ORTHOGRAPHY EFFECT ON THE PRONUNCIATION OF TURKISH EFL LEARNERS

PhD Dissertation

Canan DEVECİ

Eskişehir 2023

ORTHOGRAPHY EFFECT ON THE PRONUNCIATION OF TURKISH EFL LEARNERS

Canan DEVECİ

PhD DISSERTATION
Program in English Language Teaching
Department of Foreign Language Education
Supervisor: Prof. Dr. Handan YAVUZ

Eskişehir
Anadolu University
Graduate School of Educational Sciences
June 2023

JÜRİ VE ENSTİTÜ ONAYI

ÖZET

TÜRK ÖĞRENCİLERİN İNGİLİZCE SESLETİMİNDE YAZIMIN ETKİSİ

Canan DEVECİ
Yabancı Diller Eğitimi Anabilim Dalı
İngilizce Öğretmenliği Doktora Programı
Anadolu Üniversitesi, Eğitim Bilimleri Enstitüsü, Haziran 2023
Danışman: Prof. Dr. Handan YAVUZ

Bu çalışma İngilizceyi yabancı dil olarak okullarda ve genellikle yazılı materyaller ile öğrenmek durumunda kalan Türk öğrencilerin İngilizce sesletiminde yazımın etkisini araştırmayı amaçlamaktadır. Her harfin tek sese karşılık geldiği anadile sahip olan Türk öğrencilerin İngilizce gibi birebir harf-ses eşleşmesi olmayan bir dili öğrenmelerinde karşılaşabilecekleri sesletim zorluklarını araştırabilmek için iki dil arasındaki farklılıklar dikkate alınarak sesletim-yazım uyuşmazlığı olan 7 ana ve 26 alt kategori belirlenmiştir. Sözcüklerle karşılaşma sıklığının da etkisi olup olmadığını görmek için her kategoriye farklı aşinalık düzeylerinde sözcükler seçilmiştir. Çalışmaya Türkiye'de bir devlet üniversitesinde hazırlık eğitimi alan orta seviyede İngilizce yeterliliğine sahip 61 öğrenci katılmıştır. Katılımcılar ile öncelikle 3 farklı oturumda gerçekleşen 4 adet veri toplama seansı düzenlenmiştir. İlk oturumda katılımcılardan sözcükleri görmeden anadili İngilizce olan bir model tarafından seslendirilmiş sözcükleri dinleyip tekrar etmeleri, ikinci oturumda yazılı olarak gösterilen sözcükleri okumaları, ardından sözcüklerin yazılışları olmadan dinledikleri modelden sonra tekrar etmeleri ve üçüncü oturumda sözcükleri sesleten modeli izledikleri bir videodan sonra sözcükleri tekrar etmeleri istenmiş ve ses kayıtları alınmıştır. Sonrasında katılımcılara bu çalışma için belirlenen kategorileri içeren 6 haftalık bir eğitim verilmiştir. Bu eğitimde, öğrencilerin İngilizcenin yazı dili ve sesletimi arasındaki farklılıklardan kaynaklanan sesletim zorlukları konusunda farkındalık oluşturmaları amaçlanmıştır. Katılımcılardan eğitim öncesindeki veri toplama seanslarında ürettikleri sözcükleri ve eğitimde öğrendiklerini yeni sözcüklere uygulayabilme becerilerini belirleyebilmek için her bir kategoriye eklenen yeni sözcükleri tekrar sesli okumaları istenmiş ve bu üretimler eğitim öncesi ile karşılaştırılmıştır. Sözcüklere aşinalık seviyesi, veri toplama yöntemi ve kategoriler için yapılan betimsel analizler sonucunda Türk öğrencilerin kendi alfabelerinde birebir harf-ses eşleşmesinin olması sebebi ile düzensiz uyuma sahip İngilizce yazı dilinden etkilendikleri görülmüştür.

Anahtar Kelimeler: Yabancı dil öğrenimi, Harf-ses uyumu, Yazımın etkisi, Türk öğrenciler, Sesletim sorunları

ABSTRACT

ORTHOGRAPHY EFFECT ON THE PRONUNCIATION OF TURKISH EFL LEARNERS

Canan DEVECİ

Department of Foreign Language Education

Program in English Language Teaching

Anadolu University, Graduate School of Educational Sciences, June 2023

Supervisor: Prof. Dr. Handan YAVUZ

This study investigated the effect of spelling on the pronunciation difficulties of Turkish EFL learners who learn English as a foreign language in schools and generally with written materials. Considering the differences between the two languages in terms of grapheme-sound correspondences, 7 main categories and 26 subcategories were determined. Turkish EFL learners with a native background of transparent grapheme-phoneme correspondence may encounter problems when they learn a language with an opaque orthography. Words with different familiarity levels were selected for each category to determine whether familiarity had an effect. 61 students receiving preparatory education at a state university in Turkey participated in the study. The participants completed 4 tasks in 3 different sessions. The tasks included word repetition with audio form only, read-aloud and immediate word repetition after the audio, and immediate word repetition with the video form. The participants were then given a 6-week intervention which aimed to raise participants' awareness about orthography-induced pronunciations caused by the differences between the written language and pronunciation of English. Participants' productions of words before and after the intervention were analyzed. The results showed that the familiarity level of words, tasks and different categories showed an effect of orthography-induced pronunciation. A comparison of read-aloud task before and after the intervention revealed that the number of orthography-induced pronunciation was decreased.

Keywords: EFL, Grapheme-phoneme correspondence, Orthography effect, Turkish EFL Learners, Pronunciation difficulties

06.06.2023

ETİK İLKE VE KURALLARA UYGUNLUK BEYANNAMESİ

Bu tezin bana ait, özgün bir çalışma olduğunu; çalışmamın hazırlık, veri toplama, analiz ve bilgilerin sunumu olmak üzere tüm aşamalarında bilimsel etik ilke ve kurallara uygun davrandığımı; bu çalışma kapsamında elde edilen tüm veri ve bilgiler için kaynak gösterdiğimi ve bu kaynaklara kaynakçada yer verdiğimi; bu çalışmanın Anadolu Üniversitesi tarafından kullanılan "bilimsel intihal tespit programı"yla tarandığını ve hiçbir şekilde "intihal içermediğini" beyan ederim. Herhangi bir zamanda, çalışmamla ilgili yaptığım bu beyana aykırı bir durumun saptanması durumunda, ortaya çıkacak tüm ahlaki ve hukuki sonuçları kabul ettiğimi bildiririm.

Canan DEVECİ

06.06.2023

STATEMENT OF COMPLIANCE WITH ETHICAL PRINCIPLES AND RULES

I hereby truthfully declare that this thesis is an original work prepared by me; that I have behaved in accordance with the scientific ethical principles and rules throughout the stages of preparation, data collection, analysis and presentation of my work; that I have cited the sources of all the data and information that could be obtained within the scope of this study, and included these sources in the references section; and that this study has been scanned for plagiarism with "scientific plagiarism detection program" used by Anadolu University, and that "it does not have any plagiarism" whatsoever. I also declare that, if a case contrary to my declaration is detected in my work at any time, I hereby express my consent to all the ethical and legal consequences that are involved.

Canan DEVECİ

ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude and appreciation to all the people who have supported and guided me throughout my dissertation journey. Their invaluable contributions have played a significant role in the successful completion of this research.

