (CALL) on post intermediate EFL learners	Article	2014	Google Scholar
Shafiee, S., Akbari, S., & Hajijali, M.	Comparing the impact of CALL-based versus non-CALL-based methods of instruction on reading comprehension among Iranian upper-intermediate EFL learners	Article	2019	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Ekinci, E.	The use of video materials in EFL learners' reading comprehension	MA Thesis	2020	National Thesis Center of the Council of Higher Education

Table 21 demonstrates that 10 of the included research papers were published articles, amounting to 90% of all studies included. There was only 1 other study that was MA thesis. Also, 50% or a half of all studies were published in years 2020-2022, while the other papers were published between years 2013-2019. When it comes to database sources, most of the studies (81%) were found in Google Scholar, while ERIC and National Thesis Center of the Council of Higher Education provided a paper each.

Table 22. Characteristics of the Included Studies: reading

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
1. Akyıldız, S. T., & Çelik, V., 2022	54	11-12	A2	WhatsApp	positive
2. Taj, I. H., Ali, F., Sipra, M. A., & Ahmad, W., 2017	122	19-22	No information	CALL and MALL	positive
3. Naderi, S., & Akrami, A., 2017	103	19-46	B1	Telegram	positive
4. Khubyari, L., & Narafshan, M. H., 2016	40	15-20	B1	MALL	positive
5. Saqr, A. K., 2021	32	15-16	No information	Digital reading	positive
6. Yaghoobi, M., & Razmjoo, S. A., 2013	50	22-24	No information	CAI	positive

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
7. Sidabutar, M. N. A., Sayed, B. T., İsmail, S. M., Quispe, J. T., Vincente, J. S. Y., Wekke, I. S., Shanan, A. J., & Nourabadi, S., 2022	60	21-35	B1	Digital reading	positive
8. Kim, N. Y., 2018	70	19-22	B1	Reading aloud tasks via mobile phone	positive
9. Adel, S. M. R., Davoudi, M., & Pourfarhad, 2014	40	19-25	B2	CALL (computer assisted reading)	positive
10. Shafiee, S., Akbari, S., & Hajijali, M., 2019	52	17-20	B2	CALL	positive
11. Ekinci, E.	41	18-20	A2	Video integrated reading	positive

Table 22 outlines key characteristics of studies included in a meta-analysis focused on enhancing reading skills among EFL learners. Each study, identified by the author(s) and publication year, includes details such as sample size, participant age, English proficiency

level, type of treatment applied, and the reported effect. The studies encompass a variety of age groups, with only one study investigating young teenagers, aged 11 to 12, and one study with the participants age of 15 to 16 y.o. A high concentration of articles, specifically, 9 out of 11 papers or 81%, focused on late teenagers and young adults. English proficiency levels ranged from A2 (2 articles or 18%), B1 (4 articles or 36%), B2 (2 articles or 18%), and 3 articles or 28% did not provide any related information. The treatments vary widely, incorporating tools like WhatsApp, CALL, MALL, digital reading, and video-integrated reading. Encouragingly, all eleven studies report a positive effect following the respective treatments, emphasizing the potential effectiveness of these diverse interventions in enhancing the reading skills of EFL learners. Further exploration into the methodologies and outcomes of each study will provide a detailed understanding of how these digital tools are used for enhancement of reading proficiency.

1. The study by Akyıldız, S. T., and Çelik, V. in 2022. Reading tasks delivered through WhatsApp were used to improve students' achievements in English reading comprehension and students' views on the process was discussed. To do that, the research employed explanatory sequential design, a mixed-method approach. Quantitative data was derived from a pre-post test results, which aligned with quasi-experimental design. A total of 54 7th grade students, aged 11-12, from a state school in Turkey participated in the study. Their English level was A2. There were two groups with equal numbers of students (N=27). Over 8 weeks of treatment, the experimental group received two reading texts and related questions were sent to individual WhatsApp accounts of each participant twice a week. Sometimes, lyrics were chosen as a type of reading text and related MP3 audio files were provided. Due to lack of motivation, the researcher adopted a ranking scheme where the top three participants would be announced weekly. Meanwhile, control group was taught traditionally. Based on the results, experimental group had higher scores.

2. The study by Taj, I. H., Ali, F., Sipra, M. A., and Ahmad, W. in 2017. This quasi-experimental study attempted to examine the effects of using CALL and MALL on EFL reding comprehension at tertiary level. The participants included 122 mixed-ability students, aged 19-22, from a public university in the Kingdom of Saudi Arabia. No information specifying their English level was provided. The first group, namely, control (N=61), received traditional reading lessons, and experimental (N=61) were taught using CALL and MALL. The treatment included pre-teaching of target vocabulary items

through WhatsApp application and going to language laboratory where they could use glossed vocabulary cards and complete reading activities. The data was collected through researcher-made pre- and post- tests. CALL and MALL approaches were found to be useful when trying to enhance students' reading skills.

3. The study by Naderi, S., and Akrami, A. in 2017. The researchers looked into the effect of instruction through Telegram application groups on the EFL learners' reading comprehension. The study employed quasi-experimental research design. A total of 103 participants, aged 19 to 46, attended the research. They were students at a university in Iran and their English level was intermediate. The control group consisted of 48 participants and received traditional reading comprehension instruction. Meanwhile, the experimental group used Telegram groups for a total of 14 sessions. The treatment included receiving target vocabulary, pre-reading questions, reading passages, comprehension activities and discussions of individual challenges students faced. All of these steps were done via Telegram app where students shared all the answers and personal experience with others as well as their instructor. The data was collected via researcher-made reading comprehension pre- and post- tests. Telegram was found to be an important digital tool that affected the reading skills positively.

4. The study by Khubyari, L., and Narafshan, M. H. in 2016. This study detailed, how MALL affected EFL learners' reading comprehension. To do that, 40 B1 EFL learners, aged 15-20, from an English Language institute in Iran were the participants of the study. There were two groups in the experiment. Both groups received traditional in-class instruction. However, as follow-up activities outside the classroom, the control group (N=20) received paper and pencil activities, while the experimental group (N=20) received such materials through mobile phones. The data was collected through a reading comprehension pre and posttests which were extracted from EnglishForEveryone.org graded English Worksheets. The results showed a positive impact of the treatment.

5. The study by Saqr, A. K. in 2021. The study investigated the impact of digital reading on the EFL learners' reading comprehension. There were 32 participants who studied at the Al Mafraq First Basic School for Boys in Jordon. There was no information provided related to the participants level of English. The control group (N=16) had their usual instruction, but the experimental group (N=16) used digital reading. As the author

noticed, not all on-screen texts were considered digital reading. Instead, the students in the experimental group received only texts that incorporated various modalities as well as hyperlinks. The treatment lasted for a period of 2 weeks. The researcher developed and administered pre- and post- tests for the collection of data. The findings revealed that digital reading had a significantly positive impact.

6. The study by Yaghoobi, M., and Razmjoo, S. A. in 2013. This study attempted to reveal the potential effect of computer-assisted instruction (CAI) on Iranian EFL learners' reading achievement. A total of 50 EFL learners enrolled in a language institute in Iran were selected as participants. The experimental group (N=25) were taught using CAI, while the control group (N=25) was taught the same materials traditionally in the classroom. The researchers created and used two tests to check the progress of the two groups. The results revealed that CAI affect the development of EFL learners' reading skills positively.

7. The study by Sidabutar, M. N. A., Sayed, B. T., İsmail, S. M., Quispe, J. T., Vincente, J. S. Y., Wekke, I. S., Shanan, A. J., and Nourabadi, S. in 2022. The study investigated the effect od reading digital texts vs. reading printed texts on developing Iranian B1 EFL learners' reading comprehension. The participants included 60 B1 level EFL learners, aged 21-35, in Iran. They were divided into control group (N=30), which received instruction using printed texts, and experimental group (N=30), which was taught using digital texts. Pre- and post- tests, prepared by the authors, were used to collect the data and the analysis revealed the positive effect of the treatment.

8. The study by Kim, N. Y. in 2018. The study explored the effect of reading aloud tasks through a mobile phone with a focus on EFL learners' vocabulary and reading skills. There were 70 B1 level Korean college students, aged 19 to 22, who participated in this experiment. The control group (N=36) had to carry out traditional reading aloud tasks, while experimental group (N=34) used mobiles to achieve the tasks. Researchers gathered data by two tests that were prepared by themselves. The results confirmed that mobile assisted reading aloud tasks help students improve their reading comprehension skills.

9. The study by Adel, S. M. R., Davoudi, M., and Pourfarhad in 2014. The authors described the impact of CALL on Iranian EFL learners' reading comprehension and

motivation. The participants included in this study were 40 B2 level university students at Islamic Azad University of Tabris, Iran. There were two equal groups, namely, control, which was taught in a traditional classroom setting with paper based and printed text materials, and experimental, which used computers in the language lab. The pre- and post-tests were chosen from the course book's assessment test series, namely, Complete Assessment Package, Summit 1. There was a positive effect of CALL.

10. The study by Shafiee, S., Akbari, S., and Hajijali, M. in 2019. The study investigated the effect of CALL-based versus non-CALL based methods of instruction on Iranian B2 level EFL learners' reading comprehension. The participants included 52 upper intermediate EFL learners, aged 17-20, from a private English language institute in Isfahan, Iran. The control group (N=26) was instructed through the traditional paper and pen method, relying only on cassette player, pictures, and realia. In contrast, the experimental group (N=26) underwent a treatment that involved studying in a language lab and using AceReader software. This program had been developed specifically for improving reading skills. It includes reading assessment, fluency, speed reading, and vision training since there are rapid serial visual presentation and tachistoscopic scroll presentation modes that can be chosen by the user. Two ready-made reading comprehension tests applied to the participants. It was found that CALL materials helped the experimental group improve their reading comprehension and they scored statistically significantly higher than students in the control group.

11. The study by Ekinci, E. in 2020. This study attempted to reveal the effect of using video materials in EFL learners' reading comprehension. To do so, 41 A2 level students from a private university in Turkey were selected. There were two groups. The control group (N=21) received traditional instruction, while the experimental group (N=20) had video integrated reading activities, where students would be focusing on a particular reading strategy, such as questioning or prediction. Then, with the guidance of the teacher, pre-, while-, and post- activities would be carried out. The experimental group would usually watch the video and later be given the transcript of it or a related text to read. The duration of the experiment was 8 weeks. Pre- and post- tests, adopted from Preliminary English Tests (PET) of Cambridge English, were used as data collection tools. Video integrated reading had a positive effect of on the development of reading skills.

4.3.1 Digital tools: reading

The first research question asked to find the ways digital tools were used to improve reading skill of EFL learners. Table 23 represents the types of digital tools that were chosen in each study to improve EFL learners' reading skill.

Table 23. The types of Digital Tools Used for Treatments: reading

Type of tool	*Name of tool*	*Study*											*Total*	
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*Tool*	*Type*
Messaging tools	WhatsApp	x											1	2
	Telegram			x									1	
Teaching approaches	CALL/CAI		x				x			x	x		4	9
	MALL		x		x				x				3	
	Digital reading					x		x					2	
Video-based materials	Videos											x	1	1

Table 23 outlines the frequency of usage for various technology tools designed to enhance the reading skills of EFL learners. CALL/CAI was employed most often, with 4 studies, or 36% of all studies included in this section. Mobile-Assisted Language Learning (MALL) with continuous opportunities for improving learners' reading comprehension was utilized in 3 research papers, or 28% of all reading-related studies. Digital reading tools were employed in 2 studies, or 18% of reading-related studies. WhatsApp and Telegram emerge as regularly employed communication tools, facilitating ongoing discussions and exchanges related to reading materials. The videos were chosen for the treatments once. Overall, the table reflects the frequency in application of a diverse range of tools, all aimed at consistently advancing the reading proficiency of EFL learners.

4.3.2 The results of meta-analysis: overall effect size on reading

It is essential to compute individual effect sizes before gauging the overall impact of technology on the enhancement of reading skills. For this purpose, Cohen's d was selected

as the metric for individual effect sizes. Figure 7 showcase the results.