First and foremost, I would like to express my deepest gratitude to my supervisor, Prof. Dr. Handan YAVUZ, for her invaluable guidance, support, and encouragement throughout the entire research process. Her expertise, dedication, and patience have been instrumental in shaping this dissertation. I am truly grateful for her mentorship and the inspiration she has provided. I am very fortunate to collaborate with her all through this challenging process.

I would also like to express my sincere appreciation to the members of the monitoring committee, Prof. Dr. İlknur MAVİŞ and Prof. Dr. Özgür YILDIRIM, for their detailed and helpful comments which made the theoretical basis of this study stronger. I am grateful for their time, dedication, and commitment to my academic growth.

Furthermore, I extend my thanks to the members of the thesis committee, Prof. Dr. Deniz ZEYREK BOZŞAHİN and Assoc. Prof. Dr. Oktay YAĞIZ, for their constructive feedback and suggestions.

I am also grateful for the support and encouragement of my friends who have been with me throughout this journey. Their belief in me and their words of encouragement have been a constant source of motivation.

Last but not least, I am grateful for my family's unwavering love and support.

Canan DEVECİ

June, 2023

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BrE : British English

AmE : American English

CEFR : Common European Framework of Reference for Languages

EFL : English as a Foreign Language

IPA : International Phonetic Alphabet

L1 : First Language

L2 : Second Language

NLM : Native Language Magnet Model

PAM : Perceptual Assimilation Model

PME : Perceptual Magnet Effect

RP : Received Pronunciation

SLA : Second Language Acquisition

SLM : Speech Learning Model

VWFA : Visual Word Form Area

1. INTRODUCTION

1.1. Background of the study

In settings where English is taught as a foreign language, students primarily learn the language in schools (instructed learners), and materials presented are often written; in other words, a substantial portion of their primary L2 input is composed of written input. Learners are therefore most frequently exposed to the orthography of the second language in the learning environment. However, according to Bassetti (2008, p. 192), pronunciation problems that would not exist if students relied only on auditory input are attributed to orthography. She states that such incorrect pronunciations as phone additions, phone omissions, and phone substitutions may result from the orthographic image of L2 phonology.

Exposure to written input is undoubtedly one of the most significant distinctions between the acquisition of L1 and L2 (Young-Scholten & Langer, 2015, p. 95). In L1 acquisition, children acquire the phonology of the language before reading, whereas younger and older L2 pupils acquire phonology through exposure to written L2 input. However, only few of the studies in L2 phonology examine the variable of the exposure to written input in the studies with L2 populations consisting of classroom learners. According to Bassetti (2009), Young-Scholten (2002), and Young-Scholten and Langer (2015), written input serves as an extra form of source in L2 phonology. When learners who are already capable of reading in their native language receive written materials in the target language during their L2 phonological development, it is highly possible for them to interpret L2 graphemes employing their L1 grapheme–phoneme correspondences. The role of exposure to written materials in the acquisition of a second phonology in a language such as English is crucial, as the visual representation of phonemes in the language is sometimes imprecise.

The variation between orthographic systems of languages, also known as orthographic depth, is an essential factor in orthographic input resulting in inaccurate pronunciations. Orthographic depth, as defined by Van den Bosch et al. (1994) is the extent to which the alphabetic system of a language diverges from a direct grapheme-to-phoneme correspondence with the two endpoints being transparent and opaque. This continuum's transparent end comprises languages with definite and straightforward

grapheme-to-phoneme correspondences. One phoneme corresponds to a single grapheme in an optimal situation. For example, some languages that are close to this side of the continuum include Turkish, Italian, and Spanish. As Öney and Durgunoğlu (1997, p. 2) express, the Turkish writing system has remarkably precise grapheme-to-phoneme correspondences. This means each letter represents a particular sound, and this representation does not change in different environments. Opaque orthographies, on the other hand, are distinguished by deviations from grapheme-to-phoneme correspondences. English, Hebrew, and Irish are examples of opaque orthographies (Erdener & Burnham, 2005, p. 1997).

According to the classification by Pennington and Rogerson-Revell (2019, p. 29), "English has an opaque orthography including not one-to-one but many-to-one (i.e., different phonemes are spelled the same way) and one-to-many (i.e., one phoneme is spelled in different ways) correspondence". Pennington and Rogerson-Revell (2019, p. 30) exemplify one-to-many correspondence with the homophone set *I*, *aye*, and *eye* containing the vowel phoneme /aɪ/ and many-to-one correspondence with the single letter o, such as in *do* /u/, *done* /ʌ/, *bosom* /ʊ/ (first syllable) and /ə/ (second syllable), *people* (unpronounced or silent o), and *word* /ɜ/ (or /ɝ/ in AE). In the same way, Khalilzadeh (2014, p. 4) exemplified the different sounds of "ough" in words *though* (like o in go), *through* (like oo in too), and *cough* (like off in offer). Thus, a learner of English cannot rely on the spelling of a word to predict the correct pronunciation.

In situations where a learner is literate in a language with transparent orthography and learning a language with opaque orthography, the mapping between the orthography and phonology of the two languages is crucial. As Roelofs emphasizes, "cross-linguistic differences in the degree to which orthography and phonology interact in speech production (are) perhaps related to differences in orthographic depth between languages". (2006, p. 37)

Turkish EFL learners' pronunciation performances are likely to be affected by the English orthography, as can also be predicted for other languages with transparent orthographies, and they may make errors due to the abovementioned reasons in terms of grapheme-to-phoneme inconsistencies. Lado (1957) names such errors resulting from orthography as problems of spelling pronunciation and presents two potential reasons. One of those problems is the use of different graphemes representing the same sounds in

the two languages and the learners' transfer from their native language. Lado explains the second reason as follows:

> The other possibility of spelling interference with pronunciation arises with the inconsistencies in the spelling of the foreign language. The symbol which in one word represents the one sound turns out to represent a different sound in another word. The student mispronounces the word by assuming that the symbol represents the same sound in both cases (p. 20).

1.2. Statement of the problem

Previous psycholinguistic research has demonstrated that orthography has an effect on word recognition and phonemic awareness (Cheung et al., 2001; Perre & Ziegler, 2008; Taft, 2001; Tyler & Burnham, 2006). However, few studies have been conducted on the influence of orthography in second language acquisition, even though the significance of orthography has been demonstrated in word recognition. As Simon and Herreweghe (2010, p. 303-304) report, the interest in orthography has primarily originated from psycholinguistics and acquisition of reading. Psycholinguistics and reading acquisition are the disciplines that have shown the most interest in orthography to date. Previous research in the field of psycholinguistics has frequently examined word recognition on the effects of the inconsistencies between spelling-to-sound and sound-to-spelling (as also used: grapheme-to-phoneme and phoneme-to-grapheme) (Pattamadilok et al., 2007; Ziegler & Ferrand, 1998; Ziegler, Ferrand & Montant, 2004; Ziegler, Petrova & Ferrand, 2008). The main objective of such studies is to find the way literate individuals map graphemes and phonemes in their minds. Goswami, Ziegler, and Richardson (2005) found that the introduction of reading affects a child's developing phonological system. A close relationship can be built between orthographic forms and their phonological representations.