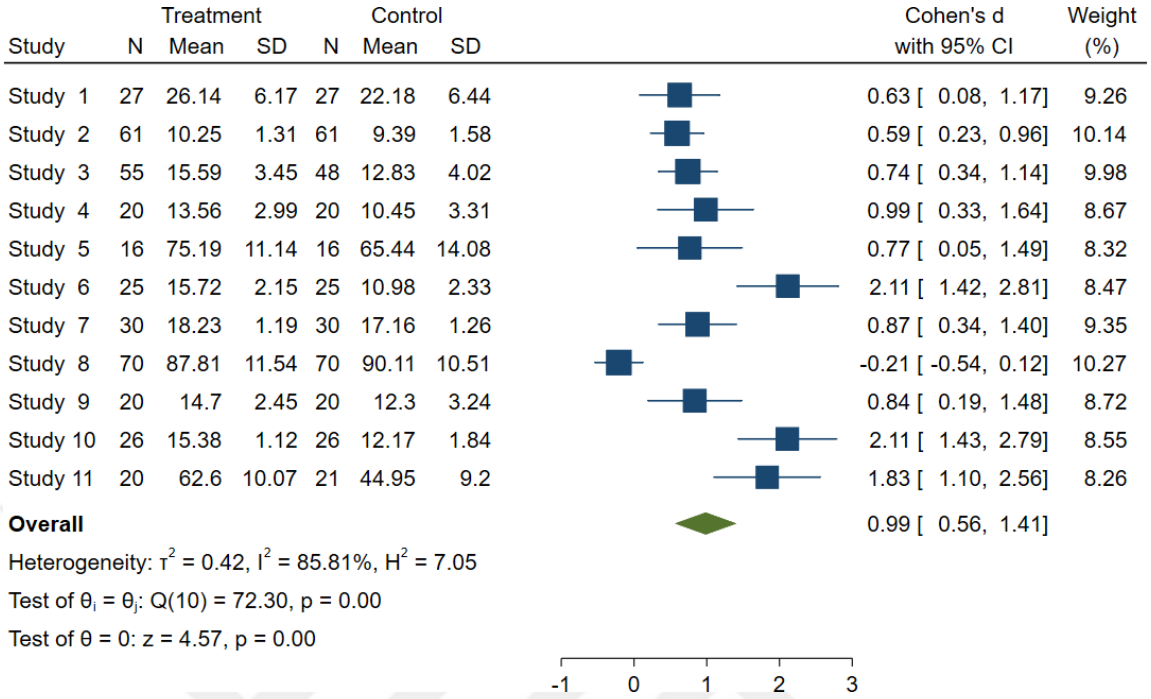


Figure 7. Random-Effects Model Result of Effect Sizes: reading

As depicted in Figure 7, most studies or 91% indicate a favorable influence of technology on the development of reading skills. Nevertheless, the degrees of impact vary. Most notably, Study 8 reports a small negative effect technology had on reading, i.e., Cohen's d equaled to -.21, which might suggest that mobile phones are not particularly useful in reading aloud tasks. Otherwise, 4 other studies or 36% suggest medium positive effect sizes, ranging from .59 to .77. Moreover, large effect size with the value over .8 was observed among the rest of the papers, including 3 studies or 27% that exhibited substantial positive effect sizes (2.114; 2.107; 1.832), suggesting a significant impact on improving reading comprehension skills among the targeted populations.

Based on Figure 7, the overall effect size (theta) is 0.99, indicating a statistically significant positive effect across the studies. The test of theta = 0 is significant ($z = 4.57$, $p < 0.0001$), affirming the overall effect's statistical significance. The calculated z-value of 4.57, with a p-value less than 0.0001, underscores the strength of the evidence supporting the positive effect. This statistical significance attests to the reliability and confidence with which we can assert that technological interventions have a meaningful influence on reading skill development. These statistical indicators not only affirm the

overall impact of technology on reading skills but also bolster the validity of these findings, adding a layer of confidence to the assertion that the effect is more than a chance occurrence.

The heterogeneity test assesses the degree of variability or inconsistency among the effect sizes reported in the individual studies. In this meta-analysis summary comprising 11 studies, the test of homogeneity is conducted using the Q statistic. The calculated Q value of 72.30, with a corresponding p-value less than 0.0001, indicates a significant level of heterogeneity. The high I^2 value of 85.81% further emphasizes substantial inconsistency, suggesting that a considerable proportion of the observed variability in effect sizes is beyond what would be expected due to random chance alone. This finding stresses the importance of considering and exploring sources of heterogeneity, such as participant characteristics. Table 24 represents the findings of heterogeneity test.

Table 24. The Results of Heterogeneity Test: reading

Estimates	*Values*
Q	72.3
df(Q)	10
p-value	<0.0001
I-Squared	85.81

4.3.3 The results of meta-regression: reading

To explore the possible reasons for the heterogeneity, student-related factors, namely, age and level of English, were chosen as moderators for meta-regression. Firstly, the effect of participants' age was explored. To do that, some preparations were made. Particularly, since the studies provided the brackets of age, the participants were grouped as follows: 1 equaled to ages 11 to 12, 2 equaled to ages 13 to 17, and 3 equaled to ages 18 to 50. The results of meta-regression are illustrated in Table 25.

Table 25. Meta-regression Results for Age Moderator: reading

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
0.223	0.361	0.62	0.538	-0.486 to -0.932	0.00	86.93

SE, standard error

Table 25 illustrates that after conducting meta-regression analysis, the coefficient is estimated at 0.223, with a p = 0.538 which indicates non-significant coefficient which suggests that the age group does not significantly predict the variation in effect sizes. The overall model's goodness of fit is assessed by the residual heterogeneity measures, indicating I^2 = 86.93%. The R-squared value is negligible (0.00%), implying that the age group variable explains virtually no variation in the effect sizes. Overall, these results suggest that age group alone does not significantly contribute to the observed heterogeneity in effect sizes across the analysed studies.

To investigate the impact that level of English may have on overall effect size, meta-regression was carried out with Level of English as a moderator. Table 26 illustrates the results.

Table 26. Meta-regression Results for Level of Proficiency Moderator: reading

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
0.130	0.393	0.33	0.740	-0.6411 to 0.9020	0.00	88.29

SE, standard error

Table 26 shows that the coefficient for Level of English moderator is estimated at 0.130, with a, p = 0.740. It shows the coefficient to be non-significant, suggesting that the level of English does not significantly predict the variation in effect sizes. The overall model's fit is assessed by measures of residual heterogeneity, revealing I^2 = 88.29%.The R-squared value is negligible (0.00%), indicating that the level of English explains virtually

no variation in the effect sizes. These results mean that the level of English alone does not significantly contribute to the observed heterogeneity in effect sizes across the analysed studies.

4.3.4 Publication bias: reading

The potential publication bias may affect the results of meta-analysis. Therefore, it is important to test for any publication bias. Figure 8 represents the findings of reading related studies for the current meta-analysis.

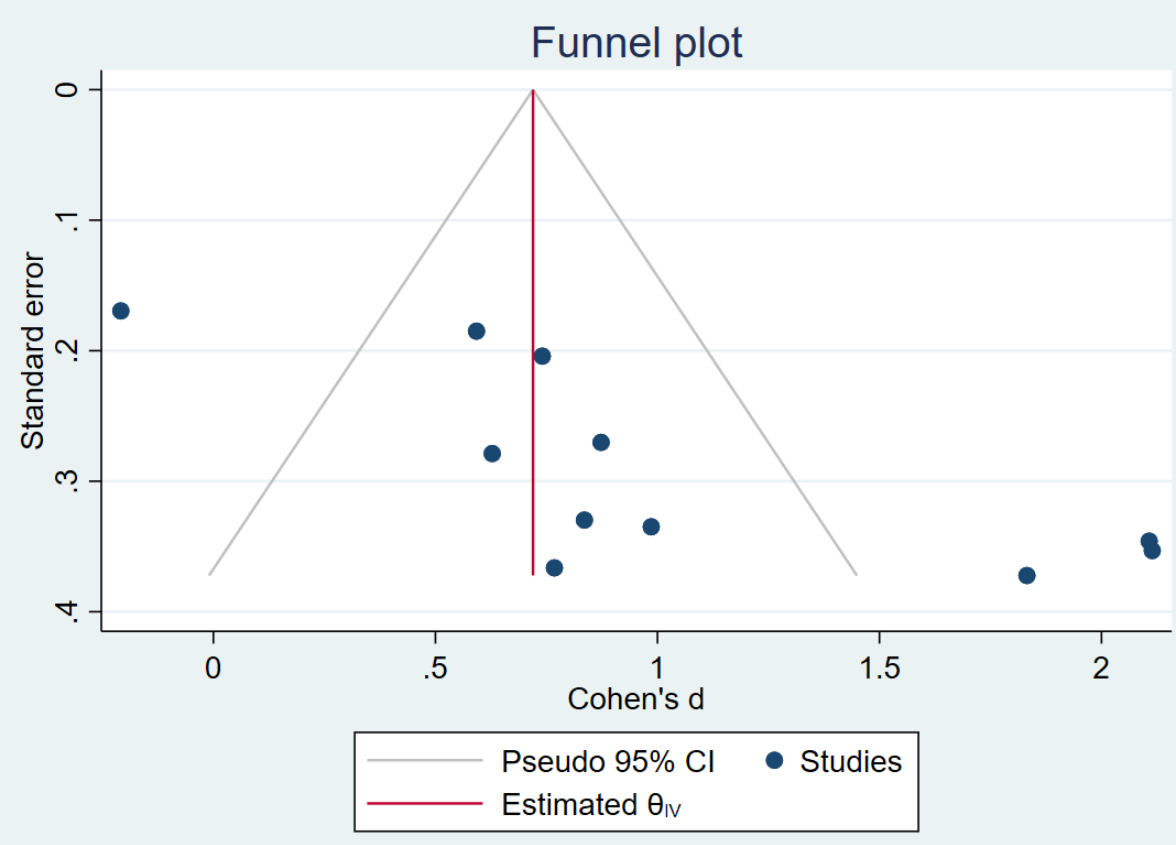


Figure 8. Funnel Plot for Publication Bias Assessment: reading

As Figure 8. suggests, the funnel plot is asymmetrical. The presence of an asymmetrical funnel plot in the meta-analysis suggests a potential publication bias or other sources of bias, as it indicates that smaller studies seem to report more extreme effect sizes. This asymmetry should be interpreted cautiously; therefore, Trim and Fill test was performed (see Table 27).

Table 27. The Result of Trim and Fill Test: reading

Studies	*N*	*Cohen's d*	*95% CI*
Observed	11	0.985	0.563 to 1.407
Observed and Imputed	11	0.985	0.563 to 1.407

Table 27 represents the results of the nonparametric trim-and-fill. The observed and imputed effect sizes were found to be consistent, with no additional studies imputed. The overall effect size remained stable at 0.985, with a 95% confidence interval of 0.563 to 1.407, suggesting that the publication bias has a minimal effect on the results of the study.

4.3.5 The overall summary of findings: reading

Table 28 provides an overall findings, related to reading skills. In summary, concerning the types of interventions, the broad categories of CALL and MALL emerged as the most prevalent. The overall impact was observed to be substantial, indicating a crucial role for digital tools in enhancing EFL reading skills in the contemporary era. Meta-regression analysis revealed that age and proficiency level do not significantly affect the development of reading skills, implying that digital tools can be equally beneficial for learners of various ages and English proficiency levels. The test of heterogeneity demonstrated considerable diversity among the articles, leading to the adoption of a random-effects size model for data analysis. Lastly, both funnel plot and trim-and-fill tests were employed to assess potential publication bias. The outcomes suggested that publication bias had no significant impact on the effect size, ensuring the reliability of the overall impact of digital tools on reading skills.

Table 28. The Summary of Findings: reading

Digital tool	*Description of the digital tool*	*Effect size*		*Moderator analysis*	
		Individual	*Overall*	*Age*	*Proficiency Level*
CALL and CAI (Computer-Assisted Instruction)	CALL and CAI is a general term to refer to the usage of computer technology in EFL education.	2.11; 2.11; 0.84	0.99	no relationship	no relationship
Video integrated reading	Reading activities based on transcripts of videos.	1.83			
MALL	General term to refer to usage of mobile phones in EFL education.	0.99			
Digital reading	Digital texts in PDF format that include hyperlinks to reach additional resources such as audios, videos, or visuals.	0.87; 0.77			
Telegram	Messaging app	0.74			
WhatsApp	Instant messaging app	0.63			
CALL and MALL	CALL is a general term to refer to the usage of computer technology in EFL education. General term to refer to usage of mobile phones in EFL education.	0.59			
Reading aloud tasks via mobile phones	Referred to learners recording themselves reading texts.	-0.21			

4.4 Writing Skill

Related to writing skill, a total of 11 studies that met the inclusion criteria were included in meta-analysis. The summary of these articles, including the authors, titles of the papers, types and years of publications, the database source and the number of the participants are presented in Table 29. The detailed descriptions of each article are presented later in this chapter.

Table 29. Classification of the Studies Used for Meta-analysis: writing

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Ma'azi, H., & Janfeshan, K.	The effect of Edmodo social learning network on Iranian EFL learners writing skill	Article	2018	Google Scholar
Malekzadeh, R., & Najmi, K.	The effect of Mobile-Assisted Language Learning (MALL) on guided writing skill of Iranian upper-intermediate EFL learners	Article	2015	Google Scholar
Estark, N. K., & Bazyar, M.	The effect of MALL on pre-intermediate EFL learners' writing performance	Article	2016	Google Scholar
Mustafa, G., Khan, R. M. I., & Abbasi, A. A.	Impact of social media on EFL writing skill	Article	2022	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Imelda, Cahyono, B. Y., & Astuti, U. P.	Effect of process writing approach combined with video-based mobile learning on Indonesian EFL learners' writing skill across creativity levels	Article	2019	Google Scholar
Sarvari, S., & Ezzati, E.	Teaching writing through Telegram social network and its effect on EFL learners' writing performance	Article	2019	Google Scholar
Al-Subaihat, T. A., & Bataineh, A.	The effect of using IPod technology on EFL college students' writing skill	Article	2020	Google Scholar
Salajeghe, N., & Hasani, S.	Effect of technology and online learning on EFL learners' writing achievement and their self- concept	Article	2021	Google Scholar
Rostami, S., Seidi, A., Amree, S. F. N., & Fallahi, H.	The effect of using CALL-based paragraph writing tasks on Iranian upper- intermediate EFL learners' writing skill	Article	2017	Google Scholar

Authors	*Title of paper*	*Type of publication*	*Publication year*	*Database source*
Alotaibi, A. N., & Alzu'bi, M.	Computer-assisted language learning (CALL): Using paragraph punch software in developing EFL paragraph writing skills	Article	2022	ERIC
Ekinci, E.	Tweet circle: Effects of Twitter on EFL students' writing skill development	MA Thesis	2017	National Thesis Center of the Council of Higher Education

Table 29 shows that the provided list encompasses diverse research works focusing on the impact of technology and innovative methodologies on the writing skills of EFL learners. The publications span a range of years, commencing with a single article in 2015, followed by one each in 2016 and 2018. The year 2017 witnessed a heightened interest with two articles, while 2019 and 2022 also contributed two articles each. The subsequent years, 2020 and 2021, each added a distinct piece to the body of literature. The types of publications include 10 articles and a thesis. Concerning the origins of research materials, it's evident that nine articles originated from Google Scholar, with ERIC and the National Thesis Center of the Council of Higher Education contributing one research paper each.

Table 30. Characteristics of the Included Studies: writing

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
1. Ma'azi, H., & Janfeshan, K., 2018	40	18-21	B1	Edmodo	positive
2. Malekzadeh, R., & Najmi, K., 2015	30	16-23	B2	MALL (Oxford A-Z of Grammar and Punctuation app)	positive
3. Estark, N. K., & Bazyar, M., 2016	30	15-21 (mean 17.1)	A2	Viber	positive
4. Mustafa, G., Khan, R. M. I., & Abbasi, A. A., 2022	42	No information	No information	Facebook	positive
5. Imelda, Cahyono, B. Y., & Astuti, U. P., 2019	61	No information	No information	Video-based materials and WhatsApp	positive
6. Sarvari, S., & Ezzati, E., 2019	30	16-22 (mean 18)	B1	Telegram	positive

Name of study	*N*	*Age*	*Level of English*	*Type of Treatment*	*Effect Type*
7. Al-Subaihat, T. A., & Bataineh, A. M., 2020	65	20-25	No information	iPod	positive
8. Salajeghe, N., & Hasani, S., 2021	50	15-17	A2	Big Blue Button (BBB) app	positive
9. Rostami, S., Seidi, A., Amree, S. F. N., & Fallahi, H., 2017	60	17-27	B2	CALL	positive
10. Alotaibi, A. N., & Alzu'bi, M., 2022	80	No information	No information	Paragraph Punch software	positive
11. Ekinci, E., 2017	63	18-21	B1	Twitter	positive

Table 30 provides an overview of key characteristics found in the studies incorporated in this meta-analysis, encompassing authorship and publication year, sample size, participants' age and English proficiency level, details on the treatment administered to the experimental group, and the overall effect observed. Notably, each study featured a participant count of 30 or more. Approximately 27% of the research papers lacked information on participants' age, while the remaining 73% categorized participants into

two groups: teenagers (15-17 years old) and young adults (18-27 years old). Among these, 55% focused on young adults, while teenagers were the focal point in 18% of the studies. Regarding the English proficiency level, details were absent in 37% of the papers, with the remaining 63% distributing subjects across A2 (18%), B1 (27%), and B2 (18%). The treatment specifics were unspecified in 1 research paper, accounting for 9%, while 36% of the articles employed digital tools tailored for educational purposes, and 55% assessed the effectiveness of non-educational technology. Importantly, all experiments reported a positive effect resulting from the treatment, and individual research paper details will be elaborated on subsequently.

1. The study by Ma'azi, H., and Janfeshan, K. in 2018**.** The researchers attempted to find out how Edmodo social learning network affected Iranian learners' writing skill. A total of 40 Iranian intermediate EFL learners participated in this research. The control group (N=20) followed the usual writing classes, while the experimental group (N=20) practiced writing by using the Edmodo application. The treatment included various tasks, such as writing paragraphs and discussing each other's work, and participation in a quiz. In addition, Edmodo allowed the participants to have access to resources, rehearse activities, present support, and evaluate. Two researcher-developed writing tests were used before and after the experiment. The results indicated that Edmodo was a useful tool to develop writing skill.

2. The study by Malekzadeh, R., and Najmi, K. in 2015. In this study, the impact of MALL on guided writing among Iranian B2 level EFL learners. A total of 30 B2 EFL learners, aged 16 to 23, who attended Afag language center in Iran were selected for the research. They were grouped into two equal groups, namely, control and experimental. The control group (N=15) received regular writing instruction with 10 minutes of paper-based feedback on texted sentences each session. Meanwhile, following the same writing instruction, the experimental group (N=15) used Oxford A-Z of Grammar and Punctuation app for the last 10 minutes of each session. Standard tests, specifically, the writing section of IELTS test, were chosen as pre- and post- tests. The results of data analysis showed a positive effect of MALL on the development of the writing skill.

3. The study by Estark, N. K., and Bazyar, M. in 2016. The authors looked into MALL and its effect on the writing performance of pre-intermediate learners. Participants, consisting of 30 pre-intermediate learners, aged 15-21, from a language center in Iran, were divided

into two homogenous groups: an experimental group (N=15) and a control group (N=15). Both groups received the same instruction on all aspects of the curriculum. To assess the impact of technology on teaching writing, the experimental group engaged in a Viber group where they discussed weekly topics and generated relevant materials, while the control group received traditional in-class writing instruction. Pre- and post- test composition assessments were conducted for both groups, and the statistical analysis of post-test scores revealed a significant improvement in the writing skills of the experimental group due to the use of MALL.

4. The study by Mustafa, G., Khan, R. M. I., and Abbasi, A. A. in 2022. The present quasi-experimental study explored the effects of Facebook on developing EFL learners' writing skills. A total of 42 undergraduate students undertaking the Preparatory Year Program at the Majmaah University in Saudi Arabia were selected as participants. They were divided into control (N=20) and experimental groups (N=22). Members of the experimental group had to post comments on a given topic to the post and to their peers. Control group was given a handout to read and discuss similar situations. Writing pre- and post- tests were selected from the course book the researcher followed. The results showed that Facebook had a significant effect on students' writing skill development.

5. The study by Imelda, Cahyono, B. Y., and Astuti, U. P. in 2019. In this research, process writing approach combined with video-based mobile learning was studied among Indonesian EFL learners across their creativity levels. A total of 61 EFL learners who were second grade students at Vocational High School 2 at Batu City, East Java, Indonesia were chosen for this research. No information related to students' age or level of English was provided. The control group (N=30) received traditional paper-based writing activities, while the experimental group (N=31) received the treatment alongside their regular writing classes. The treatment included extra tasks, such as collecting photos, doing video-based assignments using video editor apps and publishing videos on WhatsApp. Meanwhile, similar paper-based activities were employed with the control group. Pre- and post- tests, developed by the researchers, were administered throughout the experiment. Video-enhanced education was concluded to be important developing writing skill.

6. The study by Sarvari, S., and Ezzati, E. in 2019. This research investigated the efficacy

of the Telegram social network in enhancing the writing proficiency of adult EFL learner at the intermediate level. To accomplish this, 30 EFL learners at Zaban-e No language institute in Talesh, Iran. Over 8 weeks, the experimental group (N=15) received writing instruction and collaboratively engaged in writing tasks through Telegram, while the control group (N=22) underwent traditional writing instruction. Researcher-made pretests and posttests for writing tasks were conducted. The findings indicated that, despite homogeneous writing performance at the outset, the experimental group exhibited significantly superior results on the posttest. In essence, utilizing the Telegram social network for teaching writing proved to be a notably effective approach in enhancing the writing performance of EFL learners.

7. The study by Al-Subaihat, T. A., and Bataineh, A. M. in 2020. The authors studied how employing iPod technology would affect the writing skills and assessed whether teaching writing through iPod technology is more effective than traditional teaching methods. The participants, comprising of 65 male and female undergraduate EFL students, aged 20 to 25, enrolled in a Writing 2 course at Al-alBayt University, Jordan, and two groups were formed. Experimental group (N=35) received instruction through iPod technology, while control group (N=30) received instruction through conventional methods. Both groups were exposed to the same material, on the same days, and during the same timeframe. The authors did not provide any more details, related to how iPods were used in the experiment. Pre-post-tests, developed by the researcher, were administered to collect data. The results revealed statistically significant differences favouring the group that had treatment in terms of writing performance, suggesting that the progress observed may arise from iPod technology.

8. The study by Salajeghe, N., and Hasani, S. in 2021. The authors tried to understand whether or not online learning would alter the self-concept of Iranian EFL learners and help them with their their writing achievement. A total of 50 pre-intermediate level students, aged 15 to 17, were selected through available sampling. There were two groups, and 25 students were assigned to each of them. The experimental group utilized online learning through BigBlueButton (BBB), while the control group had the usual instruction. BBB is a web-based tool, specifically designed for remote education purposes, like any commercial video conferencing platforms, which encourages communication among

students and their teachers and offers rich resources for feedback. Two tests were prepared and administered before and after the experiment. Analysis of tests data revealed that online learning helped students to better their writing achievement.

9. The study by Rostami, S., Seidi, A., Amree, S. F. N., and Fallahi, H. in 2017. In this study, the potential impact of CALL on the writing skills of Iranian EFL learners was researched. A sample of 60 participants was drawn from a pool of 100 upper intermediate EFL learners across three language institutes in Gilanegharb. After homogenizing the participants, two equal groups were created (N=30). The control group performed their writing activities through pen and paper. However, the experimental group did their assignments on computer. Pre- and post- tests which were taken from New Interchange book series were used to assess the progress The study revealed a significant positive impact of CALL on the writing proficiency of Iranian EFL learners.

10. The study by Alotaibi, A. N., and Alzu'bi, M. in 2022. The study aimed to assess the impact of Paragraph Punch on the development of paragraph writing skills among EFL students. The 80 participants, enrolled in the Writing Paragraph course at the English Department of Al-Balqa Applied University, were divided into two sections: the experimental group (N=40) with experience using Paragraph Punch software, and the control group (N=40) taught through traditional methods. Researcher-designed pre- and post- tests provided the data. The findings indicated that Paragraph Punch positively influenced students' paragraph writing abilities.

11. The study by Ekinci, E. in 2017. The present experimental study investigated the potential effects of incorporating Twitter, a microblogging and social networking platform, on students' writing performance. A total of 63 EFL students, drawn from various university faculties to OKU, Turkey, Prep classes and attending 24 hours of English courses per week, were divided into experimental (N=33) and control (N=30) groups. In the experimental group, students followed teacher-provided instructions through Twitter hashtags related to course content, such as writing English sentences about their dream career under the #DreamJobs heading. The teacher offered immediate feedback throughout the study. The control group underwent regular learning without Twitter intervention. Both groups took a writing achievement test at the term's beginning and end. The study's outcomes indicated that using Twitter increased students' overall

achievement in EFL writing.