Bassetti (2008, p. 192) states that the effect that L2 orthography has on L2 pronunciation is well-known by many language teachers. It is surprising, however, that only recently has systematic empirical research been conducted on the orthography effect in second language phonology. Within the first ten years of the 21st century, researchers began examining the orthographic effects on second language phonology. Some researchers have only just begun to consider the implications of the relation between orthography and phonology for the phonology of second languages (Bassetti, 2007;

Bassetti, 2008; Detey & Nespoulous, 2008; Erdener & Burnham, 2005; Escudero, Hayes-Harb & Mitterer, 2008; Silveira, 2009; Simon et al., 2010; Steele, 2005). There is a need for more research into L2 phonology to better understand what effects L2 orthography has and what factors could mitigate those effects.

There has been progress in terms of research investigating the effect orthography in L2 phonology, but for learners who have been learning a language for years (experienced learners), it is unclear to what extent orthography influences their language ability in oral production. The majority of previous research conducted on the orthography effect in the production of sounds has focused on either beginning speakers focusing on the initial phases of language learning (Rafat, 2011) or pseudowords (Hayes-Harb et al., 2010; Pytlyk, 2011; Silveira, 2009; Young-Scholten et al., 1999). Some studies with experienced L2 speakers focused on producing pseudo words (Escudero et al., 2008; Escudero & Wanrooij, 2010). Bassetti and Atkinson (2015, p. 67) state that by studying with pseudowords or artificial languages, the researchers can control confounding variables and study with a larger set of phonemes. However, they suggest that overreliance on novices and pseudowords could be substituted with other variables to prevent an overestimation of orthographic effects on phonology. Thus, there is a need for research examining various orthographic effects on experienced learners producing words that are real. More in-depth research is needed that specifically examines the impact of orthography and demonstrates how it affects experienced language learners who have had several years of exposure to the language.

Conducting one of the pioneering studies in this relatively new field, Bassetti and Atkinson (2015) suggest the effect of orthography on L2 phonology should be explored through direct comparisons between languages in future studies. At the same time, they also note that this should not be interpreted as orthographic input being as the only cause of the impacts seen. Other students' and instructors' phonological input, which may be impacted by orthography, may reinforce students' orthographic input. Such long-lasting results are expected among students who have spent the better part of their lives in a classroom learning English as a second language.

Considering the suggestions for further research in previous studies, Turkish EFL learners who come from a transparent L1 orthography background and spend years learning English as a foreign language at schools are appropriate to be investigated in terms of pronunciation of English. These individuals do not represent all students of

second language acquisition, but as a result of the high degree of phonological transparency in their native orthography, it is possible to conclude several effects that would also be observed in other languages with transparent orthography.

Studying the orthography effect in phonology in several languages, Hayes-Harb and Barrios (2021) published a review article on orthographic influence on pronunciation in which they revealed the scarcity of research on the subject of minimizing the impact of orthography on pronunciation. Few studies have specifically examined the effectiveness of therapies or instructional techniques to mitigate the negative consequences of orthographic input. To date, to my best knowledge, no study has demonstrated the use of instructional designs to counter the misleading impacts of orthographic input on L2 learners' pronunciation, and there is not enough research that explicitly investigates the efficacy of practices.

As a result of the above-mentioned review conducted by Hayes-Harb and Barrios (2021), there is a pressing need for more high-quality studies done in real classrooms. Also, they have raised some questions which are in need of answers to have a better understanding of the effect of orthography on L2 phonology. The questions included:

> "How does the degree of familiarity of a word interact with orthographic input effects—are these effects reduced for more familiar words?",
> "How does orthographic input affect the acquisition of a variety of phonological processes?",
> "Under what conditions can orthographic input effects be moderated through instruction?" (Hayes-Harb and Barrios, 2021, p. 322)

This study attempts to answer the questions raised by Hayes-Harb and Barrios (2021) by investigating experienced instructed Turkish EFL learners.

1.3. Purpose of the study

The purpose of this study is to examine the effect of the English orthographic system on Turkish EFL learners' pronunciation difficulties by discovering the impact of orthographic forms of English words on English (L2) production in experienced instructed learners who have been learning English for almost ten years at schools. The study addresses the research questions below:

1. Is there an effect of English orthography on Turkish EFL learners' pronunciation?

a) Does learners' performance vary depending on the level of familiarity with the words?

b) Does learners' performance vary depending on the level of orthographic and phonological input?

2. How do different categories of grapheme-to-sound correspondences affect orthography-induced pronunciation?
3. Does awareness-raising intervention have an effect on orthography-induced pronunciation?

1.4. Significance of the study

The theoretical basis of this research is that there needs to be more studies that examine the impact of orthography on pronunciation. According to the literature, most research has used the same kind of tasks and studied similar participants. This study, on the other hand, intends to synthesize prior research on the topic by using qualitative and quantitative data to examine the impacts of various factors, including task type, word familiarity, and a different study group, who are experienced language learners, in a single study. By identifying the categories that are seen as actual challenges for Turkish EFL learners who are from a transparent orthography background, this study is also intended to contribute to the current literature.

The second major concern of this research is how to mitigate the negative impact of spelling conventions by drawing attention to potentially misleading aspects of orthography. In addition to testing the intervention's impact on students' pronunciation, this study also delves into their impressions of it. Thus, the study aims to add to the field by using a mixed-methods research design to (1) categorize the orthography effect for Turkish EFL learners (who are a good representative of transparent orthography) and (2) attempt to make the learners aware of the orthographic influence. Given the differences in orthographic depth between these two languages, studying this element of language acquisition would provide considerable implications for EFL instruction, particularly in Turkey.

2. LITERATURE REVIEW

This chapter presents information from the literature on the relationship between pronunciation and orthography. First, the importance of pronunciation in language instruction and the challenges it provides for educators will be reported. Second, the orthography effect on phonological awareness will be given. Third, the orthography effect will be discussed in light of some well-known speech-learning theories. Fourth, pronunciation training methods will be presented. Then, the differences between Turkish and English languages concerning the writing systems of these two languages and the problems of Turkish EFL learners due to these differences will be shown from the studies. At the end of the chapter, the methodology of the previous studies in the field of orthography effect on pronunciation will be summarized.

2.1. Teaching pronunciation

Phonology, which was extensively studied just before the turn of the 20th century, has been largely ignored by linguists and philologists in favor of focusing on grammar and vocabulary. Kelly (1969, p. 87) calls phonology the “Cinderella” of this field. Since intelligible communication relies heavily on proper pronunciation, researchers have explored various aspects of pronunciation instruction, including its objectives, needs, difficulties, and requirements, despite receiving the least attention in language classrooms.

According to Khalilzadeh (2014, p. 14), the Turkish language testing system is a major contributor to the pronunciation issues of Turkish EFL students. Bekleyen (2007) claims that there is no need to teach pronunciation in Turkey because language exams do not include oral-aural parts. Students, as a result, do not bother working on improving their pronunciation. As all centralized exams and English lesson exams being held in the Turkish ELT system depend on grammar, vocabulary, and reading, teachers may put less emphasis on pronunciation. Since there is no expectation of assessment in this area, students see no reason to put any effort into improving their speaking and, therefore, pronunciation abilities.

The importance of pronunciation in second language oral skill acquisition is emphasized by Varasarin (2007), but the importance of this to language instruction and how much time and energy teachers devote to it are largely up to them as individuals.

Similarly, Levis (2005) argues that teachers' perceptions of the importance of pronunciation in language schools vary widely and that this perception has been mostly based on ideology and belief. Because of this, teachers of a foreign language have to depend on their judgment to determine which parts of pronunciation are most important and suitable for classroom instruction. Lord (2008), who examines the role of pronunciation in the classroom, explains another reason by arguing that teachers ignore it because they assume their students can figure it out independently without assistance.

Learners who struggle with pronunciation face difficulties in both social interaction and confidence. Gilakjani and Sabouri (2016) explain how accurate/proper pronunciation helps students feel good about themselves by explaining how poor pronunciation leads to miscommunication between speakers and listeners, a lack of confidence, and a negative impact on students' perceptions of their skills. Given this, it's reasonable to say that pronunciation is crucial to both the professional and personal success of language students. According to Gilakjani and Sabouri (2016), one of the most crucial aspects of learning a language is focusing on pronunciation because it facilitates communication between speakers of different languages.

Although researchers have revealed the importance of having intelligible pronunciation, this has raised doubts about the teachability and whether the time spent in the classroom is worthwhile. The possibility of teaching pronunciation depends heavily on teachers, and this makes them feel unsure of how much they can actually teach (Derwing & Munro, 2005; Morley, 1991). Baker (2014) and Sarıkaya (2013), in their studies conducted that teachers lacked both knowledge and classroom strategies. For this reason, the essential knowledge for teaching pronunciation was laid out in detail by Celce-Murcia, Brinton, and Goodwin (2010). Teachers are urged to know which aspects of pronunciation are most important to teach their students. Recognizing its nature as having many aspects, there is no agreement on which parts should be prioritized for effective communication and which may be taught successfully.

Imitation was the sole method of pronunciation teaching that had been developed up until the late 19th century. However, Dalton and Seidlhofer (1994) point out that imitation is unlikely to be effective for the vast majority of students and that it may work mainly for groups of learners with inherently good mimics. It uses rote memorization of information with no emphasis on understanding or instruction. Since then, there has been an appeal for more explicit methods of instruction, with the goal of drawing students'

attention to the pronunciation of the target language. As Celce-Murcia, Brinton, and Goodwin (2010) exemplified, these methods make use of a wide variety of resources, including the International Phonetic Alphabet (IPA) chart, articulatory descriptions, vocal apparatus charts, and contrastive data.

2.2. Orthography effect

Elias (2000) emphasizes the need for spelling training to enhance pronunciation to promote efficient communication. In terms of learning to read and write, it is unnecessary to focus on correct pronunciation. Conversely, pronunciation, along with spelling-to-sound correspondences, is vital for spoken language. Different levels of spelling-to-sound correspondences between native and target languages might cause L2 learners to mismap the graphemes and sounds.

The Orthographic Depth Hypothesis, proposed by Katz and Frost (1992), states that transparent orthographies are simpler for users to decode. Graphemes and phonemes are not always in one-to-one correspondence in all languages. A direct relationship between graphemes and phonemes characterizes a shallow, phonemic, or transparent orthography. There is a strong connection between the letters of the alphabet and the sounds they represent (Frost, 1998, p. 94). Some languages that use orthographic phonemics include Italian, Polish, Finnish, Spanish, and Turkish. Opaque orthographies, like English, French, and Chinese, are instances of languages where grapheme-phoneme matching is not highly accurate (Carr et al., 1979; Lems, 2012). But how different languages' orthographies reflect how they are spoken varies from one another. As Ellis et al. (2004) stated, students who learn to read in orthographies where the correspondence between graphemes and phonemes is straightforward appear to rely heavily on their own phonological knowledge when decoding a text. However, students who learn to read in orthographies where the grapheme-phoneme correspondence is weaker rely more on contextual cues within words.

Studying how orthography affects pronunciation can shed light on how literate individuals' brains map and conceptualize the relationships between graphemes and phonemes (Simon & Herreweghe, 2010). Much of the previous research has narrowly focused on the effects of orthographic variation on a single element of L2 speech production. For example, Vokic (2011) studied flaps showing L1 Spanish speakers learning American English produce the flaps with either /t/ or /d/ depending on the letters

in the orthographic form. This is an example of sound substitution, which is the most commonly observed orthographic effect. Bassetti and Atkinson (2015) report that when two languages map the same grapheme (single letter, digraph, or trigraph) onto distinct phonemes, this is called a grapheme-to-phoneme correspondence incongruity, and it's a common cause of substitution. However, non-targetlike production may also result from L2 orthographic forms, such as when L2 speakers insert a sound for a "silent letter", as /l/ in talk (/tɔːk/ in Received Pronunciation).

Pennington (1996) raised the hypothesis that L2 learners make incorrect connections between L1 and L2 sounds due to the written language's representation of the sounds. Word-final obstruents are always voiceless in German. English speakers learning German pronounce some German word-final obstruents as voiced, perhaps because they are spelled as voiced obstruents, for example, pronouncing [d] instead of [t] in <Bund> (Young-Scholten, 2002), even if their L2 acoustic input does not contain any voiced obstruents in word-final position.

Literature on the subject of orthography effect on spoken pronunciation has uncovered a number of results. While some studies found facilitating effects of orthography, most other studies concluded negative effects.

2.2.1. Facilitating effects of L2 orthographic input

Learners of a second language may benefit from an orthographic representation of the target phonemes in order to better perceive and internalize them. Learners of Japanese and Chinese, two logographic L1s, provide evidence of the positive impacts of orthography on their second-language acquisition. English as a Second Language (ESL) students from Japan often confuse *lip* and *rip*, and *clown* with *crown*. According to Bassetti (2008, p. 192), this is because the Japanese /l/ and the English /r/ are both phonetic realizations of the same underlying L1 Japanese phoneme. However, other researchers have suggested that Japanese ESL students who can articulate /l/ and /r/ only need to see whether an L2 word is spelled with an <l> or <r> to pronounce it correctly (Brown, 1998; Eckman, 2004). Furthermore, Steele (2005) asserted that Chinese learners of French interpret (and hence pronounce) the cluster as a consonant followed by aspiration. The orthographic representation, on the other hand, reveals that there are two consonants in the spoken word, which the L2 speaker must then produce.

Davidson (2010) and Zjakic (2017) observed similar facilitating effects of orthography in newly learned consonant clusters. Davidson (2010) studied how native English and Catalan speakers created nonwords with nonnative consonant clusters in nonwords. Participants completed a word repetition task in which they heard a word twice and then repeated it. For half of the words, both the spoken and written forms were provided. Davidson (2010) found that speakers of both languages performed better on a task in which words were presented in both spoken and written forms. However, the advantage associated with written forms in the input was moderated by phonological factors, suggesting that the input modality (spoken versus spoken plus text) interacted with the properties of the consonant clusters.

Similarly, Zjakic (2017) looked into how native Australian English speakers learned words with consonant clusters that were not in their language. There were two circumstances in which participants were taught word forms with nonnative consonant clusters along with pictorial meanings. In the audio + orthographic condition, participants also saw the written forms of the words' orthographic representations. They were then given a series of trials in which they had to differentiate between clusters of sounds that were quite similar in order to identify whether or not a given audio word matched a given visual one. After they had completed the word-picture matching test, students took a phoneme deletion test in which they were instructed to remove the first or second sound of each word and then enter what was left. Results from both tests showed that participants in the audio + orthographic group performed better than those in the audio group, indicating that orthographic input was helpful for non-native consonant cluster learning.