4.4.1 Digital tools: writing

The initial research query aimed to identify the methodologies employed using digital tools to enhance the writing proficiency of EFL learners. Table 31 illustrates the specific digital tools selected in each study to foster improvement in the writing skills of EFL learners.

Table 31. The Types of Digital Tools Used for Treatments: writing

Type of tool	*Name of tool*	*Study*											*Total*	
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*Tool*	*Type*
Education-focused tools	Edmodo	x											1	2
	BBB								x				1	
Teaching approaches	MALL		x										1	2
	CALL									x			1	
Messaging tools	Viber			x									1	3
	Telegram						x						1	
	WhatsApp					x							1	
Social media	Facebook				x								1	2
	Twitter											x	1	
Video- based materials	Videos					x							1	3
	Telegram						x						1	
	WhatsApp					x							1	
Audio-based materials	iPod							x					1	1
EFL-focused tools	Paragraph software										x		1	1

Table 31 outlines the utilization of various digital tools across 11 studies aimed at enhancing the writing skills of EFL students. The tools employed include Edmodo,

MALL, Viber, Facebook, Videos, Telegram, WhatsApp, iPod, BBB (BigBlueButton), CALL, Paragraph software, and Twitter. These tools demonstrate the diverse range of digital resources explored for the improvement of EFL writing skills.

4.4.2 The results of meta-analysis: overall effect size on writing

Calculating individual effect sizes before assessing the overall influence of technology on advancing writing skills is crucial. Cohen's *d* was used as a measurement for individual effect sizes. As outlined in Figure 9, all studies had a positive impact of digital tools on the enhancement of writing skills. However, there was a high variation among the impact from varied studies. Notably, Study 8 reports a small positive effect of technology on writing with Cohen's d at .39. In contrast, 27% of the studies, including 3, indicate medium positive effect sizes ranging from .61 to .74. Furthermore, substantial effect sizes exceeding .8 were observed in the remaining papers, including 2 studies or 18% of the total with significant positive effects (2.53; 1.92), suggesting a noteworthy improvement in writing skills among the studied populations.

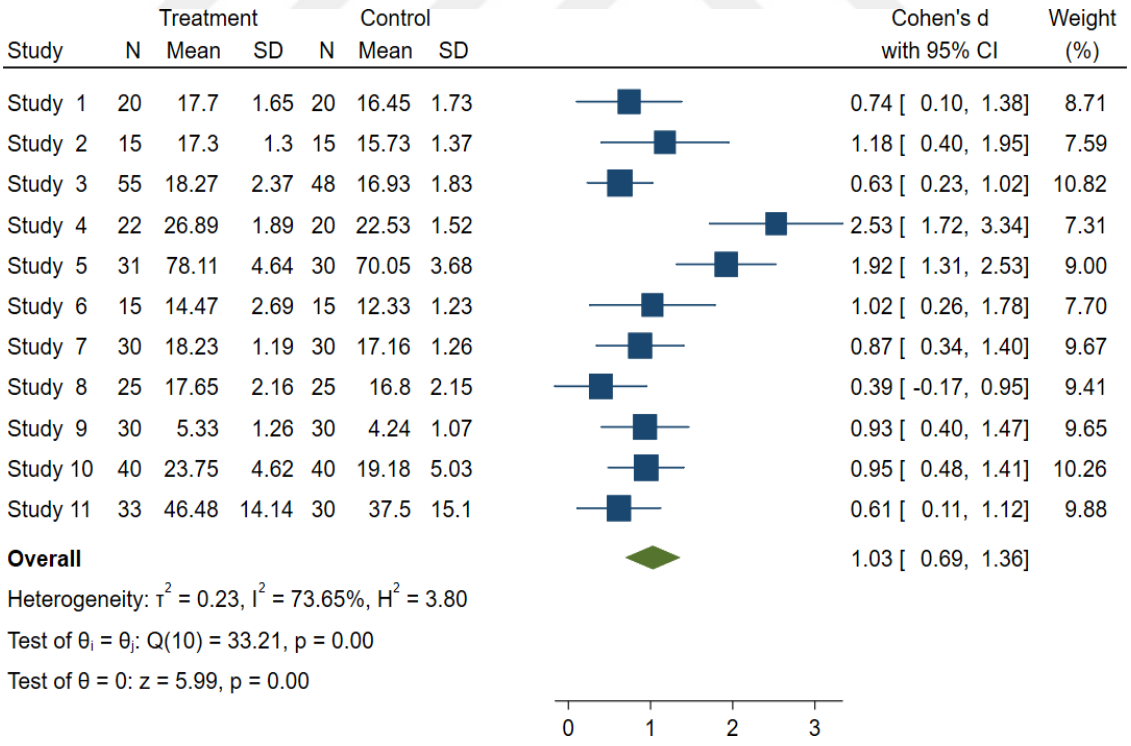


Figure 9. Random-Effects Model Result of Effect Sizes: writing

Based on the Figure 9, the meta-analysis a substantial overall effect size (theta) of 1.03, with

a 95% confidence interval ranging from 0.69 to 1.36. A random-effects model was employed for this analysis. The test of theta against the null hypothesis (theta = 0) demonstrated a highly significant overall effect ($z = 5.99$, $p < 0.0001$), reinforcing the positive influence of digital tools on EFL students' writing skills. The overall effect size indicates a consistent and statistically significant improvement in writing skills attributed to the integration of digital tools in EFL education.

Table 32 represents the results of the heterogeneity test was to shed light on the consistency of observed results. The I-Squared statistic was calculated to be 73.65%. This substantial I-Squared value suggests a notable degree of heterogeneity among the individual study effect sizes. The chi-square test for heterogeneity (Q statistic), with a value of 33.21, was statistically significant ($p < 0.001$), indicating that the observed heterogeneity could not stem from chance alone. These results collectively suggest substantial variability in the impact of digital tools on EFL students' writing skills across the analysed studies. This heterogeneity emphasizes the need to explore potential sources of variation and consider them in the interpretation of the overall effect size, contributing to a better understanding of the interaction among digital tools and proficiency in EFL learners.

Table 32. The Results of Heterogeneity Test: writing

Estimates	*Values*
Q	33.21
df(Q)	10
p-value	<0.0001
I-Squared	73.65

4.4.3 The results of meta-regression: writing

To investigate potential explanations for the observed heterogeneity, student-related variables, specifically age and level of English, were selected as moderators in the meta-regression analysis. The initial focus was on examining the impact of participants' age. To address missing data, a value was imputed through inference, following the approach

recommended by Pigott and Polanin (2020). This inference was based on the authors' contextual explanation of the study, which included details about the type of school and participants' grade levels. Subsequently, participants were categorized into two groups: Group 1 representing ages 15 to 17, and Group 2 representing ages 18 to 27, based on the age brackets provided by the authors. The outcomes of the test is detailed in Table 33.

Table 33. Meta-regression Results for Age Moderator: writing

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
-0.063	0.327	-0.19	0.847	-0.705 to 0.578	0.00	61.15

SE, standard error

The meta-regression analysis aimed to explore the influence of participants' age on the overall effect size of digital tools on writing skills in EFL learners. The results, as shown in Table 33, indicate that the coefficient for age group is -0.063, with a standard error of 0.327. However, this coefficient is not statistically significant ($z = -0.19$, $p = 0.847$), suggesting that there is no significant association between participants' age groups (15-17 and 18-27) and the effect size of digital tools on writing skills. The R-squared value, representing the proportion of variance explained by age group, is close to zero (0.00%), reinforcing the lack of relationship. The residual heterogeneity statistics indicate I-Squared of 61.15%, highlighting the presence of residual variability in effect sizes not accounted for by age group. Overall, the analysis does not provide evidence that participants' age significantly moderates the effect of digital tools on EFL writing skills.

To investigate the effect that level of English may have on the relationship between the usage of digital tools and improvement of writing skills, meta-regression was carried out with Level of English as a moderator. Table 34 illustrates the results.

Table 34. Meta-regression Results for Level of Proficiency Moderator: writing

Coefficient	*SE*	*Z value*	*P value*	*95% CI*	R^2	I^2
0.226	0.136	1.65	0.099	-0.042 to 0.494	0.00	0.00

SE, standard error

The results of meta-regression, as presented in Table 34, indicate that the coefficient for level of English is 0.226, with a standard error of 0.137. Although the coefficient is positive, suggesting a potential positive relationship, it is not statistically significant (z = 1.65, p = 0.099). The R-squared value is reported as 0.00%, indicating that the level of English proficiency does not explain a significant proportion of the variance in effect sizes. Residual heterogeneity statistics show an I-Squared of 0.00%, indicating minimal residual variability not accounted for by the level of English proficiency. In conclusion, the meta-regression results do not provide strong evidence for a significant moderation effect of the level of English proficiency.

4.4.4 Publication bias: writing

The outcomes of the meta-analysis might be influenced by potential publication bias, underscoring the significance of conducting tests to assess such bias. The results of studies related to writing in the meta-analysis are illustrated in Figure 10.

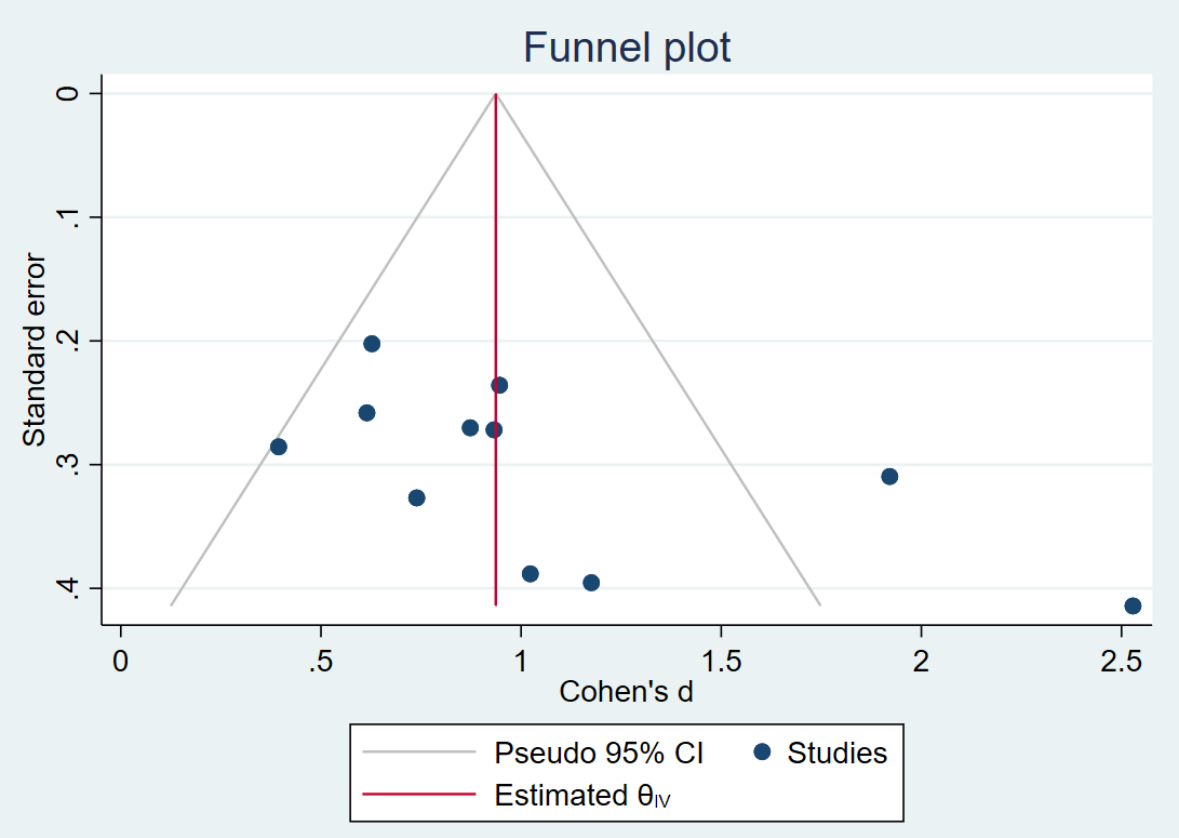


Figure 10. Funnel Plot for Publication Bias Assessment: writing

As indicated by Figure 10, the funnel plot exhibits asymmetry. The asymmetry portrayed in the Figure 10 implies the possibility of publication or other type of bias. This asymmetry suggests that smaller studies with less precise estimates may tend to report more extreme effect sizes. It is essential to interpret this asymmetry with caution. The further investigation of publication bias was addressed via Trim and Fill test was conducted (see Table 35).