2.2.2. Negative effects of L2 orthographic input

As Bassetti (2008, p. 193) stated, in order to produce phonemes, preliterate children learning an L1 or L2 phonology must first be able to distinguish between them. Literate L2 learners may be able to produce phonemes they are having trouble perceiving because the orthographic input gives a visual and permanent analysis of the auditory information. When the L2 acoustic input is also reinterpreted in accordance with the L1 phonology, non-targetlike phonological representations of L2 phonemes, syllables, and words may occur.

The reinterpretation of L2 acoustic input stems from several sources. Learners of English as a Foreign Language (EFL) in a country like Turkey acquire the language mostly through classroom instruction and textbooks. However, it is worth noting that the relationship between orthographic input and acoustic input may be more complicated, as Bassetti (2008, p. 198) points out. The L2 spoken input may contain non-targetlike pronunciations due to the influence of orthography, and it is also possible that the L2 orthographic representation influences how phonology is perceived in the L2. Instructed learners' acoustic input may include orthographic pronunciations. Students need to be exposed to a variety of auditory input to learn from both their own mistakes and the mistakes of their peers, especially when the L2 orthographic representation leads to non-targetlike pronunciations. Furthermore, when giving the oral production of words, language teachers may unknowingly produce spelling pronunciations. Learners' own inaccurate recoding of the orthographic input may be reinforced by hearing these orthography-induced pronunciations as part of their spoken input during instruction. If a student pronounces a word differently from the target because of the L2 orthographic representation, that mispronunciation becomes a part of the classroom's acoustic input. There is also a possibility that language teachers may produce spelling pronunciations. These orthography-induced pronunciations may be part of instructed learners' spoken input, reinforcing their own incorrect recoding of the orthographic input. Bassetti (2008, p. 198) also notes the sounds that are represented in the orthographic representation of a language may not be present in the acoustic input, but the learners' mental representations of L2 phonology may cause them to hear them nevertheless. It is well known that second language (L2) learners hear sounds that are not actually present in the L2 auditory input due to the influence of native language phonology. Similarly, the orthographic input may cause L2 learners to include an extra phoneme, voicing, or consonant length in their mental representations of words. In that case, the L2 learner may actually hear the extra phoneme, voicing, or length in the auditory input. The complexity of the interplay between L2 orthographic input and L2 acoustic input is not to be underestimated.

Orthographic impacts on native phonology can be explained in two ways, as stated by Bassetti et al. (2020, p. 1221). One theory proposes that persons who are able to read and write do so because of a combination of orthography and phonology (Grainger & Ferrand, 1996; Ziegler & Ferrand, 1998). This is based on the hypothesis that the processes of producing and understanding speech involve the simultaneous activation of

orthographic and phonological representations of words. The other viewpoint asserts that many representations are impractical (Muneaux & Ziegler, 2004; Taft, 2006). Orthographic effects in speech perception and production arise when text-literate speakers' phonological representations of words are affected by the orthographic forms of those words. Effects generated by the interplay of L1 and L2 orthographies can only occur in L2 speakers (Bassetti, 2008), hence there may be quantitative and qualitative differences between orthographic effects in L2 speakers and native speakers. Reinterpreting L2 phonological forms in accordance with L1 phonology and L2 orthographic forms in view of L1 orthography-phonology correspondences, as Bassetti (2006) argued, is likely to alter L2 phonological representations. If this is the case, then second-language speakers' perception of the language should likewise show orthographic effects, just like when they produce speech.

2.2.3. Orthography effect on phonological awareness

With the metalinguistic perspective, Venkatagiri and Levis (2009, p. 263) define phonological awareness as "a construct, which is measured by how well learners can focus on the structure of the L2 system, in this case, the phonology". Being phonologically aware means being knowledgeable of and able to modify phonemes, onsets, rimes, and syllables (Bassetti, 2020, p. 1221). According to Yılmaz (2014), the major distinction between good and poor readers is their phonological processing capacity, which is in turn attributed to phonemic awareness. This suggests that one must first understand that letters stand for specific sounds.

There are a wide variety of exercises that can help students improve their phonemic awareness and ultimately their pronunciation. Traditional tests of this ability have used activities including counting, separating, and combining word and pseudoword sounds (Bassetti, 2020). These processes may include the recognition and classification of phonemes, the separation of words into phonemes, and the blending, deletion, and addition of phonemes to create new words. Castles and Coltheart (2004) suggest that phonological awareness can be better understood using these activities for research. Some studies have shown that using orthographic forms impacts native speakers' abilities to complete phonological awareness tasks. For instance, because there is an extra letter <t> in the word *pitch* /pɪtʃ/, L1 English readers count that word as having one more phoneme than the word *rich* /rɪtʃ/ (Ehri & Wilce, 1980, p. 373). It has been shown that

silent letters have an impact on phonology by causing native speakers to count more phonemes when engaging in phoneme-counting exercises. For second language acquisition, Lems's (2012) research shows a discrepancy between English language learners whose first language (L1) has a transparent orthography (such as Polish) and those whose L1 uses an opaque orthography (such as Bulgarian). According to Lems's research (2012), students whose L1 orthography is relatively opaque may need a longer time to develop the skills necessary for proper decoding and pronunciation of English words.

What occurs in people's brains when they read aloud has been the subject of research. Researchers Carreiras et al. (2009) found that when Spanish speakers read, they first process the words orthographically and then quickly activate phonological codes (p. 1118). This is a finding unique to the Spanish language, as the grapheme-phoneme relationship in Spanish is very strong. It is possible that the outcomes will vary between language pairs.

2.3. How does the brain respond to reading?

How do our brains allow us to instantly process written symbols? A recent study (Sutherland, 2015) indicates that a specific region of the brain uses visual cues rather than semantic ones to identify written words. The visual word form area (VWFA), which enables us to recognize full words as objects while reading, is a small region of the brain located on its surface just behind the left ear. VWFA has received a lot of attention in recent years because of its role in word recognition. The right hemisphere's counterpart to the VWFA is the *fusiform face region*, which plays a role in facial recognition. The VWFA region and the fusiform face area both react to faces in young children and the illiterate. The VWFA area is repurposed for word recognition as children and adults start to read.

During the experiment, the participants were shown both real and pseudowords. Many neurons in the VWFA responded to the pseudowords, while only a small proportion of neurons responded to real words. When individuals were trained to recognize pseudowords, neurons responded in the same way they would to real words. The researcher concluded that our brains must respond to the orthography of words rather than their meaning because pseudowords have no meaning. Therefore, when we acquire reading skills, we create a visual dictionary in the VWFA.

2.4. Prominent theories of L2 speech learning

Seidenberg and McClelland (1989) argue that the simultaneous engagement of orthography, phonology, and semantics is a defining feature of language processing. Alario et al. (2007), Van Orden and Goldinger (1994), and Van Orden et al. (1990) all point to a mutually reinforcing connection between the activation of different forms of linguistic information. Research has shown that people's ability to make lexical decisions or rhyming judgments about spoken words is impacted by the spelling of the words being used in the task (Seidenberg & Tanenhaus, 1979; Ziegler & Ferrand, 1998; Ziegler et al., 2004).

In this section, prominent theories and models concerning speech learning including the Phonological Restructuring Model (Metsala, 1997), Speech Learning Model (Flege, 1995), Perceptual Assimilation Model (Best, 1995), Native Language Magnet Model (Kuhl, 1992), and additionally the Dynamic Systems Theory (Van Orden & Goldinger, 1994) will be presented and discussed in terms of orthographic interference.

2.4.1. Phonological Restructuring Model

It has been suggested that the origin of orthographic effects in speech perception can be traced back to a period of development in which the incorporation of orthographic information modifies the structure of phonological representations (Goswami, 2002b). Phonological restructuring theory (Metsala, 1997; Metsala & Walley, 1998) provides a useful framework for explaining such a possibility. Evidence suggests that when children learn to read and spell, they employ orthographic information to reorganize, specify, and organize lexical phonological representations, but this model does not account for these processes. It is proposed that the time it takes to access a word with an inconsistent spelling is because words with inconsistent spellings can never acquire completely detailed phonological representations. Based on this explanation, one would expect the amount of the consistency effect to diminish as the task's reliance on accessing lexical representations reduces.

This model suggests that non-targetlike phonological representations of L2 phonemes result from the interaction between L2 orthographic input, reconstrued in accordance with the L1 rules on orthography and phonology, and the L2 acoustic input, as described by Bassetti (2008). The interplay between L1 and L2 orthography and

phonology is complex enough that explaining the relationship between orthographic input and acoustic input may be much more difficult. To begin, students of a foreign language, such as Turkish EFL students who have been learning English in schools for years, have a high probability of being exposed to orthography-induced non-targetlike pronunciations that are already present in the L2 spoken input in the classroom. This is because the non-targetlike pronunciations that other students produce as a result of the L2 orthographic representation become part of the acoustic input instructed students are exposed to. Second, learners' mental representations of L2 phonology could influence their perception, causing them to hear sounds that are not actually there but are reflected in the orthographic representation. For example, if a second language learner's mental representations of a word include an extra phoneme due to orthographic input, then that phoneme might actually be audible to them in the L2 auditory input. Matthews and Brown (2004) discovered that the phonology of their native language influenced the way Japanese EFL students perceived vowels in English perception tasks.

2.4.2. Speech Learning Model (SLM)

The Speech Learning Model (SLM), developed by James Emil Flege (1995), is a significant model in the study of second language acquisition of phonology. Because it contains many well-stated ideas about how L2 segments are processed and generated, it is a prime research arena. The SLM is based on four postulates and seven hypothesis. Flege's four postulates are, (1) the mechanisms that are used to acquire L1 can be utilized to acquire L2 as these mechanisms stay intact throughout one's lifetime. (2) the specifics of speech sounds or categories are stored in the long-term memory, (3) phonetic categories formed in childhood change throughout a lifetime, (4) the differences between the phonetic categories of L1 and L2 have to be kept even when those phonetic categories share a phonological space. These postulates served as the basis for a series of theories on second language (L2) speech acquisition.

There are seven hypotheses in this model. The SLM's initial hypothesis considers that sounds in L1 and L2 are perceived as similar sounds in certain positions within a word at an allophonic level. As for the second hypothesis, it claims that so long as the L2 sound is viewed as phonetically different from the nearest L1 sound, L2 learners can build new L2 phonetic categories. The third hypothesis states that the likelihood of differentiating an L2 sound from its nearest L1 sound increases as the perceived

dissimilarity between the two increases. This suggests that it is most challenging to differentiate and form a new phonetic category for L2 sounds that are similar to L1 sounds. Hypothesis four states that as a person ages, they will be less able to notice phonetic variations between the sounds of the two languages, especially when a sound is phonemic in L2 but not in L1. In the model, equivalence classification describes how an L2 sound is prevented from being categorizing sounds. It occurs when two different sounds, which are called diaphones, one from the L1 and one from the L2, are processed together using only one phonetic category. According to the fifth hypothesis, the equivalence categorization will lead to the production of these diaphones to be very similar. According to the SLM's sixth hypothesis, it may be the case that second-language speakers' phonetic categorizations will be different from those of monolinguals once they have fully developed. This may occur with L2 sounds that are differentiated from one another by features not used in the L1, or with L1 features that are used or adjusted differently in the L2. The seventh hypothesis states that L2 speaker would produce sounds based on their corresponding phonetic representation.

From the perspective of orthography effect on phonology, the second, third, and sixth hypotheses can be associated with the grapheme-to-phoneme correspondences between languages as the similarities and dissimilarities between L1 and L2 are central in this model.

2.4.3. Perceptual Assimilation Model (PAM)

Similar to the SLM, the Perceptual Assimilation Model (Best, 1995) does not include orthography as a significant factor in L2 speech acquisition. The core principle behind PAM is that foreign phonetic segments are perceived as being equivalent to the native phonemes that are most articulatorily comparable to them. PAM relies heavily on an emphasis on the similarity of perception. Since they are assimilated phonetically and phonologically into one single L1 category, the PAM anticipates that a learner will have tremendous difficulty differentiating between two such phones. The degree to which the L2 phones fit into the L1 category will determine how successful we are in overcoming this challenging perceptual integration.

Based on this concept, the degree of difficulty in understanding speech in a second language can be predicted, as described by Best (1995) and Best and Tyler (2007). Rather than relying solely on phonological contrasts, Best and Tyler (2007, p. 22) say that they

take into account “non-contrastive phonetic similarities and dissimilarities between L1 and non-native/L2 phones, including notions of phonetic goodness of fit, and the relationship between phonetic details and phonological categories and contrasts” when comparing L1 and L2 sounds.

When discussing the possibility of orthographic interference, Best and Tyler (2007, p. 27) simply address one such instance. They talk about how the French /r/ can be interpreted phonetically as a voiceless uvular fricative /ʁ/. Even though the English liquid /r/ and the French /ʁ/ sound extremely different, English speakers learning French often confuse the two due to orthography. Both the French and English phonemes /r/ is represented by the same grapheme in the two orthographic systems, but the researchers highlight the fact that both phonetic realizations can be learned as a way to demonstrate that distinct phonological categories can be learned.

2.4.4. Native Language Magnet Model (NLM)

The Native Language Magnet Model (Kuhl et al., 2008) proposes that at a young age, children organize familiar sounds into a mental “sound map”. After hearing hundreds of thousands of examples of the /i/ sound, for example, as in “daddy” and “mommy”, by the time they are six months old, children who are exposed to English are said to create a sound map in their brains that allows them to hear the /i/ sound clearly. Babies’ sound creations are idealized models with defined boundaries around each sound. As Kuhl (2000, p. 11853) states, “it functions like a magnet for other sounds” once a sound category has been established. This leads to categorical perception whereby varying articulations of a phoneme are not discerned.

A person’s ability to learn new patterns (such as those of a foreign language) can be hindered by their brain’s insistence on encoding previously learned patterns from their native language (Kuhl, 2007, p. 71). Because prototypical (modal) sounds act like magnets for surrounding sounds, it is hypothesized that infants would have a ‘perceptual magnet effect’ for native-language sounds (Kuhl, 2007, p. 73).