Table 35. The Result of Trim and Fill Test: writing

Studies	*N*	*Cohen's d*	*95% CI*
Observed	11	1.027	0.691 to 1.364
Observed and Imputed	11	1.027	0.691 to 1.364

Table 35 illustrates Trim and Fill analysis which was performed to assess and adjust for potential publication bias in the meta-analysis. The funnel plot was initially asymmetrical, indicating the possibility of bias. However, after applying the Trim and Fill method, no imputed studies were added to achieve symmetry. The observed effect size of Cohen's *d* remained unchanged at 1.027, with a confidence interval from 0.691 to 1.364. The absence of imputed studies suggests that the overall effect size in the meta-analysis remains robust and is not significantly influenced by publication bias.

4.4.5 The summary of findings: writing

The overall findings, related to writing skill, can be seen in Table 36. In summary, researchers employed diverse digital tools to enhance the writing skills of learners. The overall impact was found to be substantial, underscoring the pivotal role of digital tools in improving EFL writing skills. Meta-regression analysis indicated that age and proficiency level did not impact the development of writing skills, suggesting that digital tools can offer equal benefits to learners across different age groups and English proficiency levels. The test of heterogeneity highlighted significant diversity among the included articles, resulting in the employment of random-effects size model for data analysis. Finally, both the funnel plot and trim-and-fill tests assessed the potential publication bias. The results indicated that publication bias did not impact the effect size, ensuring the reliability of the overall impact of digital tools on writing skills.

Table 36. The Summary of Findings: writing

Digital tool	*Description of the digital tool*	*Effect size*		*Moderator analysis*	
		Individual	*Overall*	*Age*	*Proficiency Level*
Facebook	A social networking site	2.53	1.03	no relationship	no relationship
Video-based materials and WhatsApp	Learners script and prepare a video assignment to share it on an instant messaging app, called WhatsApp.	1.92			
Oxford A-Z Grammar and Punctuation app	EFL-focused learning app	1.18			
Telegram	Messaging app	1.02			
Paragraph Punch software	A software that allows learners to enhance their paragraph writing skills by focusing on pre-, while-, and post- writing steps.	0.95			
CALL	CALL is a general term to refer to the usage of computer technology in EFL education.	0.93			
iPod	A portable MP3 player	0.87			
Edmodo	Used to be an educational platform where content, quizzes, and assignments were shared by teachers and students.	0.74			
Viber	Instant messaging app	0.63			
Twitter	A social networking site where users post short posts.	0.61			
Big Blue Button	A virtual classroom software program designed for online education.	0.39			

4.5 Discussion of Findings for Research Questions

In the ensuing sections, the comprehensive findings of the study are delineated, accompanied by a nuanced discussion that delves into the intricacies and implications of the results. The research endeavours to present a cohesive narrative, elucidating the core discoveries and their significance within the context of the study's objectives. This synthesis of findings and discussion attempts to enhance the understanding of the subject matter, fostering intellectual engagement and laying the groundwork for further exploration in the field.

4.5.1 Discussion of research question 1

This study has sought answers to three research questions. The first research question was 'What are digital tools used to develop each language skill?' To answer this question, a thorough review of all relevant articles was conducted, and each digital tool utilized during the instructional phase was examined. For the improvement of listening skills, researchers primarily utilized authentic video and audio materials, such as podcasts, TED Talks, iPod audios, Voscreen, YouTube, and Lyrics Training. Additionally, EFL-focused applications like Two Minute English, BBC Learning English apps, Talk2Me English, and Miracle English were incorporated. Notably, EFL-focused software programs included Rosetta Stone, The Four Corners, and two programs developed by researchers. Telegram and WeChat applications served as messaging tools. The use of IPA, Quizziz app, digital storytelling, Google Docs, and Google Classroom highlighted the diverse range of digital tools.

Speaking skills were improved through apps enabling video calls or instant messaging, such as Skype, ICQ, and WhatsApp. Digital tools providing access to authentic videos, such as TED Talks, YouTube, YouGlish, and Forvo, were also integrated. EFL-focused tools like the BBC Learning English app and Oxford Advanced Learning Dictionary played an important role in enhancing speaking skills, too. The inclusion of digital storytelling, computer edutainment activities, researcher-developed digital tools, and IPA underscored the diverse nature of the digital tools employed to enhance learners' speaking abilities.

Concerning reading skills, researchers opted for a general term like CALL or MALL without delving into specific descriptions of the digital tools employed. Otherwise, digital tools for developing reading skills included the use of instant messaging apps like Telegram and WhatsApp, video-integrated reading, digital reading, and reading aloud tasks through mobile phones.

The enhancement of writing skills involved the utilization of social networking sites such as Facebook and Twitter, along with messaging apps like Viber, Telegram, and WhatsApp. Online tools like Edmodo and Big Blue Button were employed for online education. EFL-focused digital tools, including the Oxford Grammar and Pronunciation app and Paragraph Punch software, were also utilized. Additionally, writing skills were honed by video materials and iPods.

The variety of digital tools identified is to be expected. Hubbard (2021) noted that technological advancements have significantly broadened the array of choices available in the field of EFL. Furthermore, Chun (2019) highlighted that the rapid proliferation of digital tools holds the promise of improving EFL education. In simpler terms, there are plenty of beneficial digital tools, and it is up to educators to decide which one would be most appropriate for their students.

4.5.2 Discussion of research question 2

The second research question investigated the overall effect digital tools had on each language skill and asked ‘What is the overall impact of the digital tools on students’ language skills, namely, listening, speaking, reading, and writing?’ After the meta-analysis, the overall effect size for each skill was found to be substantial, with theta values of 1.12 for listening, 1.74 for speaking, 0.99 for reading, and 1.03 for writing. Thus, digital tools benefit the development of all language skills. This finding is in line with the previous meta-analytic literature within the EFL field (Li, 2023, 2022; Seyyedrezaeia et al., 2022; Al-Wasy, 2020; Chang & Hung, 2019; Taj et al., 2016). The collective body of evidence supports the notion that incorporating digital tools in EFL education yields significant benefits across various language proficiency domains.

4.5.3 Discussion of research question 3

The third research question focused on moderators, and asked ‘How is the development of language skills affected by digital tools in terms of student-related factors, specifically, learners’ age and proficiency level?’ Age emerged as a significant moderator in relation to listening skill. The meta-regression analysis indicated that digital tools might be more advantageous for enhancing the development of listening skill among younger learners. This finding aligns with the notion that younger individuals, possibly due to their greater familiarity with digital technologies, especially those that provide access to audios and videos, may derive more substantial benefits from the integration of these tools in language learning activities.

Similarly, the level of proficiency was identified as a crucial factor in the development of speaking skills, with results suggesting that digital tools could be more effective for learners with lower proficiency levels. One plausible interpretation of this finding is that learners at lower proficiency levels often face more fundamental challenges in expressing themselves verbally in the target language. Digital tools, with their interactive features, may offer scaffolded support and a conducive environment for learners to practice and improve their speaking skills. The visual and interactive nature of digital tools could assist in mitigating the language barriers and providing additional resources for learners at the initial stages of language acquisition.

In contrast, the meta-regression analysis regarding reading skill did not yield any statistically significant results, indicating that students' age or proficiency level did not exert any noticeable impact on the development of this skill when employing digital tools. Li (2022), who conducted a meta-analysis regarding technology usage to develop reading skills, also found that level of proficiency was not a significant moderator on the improvement of reading. It might be due to the interactive and engaging nature of digital tools that not only captures learners' attention but also cultivates a dynamic learning environment. These tools offer a diverse array of reading materials, catering to the varied interests and comprehension levels of learners. For beginners, interactive features and multimedia elements can simplify complex concepts, while advanced learners benefit from access to authentic materials and in-depth content. The adaptability of digital tools

allows for personalized learning experiences, enabling learners to make headway without hurry and receive immediate feedback. Overall, digital tools are instrumental in fostering EFL reading proficiency across the entire spectrum of age groups and proficiency levels.

The findings pertaining to writing skill also revealed that neither age nor level of proficiency played a statistically significant role. While divergent claims exist in the literature, such as Al-Wasy's (2020) assertion that proficiency level is a critical moderator in enhancing EFL learners' writing, the outcomes of the present meta-analysis align more closely with the newer findings of Seyyedrezaeia et al. (2022). The statistically insignificant roles of age and proficiency level underscore the nuanced nature of writing skill development in EFL learners. It could be because of the inherent adaptability and versatility of digital tools, which may mitigate the impact of individual differences. Digital tools, with their interactive and personalized features, can cater to learners at various proficiency stages, providing adaptive support tailored to individual needs. Furthermore, the user-friendly interfaces and engaging nature of digital platforms may minimize age-related disparities in technology adoption and utilization.

Another way to interpret these findings might lie in the inherent nature of spoken communication as a fundamental human ability. The moderators, age and proficiency level, may reflect the developmental stages and foundational aspects of language acquisition. Speaking and listening are innate communication skills that individuals acquire naturally in their early years of life, forming the basis of oral language proficiency. Digital tools, with their interactive and audio-visual features, might align more seamlessly with the developmental needs of younger learners and those at lower proficiency levels, providing a supportive environment for the enhancement of these foundational skills. On the other hand, reading and writing, being acquired skills, might be influenced by other factors besides age and proficiency level when using digital tools. These could include individual preferences, learning styles and strategies, motivational levels, and even the complexity of tasks associated with reading and writing in a digital context. In essence, the use of digital tools for reading and writing skills may require a more flexible and tailored instructional approach that considers a variety of factors beyond age and proficiency levels.

5. CONCLUSIONS AND SUGGESTIONS

This chapter presents the findings of the current study. It starts with the overview of the current research. Then, the results for each research question are discussed. Lastly, the implications for ELT and future research are presented.

The field of EFL education has witnessed a rapid integration of digital tools. While the impact of digital tools on language learning has been widely studied, a comprehensive understanding of how various digital tools specifically influence distinct language skills remains limited. The existing literature often lacks a systematic synthesis of findings, hindering educators and policymakers from obtaining a nuanced perspective on the efficacy of digital tools. Additionally, the influence of learner-specific factors, such as age and proficiency level, on the effectiveness of these tools in language skill development is not well-explored. This research aimed to address these gaps by conducting a meta-analysis, systematically reviewing, and synthesizing relevant studies to provide a comprehensive overview of the effects of digital tools on listening, speaking, reading, and writing skills in EFL learners.

To investigate how digital tools impact the enhancement of EFL learners' language skills, a meta-analytical design of this study was selected. A total of 56 papers, including articles and MA thesis, were collected from Google Scholar, ERIC, Web of Science, and National Thesis Centre of the Council of Higher Education databases. All these research papers met the predetermined inclusion criteria. They were carefully examined, and the data presented in each article was analysed.

This study was guided by three research questions. The first research question investigated digital tools that were used to improve EFL learners' language skills. After a careful investigation of all articles, some insights were made. To begin with, various types of digital tools were utilized to enhance language skills comprehensively. Initially,

messaging apps like WhatsApp and Telegram were employed across all language skills. Secondly, digital tools facilitating access to audio and video content emerged as highly favoured. Researchers predominantly opted for TED Talks, diverse podcasts, and YouTube websites for this purpose. Lastly, EFL-focused tools were employed to address specific language skills. For instance, Rosetta Stone and The Four Corners software were utilized to enhance listening skills. Additionally, widely accessible EFL-focused platforms such as Two Minute English, BBC Learning English apps, Talk2Me English, Voscreen, Lyrics Training, and Miracle English websites were leveraged for improving listening skills. Speaking skills were honed through popular BBC Learning English apps. Among other tools, digital reading materials, which refer to texts with hyperlinks to dictionaries, audios, or videos, were employed for enhancing reading skills, while writing skills benefited from tools such as the Oxford Grammar and Pronunciation app and the Paragraph Punch software. Overall, there was a considerable diversity in the digital tools chosen to target the development of each language skill.