When it comes to explaining why some new L2 phones are more difficult to discern from others, NLM takes the SLA-favored stance of relying on the concept of prototypes. In L2 acquisition, prototypes function like magnets, drawing attention away from other noises and creating perceptual issues when the L2 phone is similar to a prototype. As a result, non-native speakers may have trouble differentiating between two sounds when

the prototype of an L1 category is similar to the two L2 phones (Kuhl, 1991). NLM-e (extended) operates on the following five principles: (1) distributional patterns and infant-directed speech are agents of change; (2) language exposure produces neural commitment that affects future learning; (3) social interaction influences early language learning at the phonetic level; (4) the perception-production link is forged developmentally; and (5) early speech perception predicts language growth (Kuhl et al., 2008, p. 982-985).

2.5.5. Dynamic Systems Theory

Most applied linguists, according to Ziegler, Ferrand, and Montant (2004), concur that SLA is a complex process, with many aspects such as motivation, aptitude, degree of input, and L1 all interrelated and impacting the L2 process of learning. While many of the major concerns in SLA research have been addressed, many of these studies have assumed a linear perspective because of the nature of the causal relationships they assumed.

Ziegler and Ferrand (1998) raise the question of why, given the superiority of speaking over reading and writing, orthographic effects should exist. The most direct response is provided by Ziegler et al. (2004) using the dynamic systems theory of word recognition (Van Orden & Goldinger, 1994). Word recognition is achieved using a highly interactive network that represents many forms of linguistic information (orthographic, phonological, and semantic). When there are discrepancies between these several units, it takes longer for the system to reach a steady state. Due to the network's sensitivity to spelling-to-sound mapping, it can easily adjust to the gradual consistency effect. As a person learns to read and spell, a close relationship develops between orthography and phonology. Word form components, therefore, contain both orthographic and phonological data. The automatic activation of orthography during speech recognition may, therefore, be due to the simultaneous activation of a large enough number of phonological neurons (by voice input) to fully ignite the entire word form assembly (Ziegler et al., 2004).

Phonological awareness is a strong indicator of future success in learning to read one's native language, according to research by Sparks, Ganschow and Javorsky (2000). Additionally, it has been claimed that difficulties with one aspect of language acquisition might spread to others (Van Orden & Goldinger, 1994). Therefore, problems with phonemic coding may have an impact on more than just the ability to read and write; they

may also affect the acquisition of oral language, both in perception and production (Sparks, Ganschow & Patton, 1995). It has also been demonstrated that phonological awareness and word recognition skills in L1 affect word recognition in L2 (Durgunoglu, Nagy & Hancin-Bhatt, 1993) and that native language literacy is an effective condition for the successful acquisition of a second language (Sparks & Ganschow, 1991). The assumption that difficulties in SLA are at least partly due to initial conditions butterflying their way through the process of second language acquisition is, of course, rather speculative. However, there is a growing body of evidence pointing to a causal relationship between issues with L1 acquisition and SLA (Ziegler et al., 2004).

Labov (1996) makes a similar argument on the root causes of L2 fossilization. Among the factors he cites as contributing to the development of L2 fossilization is the initial misinterpretation of sounds. Assuming that the processes of acquiring a second language are similar to those of acquiring a first, a person learning a second language may be more likely to internalize incorrect perceptions of sounds during the early stages of instruction, where they will remain until the learner is ready to move on. That is why it is possible for a language's lexicon or phonology to have an impact on others. This relationship evolves and changes with time, making it dynamic. As Lowie (2013) remarks, the cognitive system, which includes the language system, is embedded within the larger system and also interacts dynamically with the physical system of the body.

The above-mentioned theories, models, and approaches to speech learning all agree on one thing: L1 heavily influences L2 sound representations. Mis-mappings of sounds can hinder one's ability to completely acquire the target language phonology during the introductory stages of language learning. Even though it has been mostly ignored, orthography is critically important. In the earliest stages of learning a new language, students who are exposed to orthographic input through written materials may map the sounds of the target language based on their knowledge of their first language.

2.6. Conceptualization Theory in pronunciation training

As was said before, it may be difficult to correct grapheme-to-phoneme mismatches made early in the language-learning process leading to fossilization. According to Selinker (1972), it is difficult to reestablish the rules of phonological aspects correctly no matter how many times high-volume instructions are given since the fossilized errors occur throughout the inter-language stage. The adolescent years present

additional challenges to learning proper pronunciation, and while it is certainly possible to overcome these obstacles and achieve success, doing so is incredibly difficult and time-consuming. Fossilization, however, can be avoided if the L2 learner receives sufficient amounts of positive and cognitive feedback throughout the fixation period, as indicated by Brown (1994) and Vigil and Oller (1976). Hişmanoğlu (2007) also provides a remedy for the recovery of pronunciation issues such as fossilization employing minimal sentences, contextual sentences, and problem-based exercises in an interpersonal setting.

Fraser (2001) advocated conceptualization as a method of analytical language teaching. Fraser (2001) defines the notion as a means of getting students ready to notice the differences between the L1 and L2 sound systems. In order to fully grasp the concept of conceptualization, we must examine its historical implementation. This is the stage at which students in a certain educational system begin to realize the significance of a new sound pattern. As a result, their brain is better stimulated and able to set the appropriate functions for the noises they hear. Long-term proficiency is gained through conceptualization by delving further into the sound system and its formulations. The goal of this method is to use sequential stages to organize the most important phonological reference points in the brain.

In the Conceptualization Theory (Fraser, 2001), the following four components are prioritized: Learning the sound system in stages, Learning the phonetic alphabet and segmental sound structures, Structuring the cognitive mind map in learners, and Focusing on the stages of the sound system.

While certain phonemes between a learner's native language and the target language may be similar, there may be significant differences in the sound system between the two. Since the sounds in L2 are conceptualized differently, it is imperative that students alter their deeply rooted, problematic, and sound-related L1 concepts during the acquisition stage in L2, or else they risk serious difficulties in communicating in the target language (Celce-Murcia, Brinton & Goodwin, 2010). Sometimes, the necessary connection in the target language can be broken due to these communication issues. One of the purposes of this study is to increase student awareness of the potentially deceptive aspects of orthography, and this form of instruction is the key to doing just that.

2.7. Differences in English and Turkish phonology

This section will present the differences between Turkish and English in terms of orhographic depth and the challenges those variances present for Turkish EFL students. With the help of a scientific comparison between two languages, Lado (1957) argued difficulties in teaching a foreign language to L2 learners might be mitigated. Because of this, contrastive analysis has been a useful teaching tool. One of the main goals of contrastive analysis is to illustrate the similarities and differences between languages' phonological systems, morphological systems, and lexical meanings. Contrastive Analysis was developed and used in language teaching with a desire to find an effective method of teaching a second or foreign language (Lado, 1957).

When comparing the sounds of Turkish and English, the first step is to compare the writing systems of these two languages. Turkish writing system relies heavily on one-to-one correspondence between graphemes and phonemes. The Turkish alphabet consists of 8 vowels and 21 consonants, for a total of 29 phonemes. There is only one letter for each phoneme in Turkish, thus, there are a total of 29 letters in the Turkish alphabet. Consonants and vowels in the Turkish language are presented below.