The second research question examined what overall effect digital tools had on the improvement of each language skill. To answer this question, quantitative data was evaluated through statistical measurements and group sizes before and after the treatment. The data was processed through Stata 17, a statistical data analysis software. Firstly, the effect sizes were calculated for each treatment. The results indicated that the only tool that had a small negative effect on the development of reading skills was reading aloud tasks via mobile phone. All other digital tools had positive effect sizes for all language skills. The effect sizes of each digital tool varied mostly from moderate to substantial, leaving only a few tools that had a small positive impact. Such tools included a combination of Web 2.0 tools, i.e. Youtube, Voscreen, and Lyrics Training when used to improve listening skills. Furthermore, the overall effect of digital tools on the improvement of each language skill was found to be substantial for all language skills. These findings did not contradict previously conducted similar meta-analytical studies. The cumulative evidence affirms the idea that integrating digital tools into EFL education brings about substantial advantages across diverse language proficiency areas.

The third research question explored the moderating role of age and level of proficiency on the effectiveness of digital technologies when improving language skills. Stata 17 was

used to conduct meta-regression tests. There were two statistically significant findings made. Firstly, the moderator analysis results showed that age was an important moderator in the development of listening skills. This suggested that digital tools might be particularly advantageous for fostering listening skills in younger learners. This correlation aligns with the idea that younger individuals, potentially due to their heightened familiarity with digital technologies, especially those including videos and audios, may experience more pronounced benefits from the integration of such tools into language learning endeavours. Secondly, the research identified proficiency level as a pivotal factor in shaping the development of speaking skills, indicating that digital tools could be more effective for learners operating at lower proficiency levels. A plausible interpretation of this discovery is that individuals with lower proficiency levels often encounter foundational challenges in verbally expressing themselves in the target language. Interactive features of digital tools can offer scaffolded support for EFL learners to practice and enhance their speaking abilities. The visual and interactive elements of digital tools may assist in overcoming language barriers, providing additional resources for learners in the beginning of their learning FL journey.

Moreover, meta-regression did not show age or level of proficiency to be important moderators in the development of reading and writing skills. This could be due to digital tools being versatile and adaptable to all EFL learners. There is a plethora of reading materials available online, which can cater to the interests of any age group, possibly increasing learners' motivation. Moreover, learners can benefit from texts that are adapted to levels of proficiency. Interactive nature of digital tools allows more support to be provided to lower proficiency levels through the use of hyperlinks or online dictionaries, while more challenging texts with immediate feedback can be provided to learners with higher proficiency levels. Similarly, versatility of digital tools used to improve learners' writing skills means that students can benefit from technology irrespective of their individual differences. For instance, young learners might use game- based applications to improve their writing skills to keep their motivation high, while messaging apps allow older learners to share their experiences and learn from one another.

Another way to explain these findings involves the examination of the connections observed between age, proficiency level, and the effects of digital tools on language skills. These correlations may be attributed to the fundamental nature of spoken communication as an inherent human ability. The acquisition of speaking and listening skills in early developmental stages suggests a more significant benefit from digital tools, particularly for younger learners and those at lower proficiency levels. The interactive and audio-visual features of digital tools align closely with the foundational aspects of oral language proficiency. In contrast, reading and writing, viewed as acquired skills, may be governed by other factors beyond age and proficiency level when utilizing digital tools. These factors encompass individual preferences, learning styles, motivation levels, and the complexity of tasks within a digital context. Consequently, the effective use of digital tools for reading and writing skills may demand a more adaptable and personalized instructional approach that takes into account various considerations beyond demographic characteristics.

The findings of this study hold valuable pedagogical implications for EFL. Firstly, educators should acknowledge the diverse array of digital tools identified for enhancing language skills, ranging from messaging apps to audio-video platforms and EFL-focused applications. Understanding this diversity enables teachers to customize their instructional approaches based on the specific language skill they aim to develop. For instance, leveraging messaging apps like WhatsApp and Telegram for communication exercises or incorporating video-integrated reading materials for reading skill enhancement. Additionally, recognizing the age and proficiency-related moderating effects on listening and speaking skills underscores the importance of tailoring digital tool integration to the specific needs and developmental stages of learners. Younger students and those with lower proficiency levels may benefit more from interactive and visually engaging tools, necessitating a nuanced instructional strategy.

Furthermore, these findings underscore the critical role of policy makers in shaping the landscape of EFL education. Recognizing the importance of technology in language instruction, policymakers should prioritize integrating the benefits of technology training

into pre-service EFL teacher education programs. It is imperative to ensure that future educators not only understand the advantages of digital tools but also receive practical guidance on their effective implementation in EFL classrooms. Additionally, the implications extend to in-service teacher professional development. Policymakers should consider creating frameworks and initiatives that support ongoing training for in-service EFL teachers, allowing them to stay abreast of evolving technologies and continually enhance their instructional practices. By championing a holistic approach that addresses both pre-service and in-service teacher development, policymakers can contribute significantly to fostering a technologically proficient and innovative EFL education system.

The current study's findings prompt several recommendations for future research endeavours. While this research delved into the exploration of four language skills, the distribution of articles underscores notable patterns. Notably, almost half of all included articles (N=24) concentrated on the investigation of listening skills, indicating a research gap in the exploration of other language skills. Diversifying research to encompass the remaining skills would undoubtedly yield valuable insights for EFL educators.

Additionally, more studies should be carried out to investigate the effects of digital tools on young learners of ages under 12. The absence of research on pre-school EFL learners and a limited number of papers focused on primary school age students (N=2) underscores an evident research gap. This gap suggests an opportunity for future investigations to explore the dynamics of digital tools in this digital native age group.

To advance the future of meta-analysis in this field, researchers could consider incorporating additional dimensions of language development, such as grammar and vocabulary knowledge, as well as pronunciation. While the present study focused on the core language skills, expanding analytical framework to encompass these linguistic components would provide a more details of the multifaceted influence of digital tools on language acquisition.

Furthermore, future investigations could explore an expanded set of moderators, including experiment-related variables, such as the duration of treatment, educational level, technology device, software type, and teaching approaches. Also, more learner-related variables, e.g., cultural background, mother tongue, and type of school, could be explored to provide clearer insights into observed effect size variations.

Expanding the scope of databases accessed in future research could enhance the inclusivity of the literature search, facilitating a more comprehensive exploration of global perspective. This approach is instrumental in ensuring that the findings and insights drawn from the literature are not constrained by regional boundaries. Such literature search would also offer a broader and more nuanced understanding of the diverse contexts and practices related to the integration of digital technologies in EFL education worldwide.

Furthermore, a recommendation is made for future meta-analyses to delve into qualitative data in this field. Exploration of EFL learners' and teachers' attitudes towards the overall use of digital tools, challenges encountered while using technology, and the perceived benefits could offer valuable qualitative insights. Understanding the qualitative aspects of the learning process, including individual preferences, learning styles, the emotional and motivational factors, can significantly enrich the comprehension of the complex dynamics between learners, teachers, and digital tools. Incorporating qualitative data into future meta-analyses would ensure a more holistic understanding of the impact of digital tools in the EFL education.

REFERENCES

Abbasian, G. R., & Movahedfar, S. (2016). The effect of Multimedia Computer Assisted Language Learning (MCALL) on Iranian EFL learners' L2 listening comprehension. *Journal of Applied Linguistics and Language Research, 3*(6), 23-29. Retrieved June 8, 2023 from http://www.jallr.com/index.php/JALLR/article/view/402

Adel, S. M. R., Davoudi, M., & Pourfarhad (2014). Enhancing reading comprehension and motivation by using a mode of multimedia (CALL) on post intermediate EFL learners. *International Journal of Language Learning and Applied Linguistics World, 6*(4), 257-267. Retrieved June 20, 2023 from https://www.researchgate.net/publication/303812611_ENHANCING_READING_COMPREHENSION_AND_MOTIVATION_BY_USING_A_MODE_OF_MULTIMEDI A_CALL_ON_POST_INTERMEDIATE_EFL_LEARNERS

Ahmad, S. Z. (2019). Digital posters to engage EFL students and develop their reading comprehension. *Journal of Education and Learning, 8*(4), 169-184. DOI: 10.5539/jel.v8n4p169

AbuSeileek, A. F., & Abu Sa'aleek, A. O. (2012). Computer assisted language learning: Merits and demerits. Language in India, 12, 23-36. Retrieved May 25, 2023 from https://www.researchgate.net/publication/324756584_Computer_Assisted_Language_Learning_Merits_and_Demerits

Akdamar, N. S., & Sütçü, S. S. (2021). Effects of digital stories on the development of EFL learners' listening skill. *Education Quarterly Reviews, 4*(4), 271-279. DOI: 10.31014/aior.1993.04.04.391

Akyıldız, S. T., & Çelik, V. (2022). Using WhatsApp to support EFL reading comprehension skills with Turkish early secondary learners. *The Language Learning Journal, 50*(5), 650- 666. DOI: 10.1080/09571736.2020.1865433

Akyuz, S., & Yavuz, F. (2015). Digital learning in EFL classrooms. *7th World*

Conference on Educational Sciences (WCES-2015), 766-769. DOI: 10.1016/j.sbspro.2015.07.176

Alaref, A. (2022). *A meta-analysis of gender impact, teacher's perception, and implementation of technology in EFL teaching in Turkey*. [Unpublished master's thesis, Maltepe University]. Retrieved January 20, 2023, from: https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

Albahiri, M. H., & Alhaj, A. A. M. (2019). Role of visual element in spoken English discourse: Implications for Youtube technology in EFL classrooms. *The Electronic Library, 38*(3), 531-544. DOI: 10.1108/EL-07-2019-0172

Alqasham, F., & Al-Ahdal, A. (2021). Effectiveness of mind-mapping as a digital brainstorming technique in enhancing attitudes of Saudi EFL leaners writing skills. *Journal of Language and Linguistic Studies, 17*(2), 1141-1156. Retrieved June 2, 2023 from https://www.jlls.org/index.php/jlls/article/view/3819/1014

Aliakbari, M., & Mardani, M. (2022). Mobile-assisted language learning and its effects on learners' speaking development. *Education Research International, 2022*, 1-14. DOI: https://doi.org/10.1155/2022/9043326

Al-Shamsi, A., Al-Mekhlafi, A. M., Al Busaidi, S. & Hilal, M. M. (2020). The effects of mobile learning on listening comprehension skills and attitudes of Omani EFL adult learners. *International Journal of Learning, Teaching and Educational Research, 19*(8), 16-39. DOI: https://doi.org/10.26803/ijlter.19.8.2

Alsied, S. M., & Pathan, M. M. (2013). The use of computer technology in EFL classroom: Advantages and implications. *International Journal of English Language & Translation Studies, 1*(1), 44-51.

Alotaibi, A. N., & Alzu'bi, M. (2022). Computer-assisted language learning (CALL): Using paragraph punch software in developing EFL paragraph writing skills. *Journal of Language and Linguistic Studies, 18*(1), 323-332. Doi: 10.52462/jlls.184

Al-Subaihat, T. A., & Bataineh, A. M. (2020). The effect of using IPod technology on EFL college students' writing skill. *Journal of Educational and Psychological Sciences, 4*(6), 162-171. DOI: 10.26389/AJSRP.D190819

Al-Wasy, B. (2020). The effectiveness of integrating technology in EFL/ESL writing: A meta- analysis. *Interactive Technology and Smart Education, 17*(4), 435-454. DOI: 10.1108/ITSE-03-2020-0033

Asratie, M. G., Wale, B. D., & Aylet, Y. T. (2022). Effects of using educational technology tools to enhance EFL students' speaking performance. *Education and Information Technologies*. DOI: https://doi.org/10.1007/s10639-022-11562-y

Ayatfard, F. (2022). Effect of digital audio files on EFL learners' listening skill. *Journal of New Advances in English Language Teaching and Applied Linguistics, 4*(2), 1014-1028. DOI: 10.22034/jeltal.2022.4.2.10

Bahari, A. (2022). Affordances and challenges of technology-assisted language learning for motivation: A systematic review. *Interactive Learning Environments*, 1-21. DOI: 10.1080/10494820.2021.2021246

Bal, S. (2019). *The integration of ICT tools into listening skill classes to improve listening comprehension skills of EFL learners* [Unpublished master's thesis, Bursa Uludağ University]. Retrieved June 10, 2023from: https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

Bax, S. (2003). CALL past, present and future. *System, 31*, 13-28. https://doi.org/10.1016/S0346-251X(02)00071-4

Blake, R. (2016). Technology and the four skills. *Language Learning & Technology, 20*(2), 129-142. Retrieved May 27, 2023 from http://llt.msu.edu/issues/june2016/blake.pdf

Bouzidi, A. (2021). *Integrating mobile-based activities in teaching listening and speaking skills to EFL degree students at Algiers 2 University: A multimodal approach.* [Unpublished master's thesis, University of Algiers 2]. Retrieved June 10, 2023 from: http://ddeposit.univ-alger2.dz:8080/xmlui/handle/20.500.12387/2728

Chang, M. M., & Hung, H. T. (2019). Effects of Technology-Enhanced Language Learning on Second Language Acquisition. *Journal of Educational Technology*

& Society, 22(4), 1-17. Retrieved December 04, 2023 from https://www.jstor.org/stable/26910181

Chapelle, C. A. (2003). *English language learning and technology: Lectures on applied linguistics in the age of information and communication technology*. Philadelphia: John Benjamins. Retrieved May 20, 2023 from https://core.ac.uk/download/pdf/212816911.pdf

Chun, M. D. (2019). Current and future directions in TELL. *Journal of Educational Technology & Society*, *22*(2), 14-25. Retrieved May 19, 2023 from Current and Future Directions in TELL on JSTOR

Cooper, H. (2010). *Research synthesis and meta-analysis*. California: Sage.

Creswell, J. W. (2014). *Research designs: Quanlitative, quantitative, and mixed methods approaches.* California: Sage.

Deveci Demir, D. M., & Tavil, M.Z (2021). The effect of technology-based materials on vocational high school students' listening skill. *Journal of Language and Linguistic Studies, 17*(1), 448-457. Retrieved June 8, 2023 from https://www.jlls.org/index.php/jlls/article/view/2134

Diab, A. A. M. (2022). *Using the ubiquitous learning tools for developing EFL prospective teachers' listening comprehension and digital literacy skills.* [Unpublished master's thesis, Benha University]. DOI: 10.21608/JFEB.2022.298998

Dizon, G. (2020). Evaluating intelligent personal assistants for L2 listening and speaking development. *Language Learning & Technology, 24*(1), 16-26. DOI: https://doi.org/10125/44705

Dudeney, G., & Hockly, N. (2012). ICT in ELT: How did we get here and where are we going? *ELT Journal, 66*(4), 533-542. DOI: 10.1093/elt/ccs050

EF EPI (2023). EF English Proficiency Index. Education First. Retrieved December 04, 2023 from https://www.ef.com.tr/epi/regions/europe/turkey/

Ekinci, E. (2020). *The use of video materials in EFL learners' reading comprehension*.

[Unpublished master's thesis, Çağ University]. Retrieved June 20, 2023 from: https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

Ekinci, E. (2017). *Tweet circle: Effects of Twitter on EFL students' writing skill development*. [Unpublished master's thesis, Çukurova University]. Retrieved June 25, 2023 from: https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

El-Desouky Gaber, M. (2015). *Utilizing Mobile Assisted Language Learning (MALL) to develop EFL listening skills and learner autonomy.* [Unpublished master's thesis, Mansoura University] DOI: 10.13140/RG.2.2.34037.88805

Elghotmy, H. E. A. (2022). Using Instagram and social media engagement techniques-based programme to develop pre-service teachers' EFL speaking skills and intercultural awareness. مجلة كلية التربية - جامعة المنوفية *2022*(3), 1-60. DOI: 10.21608/muja.2022.253819

El-Sayed, M. M., Qoura, A. A. S., & El-Hadidy, M. M. S. (2017). Enhancing EFL secondary stage students' listening and reading comprehension skills through a CALL program. *Journal of Research in Curriculum, Instruction and Educational Technology, 3*(4), 35-67. DOI: 10.12816/0041907

Estark, N. K., & Bazyar, M. (2016). The effect of MALL on pre-intermediate EFL learners' writing performance. *European Online Journal of Natural and Social Sciences, 5*(2), 406-420. Retrieved June 25, 2023 from https://european- science.com/eojnss/article/view/4621

Gao, W., Namaziandost, E., & Abdulaal, M. (2021). Visual-Syntactic Text Formatting: Developing EFL leaners' reading fluency components. *Journal of Psycholinguistic Research, 51*, 707-727. DOI: https://doi.org/10.1007/s10936-021-09823-x

Gayed, J., Carlon, M., Oriola, A., & Cross, J. (2022). Exploring an AI-based writing assistant's impact on Englisg language learners. *Computers and Education: Artificial Intelligence, 3*. DOI: 10.1016/j.caeai.2022.100055

Gündüz, N. (2005). Computer assisted language learning (CALL). *Journal of Language and Linguistic Studies, 1*(2), 193-214. Retrieved May 25, 2023 from https://dergipark.org.tr/en/pub/jlls/issue/9922/122824

Hafifah, G. N. (2019). Information and communication technology (ICT) in English language teaching. *Muhammadiyah English Language Teaching Conference (MELTC)*, 21-26. Retrieved May 19, 2023 from https://core.ac.uk/download/pdf/229574767.pdf

Hamad, M. M., Metwally, A. A., & Alfaruque, S. Y. (2019). The impact of using YouTubes and audio tracks imitation YATI on improving speaking skills of EFL learners. *English Language Teaching, 12*(6), 191-198. Retrieved May 25, 2023 from https://files.eric.ed.gov/fulltext/EJ1216715.pdf

Hanafiah, W., Aswad, M., Sahib, H., Yessi, A. H., & Mousavi, M. S. (2022). Impact of CALL on vocabulary learning, speaking skill, and foreign language speaking anxiety: The case study of Indonesian EFL learners. *Education Research International, 2022*, 1-13. DOI: https://doi.org/10.1155/2022/5500077

Haswani, F. (2014). The role of technology in EFL classroom. *Indonesian Journal of English Education, 1*(2), 107-118. DOI: 10.15408/ijee.v1i2.1303

Hidalgo, F. J. P. (2020). TELL, CALL, and MALL: Approaches to bridge the language gap. In C. Huertas-Abril & M. Gomez-Parra (Eds.) *International Approaches to Bridging the Language Gap*, (pp. 118-134). DOI: 10.4018/978-1-7998-1219-7.ch008

Hubbard, P. (2021). An invitation to CALL. Foundations of Computer-assisted language learning *APACALL*. Retrieved May 25 from.https://www.apacall.org/research/books/6/An_Invitation_to_CALL_2021.pdf

Hubbard, P., & Levy, M. (2016). Theory in computer-assisted language learning research and practice. In F. Farr & L. Murray (Eds.), *The Routledge Handbook of Language Learning and Technology*, (pp. 24-38). Retrieved May 23, 2023 from The Routledge Handbook of Language Learning and Technology (routledgehandbooks.com)

Huong, L. P. H. & Hung, B. P. (2021). Mediation of digital tools in English learning. *LEARN Journal: Language Education and Acquisition Research Network, 14*(2), 512-528. Retrieved May 20, 2023 from

https://so04.tci- thaijo.org/index.php/LEARN/article/view/253278

Hwang, W. Y., Shih, T. K., Ma, Z. H., Shadiev, R., & Chen, S. Y. (2016). Evaluating listening and speaking skills in a mobile game-based learning environment with situational contexts. *Computer Assisted Language Learning, 29*(4), 639-657. DOI: 10.1080/09588221.2015.1016438

Ilyas, M., & Putri, M. E. (2020). YouTube channel: An alternative social media to enhance EFL students' speaking skill. *Journal of English for Academic, 7*(1), 77-87. DOI: 10.25299/jshmic.2020.vol7(1).4141

Imelda, Cahyono, B. Y., & Astuti, U. P. (2019). Effect of process writing approach combined with video-based mobile learning on Indonesian EFL learners' writing skill across creativity levels. *International Journal of Instruction, 12*(3), 325-340. DOI: https://doi.org/10.29333/iji.2019.12320a

İnce, I., Ozcimen, E., & Turan, A. (2019). Meta-analysis: A review article. *JARSS, 27*(1), 1-8. DOI: 10.5222/jarss.2019.76476

Jia, C., & Hew, K. F. T. (2022). Supporting lower-level processes in EFL listening: the effect on learners' listening proficiency of a dictation program supported by a mobile instant messaging app. *Computer Assisted Language Learning, 35*(1-2), 141-168. DOI: 10.1080/09588221.2019.1671462

Junaidi, Hamuddin, B., Julita, K., Rahman, F., & Derin, T. (2020). Artificial Intelligence in EFL context: Rising students' speaking performance with Lyra virtual assistance. *International Journal of Advanced Science and Technology, 29*(5), 6735-6741. DOI: https://doi.org/10.31849/utamax.v2i2.3067

Kazemnia, D. (2022). *The effect of using the Quizizz as an online game-based learning platform on primary Turkish EFL learners' listening skills improvement* [Unpublished master's thesis, Bahçeşehir University]. Retrieved June 10, 2023 from: https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

Khashan, H. S., & AbuSeileek, A. F. (2023). The effect of using British Council BBC Learning English application on the tenth grade EFL students' listening and speaking skills and their attitudes toward it. *Journal of Applied Linguistics and Language Research, 10*(2), 39-62. Retrieved June 9, 2023 from

http://www.jallr.com/index.php/JALLR/article/view/1279

Khodashenas, M. R., & Amouzegar, E. (2013). The effect of using CALL on the improvement of the listening comprehension of the intermediate EFL learners. *Modern Journal of Language Teaching Methods, 3*(3), 94-101. Retrieved June 9, 2023 from https://mjltm.org/browse.php?a_id=45&sid=1&slc_lang=en

Khoshsima, H., & Mozakka, Z. (2017). The effect of Computer-Assisted Language Learning on Iranian upper-intermediate EFL learners' listening skill. *Journal of Applied Linguistics and Language Research, 4*(2), 81-91. Retrieved June 9, 2023 from https://www.researchgate.net/publication/314229432_The_Effect_of_Computer-Assisted_Language_Learning_on_Iranian_Upper-Intermediate_EFL_Learners'_Listening_Skill

Khubyari, L., & Narafshan, M. H. (2016). A study on the impact of MALL (Mobile Assisted Language Learning) on EFL learners' reading comprehension. *International Journal of English Language Teaching, 4*(2), 58-69. Retrieved June 20, 2023 from https://www.researchgate.net/publication/353234573_A_STUDY_ON_THE_IMPACT_OF_MALL_MOBILE_ASSISTED_LANGUAGE_LEARNING_ON_EFL_LEARNERS'_READING_COMPREHENSION

Kim, N. Y. (2018). Effects of reading aloud tasks through a mobile phone on EFL vocabulary and reading comprehension skills. *Multimedia-Assisted Language Learning, 21*(1), 57- 76. DOI: 10.46346/TJHS.113..3

Kılıç, A. (2020). *A study on improving EFL learners' listening skills through education informatics network (EBA) and identifying learners' perceptions towards the platform.* [Unpublished master's thesis, Maltepe University]. Retrieved May 20, 2023, from: https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

Levy, M., & Hubbard, P. (2005). Why call CALL "CALL"?, *Computer Assisted Language Learning, 18*(3), 143-149. DOI: 10.1080/09588220500208884

Li, R. (2022). Effects of Mobile-assisted language learning on EFL/ESL reading comprehension. *Educational Technology & Society, 25*(3), 15-29. Retrieved

December 4, 2023 from Effects of Mobile-Assisted Language Learning on EFL/ESL Reading Comprehension on JSTOR

Li, R. (2023). Effects of Mobile-assisted language learning on EFL learners' listening skill development. *Educational Technology & Society, 26*(2), 36-49. Retrieved December 4, 2023 from Effects of Mobile-Assisted Language Learning on EFL Learners' Listening Skill Development on JSTOR

Liu, M. (2021). Changes in and effects of TED Talks on postgraduate students' English speaking performance and speaking anxiety. *Journal of Language and Education, 7*(3), 104-118. DOI: https://doi.org/10.17323/jle.2021.11632

Lodico, M. G., Spaulding, D. T., & Voegetle, K. H. (2006). *Methods in educational research: From theory to practice*. San Francisco: Jossey-Bass.

Ma'azi, H., & Janfeshan, K. (2018). The effect of Edmodo social learning network on Iranian EFL learners writing skill. *Cogent Education, 5*(1,), 1-17. DOI: 10.1080/2331186X.2018.1536312

Malekzadeh, R., & Najmi, K. (2015). The effect of Mobile-Assisted Language Learning (MALL) on guided writing skill of Iranian upper-intermediate EFL learners. *Journal of Applied Linguistics and Language Research, 2*(4), 42-52. Retrieved June 25, 2023 from http://www.jallr.com/index.php/JALLR/article/view/61

Mehr, H. S., Zoghi, M, & Assadi, N. (2013). Effects of synchronous computer-mediated communication and face to face interaction on speaking skill development of Iranian EFL learners. *International Journal of Applied Linguistics and English Literature, 2*(5), 36-41. DOI: 10.7575/aiac.ijalel.v.2n.5p.36

Meihami, H., Meihami, B., & Varmaghani, Z. (2013). The effect of Computer-Assisted Language Learning on Iranian EFL students listening comprehension. *International Letters of Social and Humanistic Studies, 11*, 57-65. DOI:10.18052/www.scipress.com/ILSHS.11.57

Moorhouse, B. L., & Yan, L. (2023). Use of digital tools by English language schoolteachers. *Education Sciences, 13*, 1-15. DOI: https://doi.org/10.3390/educsci13030226

Mustafa, G., Khan, R. M. I., & Abbasi, A. A. (2022). Impact of social media on EFL writing skill. *Pakistan Languages and Humanities Review, 6*(1), 1-11. DOI: https://doi.org/10.47205/plhr.2022(6-I)1

Nabilou, M., Aboutalebi, M., & Soltani, S. (2021). The effect of using mobile listening applications on listening skills of Iranian intermediate EFL learners. *Proceedings of 4th National Congress on English Language*, 1-9. Retrieved June 10, 2023 from https://www.researchgate.net/publication/353600937_The_Effect_of_Using_Mobile_Listening_Applications_on_Listening_Skills_of_Iranian_Intermediate_EFL_Learners#ful lTextFileContent

Naderi, S., & Akrami, A. (2017). EFL learners' reading comprehension development through MALL: Telegram groups in focus. *International Journal of Instruction, 11*(2), 339-350. DOI: https://doi.org/10.12973/iji.2018.11223a

Najmi, K., & Lavasani, M. N. (2021). The effect of using digital audio files on developing EFL learners' listening comprehension ability. *Journal of new advances in English Language Teaching and Applied Linguistics, 3*(2), 610-628. DOI: 10.22034/Jeltal.2021.3.2.4

Nozad, N. (2021). *The effect of authentic audiovisual materials on listening skills development and listening anxiety of EFL students* [Unpublished master's thesis, Bahçeşehir University]. Retrieved June 10, 2023 from: https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

Pigott, T. D., & Polanin, J. R. (2020). Methodological guidance paper: High-quality meta- analysis in a systematic review. *Review of Educational Research, 90*(1), 24-46. https://doi.org/10.3102/0034654319877153

Pesut, D. (2014). Technology use in EFL learning. *37th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, 26-30. DOI: 10.1109/MIPRO.2014.6859686

Phillips, D.C. (1995). The good, the bad, and the ugly: The many faces of constructivism. *Educational Researcher, 24*(7): 5–12.

Praveen Sam, D., & Shalini, R. (2021). Limitations and advantages in implementing MALL in the tertiary ESL classrooms: A review. *International Journal of Recent Technology and Engineering, 9*(5), 27-32. DOI: 10.35940/ijrte.E5097.019521

Quyen, T. T. Q., & Hien, L. D. T. (2021). Implementing mobile applications: EFL students' perceptions and listening skill improvement. *Journal of Inquiry into Languages and Cultures, 5*(3), 255-266. Retrieved June 9, 2023 from https://tapchinnvh.huflis.edu.vn/index.php/tckhnnvh/article/view/251/0

Rostami, S., Seidi, A., Amree, S. F. N., & Fallahi, H. (2017). The effect of using CALL-based paragraph writing tasks on Iranian upper-intermediate EFL learners' writing skill. *Language Education Studies, 3*(1), 1-8. Retrieved June 25, 2023 from http://www.langes.ir/upload/1-LES17311-Rostami-et-al-2017.pdf

Salehpour, F. (2018). The effect of using Telegram Instant Messaging application on listening comprehension skill among Iranian intermediate EFL students. *International Journal of Educational Investigations, 5*(3), 79-91. Retrieved 9 June, 2023 from http://www.ijeionline.com/attachments/article/67/IJEI.Vol.5.No.3.07.pdf

Salajeghe, N., & Hasani, S. (2021). Effect of technology and online learning on EFL learners' writing achievement and their self-concept. *Journal of New Trends in English Language Learning, 1*(3), 65-76. DOI: 10.30495/JNTELL.2022.697772

Santosa, M. H. (2008). Podcasting in English classroom? Why not? *Seminar Nasional Aplikasi Teknologi (SNATI 2008)*, 37-42. Retrieved May 20, 2023 from https://www.researchgate.net/publication/322868992_Podcasting_in_English_Classroom_Why_Not

Sarhan, M. I. Y. A. F. (2021). *The effectiveness of using computer edutainment activities to develop preparatory stage pupils' EFL speaking skills.* [Unpublished master's thesis, Mansoura University]. DOI: 10.21608/maed.2021.224220

Sarvari, S., & Ezzati, E. (2019). Teaching writing through Telegram social network and its effect on EFL learners' writing performance. *International Journal of Foreign Language Teaching and Research, 7*(25), 87-100. Retrieved June 25, 2023 from https://jfl.iaun.iau.ir/article_615580.html

Saqr, A. K. (2021). The effect of digital reading on EFL learners' reading comprehension. *International Journal of Education, Technology and Science, 1*(1), 59-70. DOI: https://doi.org/10.47750/pegegog.13.04.30

Seven, M. A. (2020). Motivation in language learning and teaching. *African Educational Research Journal, 8*(2), 62-71. Retrieved May 19, 2023 from https://files.eric.ed.gov/fulltext/EJ1274645.pdf

Seyyedrezaei, M., Amiryousefi, M., & Gimeno-Sanz, A., & Tavakoli, M. (2022). A meta- analysis of the relative effectiveness of technology enhanced language learning on ESL/EFL writing performance: Retrospect and prospect. *Computer Assisted Language Learning,* 1-35. DOI: 10.1080/09588221.2022.2118782

Shafaei, A. (2012). Computer assisted learning: A helpful approach in learning English. *Frontiers of Language and Teaching, 3,* 108-115.

Shafiee, S., Akbari, S., & Hajijalili, M. (2019). Comparing the impact of CALL-based versus Non-CALL-based methods of instruction on reading comprehension among Iranian Upper-intermediate EFL learners. *Language in India*, *19*(5), 33-49.

Shiri, S. (2015). The application of podcasting as a motivational strategy to Iranian EFL learners of English: A view toward listening comprehension. *Advances in Language and Literary Studies, 6*(3), 155-165. DOI: 10.7575/aiac.alls.v.6n.3p.155

Sidabutar, M. N. A., Sayed, B. T., İsmail, S. M., Quispe, J. T., Vincente, J. S. Y., Wekke, I. S., Shanan, A. J., & Nourabadi, S. (2022). Reading digital texts vs. reading printed texts: Which one is more effective in Iranian EFL context? *Education Research International, 2022*, 1-9. DOI: https://doi.org/10.1155/2022/7188266

Sidabutar, M., Sayed, T., Ismail, S., Quispe, J., Vicente, J., Wekke, I., Shanan,A., &

Nourabadi, S. (2022). Reading digital texts vs. reading printed texts: Which one is more effective in Iranian EFL context? *Hindawi Education Research International, 2022,* 1-9. DOI: https://doi.org/10.1155/2022/7188266

Stroia, M. (2012). Learning with computers: A serious challenge for the didactic of foreign language teaching. *Social Behavioral Sciences, 1*(65), 38-42.

Tafazoli, D., & Golshan, N. (2014). Review of computer-assisted language learning: History, merits & barriers. *International Journal of Language and Linguistics, 2*(5-1), 32-38. DOI: 10.11648/j.ijll.s.2014020501.15

Taj, I. H., Ali, F., Sipra, M. A., & Ahmad, W. (2017). The effect of technology enhanced language learning on EFL reading comprehension at tertiary level. *Arab World English Journal, 8*(1), 108-129. DOI: https://dx.doi.org/10.24093/awej/vol8no1.9

Taj, I. H., Sulan, N. B., Sipra, M. A., & Ahmad, W. (2016). Impact of Mobile assisted language learning (MALL) on EFL: A meta-analysis. *Advances in Language and Literary Studies, 7*(2), 76-83. DOI: 10.7575/aiac.alls.v.7n.2p.76

Taşkıran, A. (2022). AI-based automated writing evaluation for online language learning: Perceptions of distance learners. *Kocaeli University Journal of Education, 5*(1), 111-129. DOI: https://doi.org/10.33400/kuje.1053862

Tight, M. (2019). Systematic reviews and meta-analyses of higher education research. *European Journal of Higher Education, 9(*2), 133-152, DOI: 10.1080/21568235.2018.1541752

Warschauer, M. (1998) Computer assisted language learning: An introduction. In S. Fotos (ed.) *Multimedia language teaching,* (pp. 3-20). Retrieved May 25, 2023 from http://www.ict4lt.org/en/warschauer.htm

Warschauer, M. (2000). The death of cyberspace and the rebirth of CALL. *English Teachers' Journal, 53,* 61-67. Retrieved May 19, 2023 from https://education.uci.edu/uploads/7/2/7/6/72769947/cyberspace.pdf

Warschauer, M., & Healey, D. (1998). Computers and language learning: An overview. *Language Teaching, 31,* 57-71. Retrieved May 19, 2023 from

https://hstrik.ruhosting.nl/wordpress/wp-content/uploads/2013/03/Warschauer-Healey- 1998.pdf

Wei, Q., Siriyothin, P., & Lian, A. P. (2018). Improving Chinese university EFL students' speaking skills through digital storytelling. *Suranaree Journal of Social Sciences, 12*(2), 47-68. DOI: https://doi.org/10.55766/OXMZ7550

Xodabande, I. (2017) The effectiveness of social media network telegram in teaching English language pronunciation to Iranian EFL learners. *Cogent Education, 4*(1), 1-14. DOI: https://doi.org/10.1080/2331186X.2017.1347081

Xu, Y. (2023). Investigating the effects of digital multimodal composing on Chinese EFL learners' writing performance: a quasi-experimental study. *Computer Assisted Language Learning, 36*(4), 785-805. DOI: 10.1080/09588221.2021.1945635

Yaghoobi, M., & Razmjoo, S. A. (2013). The potentiality of computer-assisted instruction towards ameliorating Iranian EFL learners' reading level. *Computers in Human Behavior, 59*, 108-114. DOI: https://doi.org/10.1016/j.chb.2016.01.033

Yang, C. T. Y., Lai, S. L., & Chen, H. H. J. (2022). The impact of intelligent personal assistants on learners' autonomous learning of second language listening and speaking. *Interactive Learning Environments*, 1-21. DOI: 10.1080/10494820.2022.2141266

Zaini, A., & Mazdayasna, G. (2015). The impact of computer-based instruction on the development of EFL learners' writing skills. *Journal of Computer Assisted Learning, 31*, 516-528. DOI: 10.1111/jcal.12100

Zhu, E., & Kaplan, M. (2001). Technology and teaching. In M. Svinicki & W. J. McKeachie (Eds.) *McKeachie's Teaching Tips,* (pp. 235-266). Retrieved May 20, 2023 from http://ndl.ethernet.edu.et/bitstream/123456789/29260/1/5..pdf

CURRICULUM VITAE

Svajune İSTİKBAL

Eğitim

Derece	Yıl	Üniversite, Enstitü, Anabilim/Anasanat Dalı
Yüksek Lisans	2024	Maltepe Üniversitesi, Lisansüstü Eğitim Enstitüsü, Yabancı Diller Eğitimi Anabilim Dalı
Lisans	2019	Yıldız Teknik Üniversitesi, Eğitim Fakülesi, İngilizce Öğretmenliği
Lisans	2014	Vytauto Didziojo Ünivesitesi, Sosyal Bilimler Fakültesi, Psikoloji

İş/İstihdam (Varsa)

Yıl	Görev	Kurum
2019	İngilizce Öğretmeni	Marmara Eğitim Kurumları
2018	Stajer İngilizce Öğretmeni	ENKA Okulları
2017	İngilizce Öğretmeni	Amerikan Kültür Okulları
2016	İngilizce Öğretmeni	Just English Okulları