Consonants:

b /b/
c /dʒ/
ç /tʃ/
d /d/
f /f/
g /g/
ğ –
h /h/
j /ʒ/
k /k/
l /l/
m /m/
n /n/
p /p/
r /r/
s /s/
ş /ʃ/
v /v/
y /j/
z /z/

Vovels:

a /a/
e /ɛ/
ı /ɯ/
i /i/
t /t/
o /ɔ/
ö /œ/
u /u/
ü /y/

English, on the other hand, uses 26 letters derived from the Latin alphabet. There are, however, 44 phonemes in British English Received Pronunciation (24 consonants and 20 vowels) give reference here. This means that there are only 26 letters to represent the 44 phonemes in English suggesting that there cannot be one-to-one correspondence

between graphemes and phonemes. Bayraktaroğlu (2008, p. 23) represents the 20 vowels (monophthongs and diphthongs) and 24 consonants which make up the whole range of 44 sounds used in British English Pronunciation are as follows:

Vowels and Diphthongs:

/iː/ - seed /siːd/
/ɪ/ - sit /sɪt/
/e/ - set /set/
/æ/ - sat /sæt/
/ɑː/ - hard /hɑːd/
/ɒ/ - hot /hɒt/
/ɔː/ - sword /sɔːd/
/ʊ/ - full /fʊl/
/uː/ - fool /fuːl/
/ʌ/ - hut /hʌt/
/ɜː/ - heard /hɜːd/
/ə/ - banana /bə`nanə/
/eɪ/ - hate /heɪt/
/əʊ/ - boat /bəʊt/
/aɪ/ - height /haɪt/
/aʊ/ - out /aʊt/
/ɔɪ/ - choice /tʃɔɪs/
/ɪə/ - fierce /fɪəs/
/eə/ - tear /teə/
/uə/ - tour /tuə/

Consonants:

/p/ - pea /piː/
/t/ - tea /tiː/
/k/ - key /kiː/
/b/ - bee /biː/
/d/ - deed /diːd/
/g/ - gay /geɪ/
/tʃ/ - cheese /tʃiːz/
/dʒ/ - judge /dʒʌdʒ/
/f/ - five /faɪv/
/θ/ - thigh /θaɪ/
/s/ - sigh /saɪ/
/ʃ/ - shy /ʃaɪ/
/h/ - high /haɪ/
/v/ - vine /vaɪn/
/ð/ - these /ðiːz/
/z/ - zeal /ziːl/
/ʒ/ - measure /meʒə/
/r/ - read /riːd/
/m/ - meal /miːl/
/n/ - kneel /niːl/
/ŋ/ - king /kɪŋ/
/l/ - lean /liːn/
/j/ - year /jɪə/
/w/ - west /west/

It is important to note that Turkish is a phonetic language, therefore Turkish native speakers tend to pronounce words based on their spelling patterns. In words such as *şair* and *şiir* in which two vowels follow each other each of these vowels is pronounced separately. This is not the case in English. English allows two consonant or two vowel letters to be pronounced as one sound, while Turkish does not.

Students might not have trouble picking the pronunciation if only the spoken version of English is presented to them. The difficulties come while attempting to study English as a foreign language in a setting where English is not spoken. Since written English is used by the student far more frequently than spoken English, and since English spelling is highly irregular and often does not correspond with pronunciation, this creates difficulties for Turkish EFL learners. When learning English, it can be difficult for Turkish students to decode words because the alphabet in English has 26 letters for 44 phonemes, whereas the alphabet in Turkish has 29 letters to reflect the 29 phonemes.

Error analysis studies on Turkish EFL students' pronunciation difficulties were undertaken by Bayraktaroğlu (2008) and Bekleyen (2011). The errors made by a group of 14 adult Turkish EFL students were analyzed by Bayraktaroğlu (2008), who used the characteristics of RP to categorize the errors as follows:

1. Phonemic errors: In Turkish, <s> and <z> always signify /s/ and /z/, respectively. However, in English, /s/ and /z/ are both represented by the grapheme <s>.
2. Phonemic distributional errors: The letter <r> is pronounced in all contexts in Turkish orthography because of its phonemic character. However, in English, the letter <r> is silent until it comes before a vowel in syllable-initial position, as in the word *story* /stɔɪɪ/.
3. Phonetic errors: An example of a phonetic error is the Turkish pronunciation of the English vowels /ə/ and /ɪ/ in unstressed syllables, which is the same as the sound represented by the corresponding orthographic symbol (i.e., pronouncing *address* /əˈdɪɛs/ as /ʌdˈɪɛs/.
4. Allophonic errors: In some English loanwords, the letter <j> is pronounced as /dʒ/, while in Turkish loanwords, it is pronounced as /ʒ/. Turkish English speakers followed Turkish pronunciation conventions and pronounced the letter <j> as /ʒ/ in the word *jet* /dʒɛt/ as /ʒɛt/.
5. Allophonic distributional errors: Although the letter <l> is silent in the pronunciation of many everyday English words, the phonemic nature of Turkish orthography causes it to be sounded as /l/ by native Turkish speakers (i.e., pronouncing the word *would* /wʊd/ as /ʊuld/.
6. Orthographic errors: Some English words end in <mb>, and the <b> is silent in pronouncing these words, but Turkish speakers pronounce this as /mp/. Since /b/ does not occur in final positions in Turkish, /p/ was substituted for it, making this an orthographic interference as well as a phonemic distributional interference.

Dental fricatives /θ/ and /ð/ are not present in Turkish. Turkish speakers use /t/ and /d/ in place of /θ/ and /ð/ since <th> is the only consistent orthographic representation for both sounds in English. It is possible that Turkish speakers have made substitutions due to a generalization of the two English phonemes that do not exist in the language. Based on the report by Bayraktaroğlu (2008, p. 13), Turkish speakers are said to have a tendency

to overgeneralize the phonemic representation of the English orthographic representation <th> of /θ/ and /ð/, and use it interchangeably.

In another study, Bekleyen (2011) transcribed classroom recordings of 43 adult Turkish EFL students and interviewed them about the reasons they made mistakes. Using characteristics of RP, Bekleyen (2011, p. 98) analyzed the errors and categorized them as follows.

1. Phonemes that do not exist in Turkish: /θ/, /ð/, /æ/, /ə/, /w/, and /ŋ/
2. The borrowed words with French, Latin, or Greek origin: i.e., *vague*
3. Words that may be pronounced in two different ways: i.e., *live, tear, content*
4. Silent letters: i.e., *answer, calm, debt, guard, guilt, scene*
5. Two letters are pronounced as two different phonemes: i.e., <au> in *cause, autumn, pause*
6. Two words that share the same spelling: i.e., *face* and *surface, mine* and *examine, able* and *capable*
7. Words pronounced differently after derivation: i.e., *analyze* and *analysis*
8. Weak and strong pronunciation of words: i.e., *a, the, do*

Taking the differences between Turkish and English and findings about the pronunciation problems of Turkish EFL learners into account, the present study aimed to classify orthographic interference in terms of grapheme-to-phoneme correspondences between Turkish and English. Below, the methodology of previous studies on orthographic interference in pronunciation are discussed.

2.8. Methodology of previous studies investigating orthography effect on pronunciation

The methodology of the previous studies conducted on investigating orthographic interference has common parts. In this section, the methodology of the previous studies conducted to determine the effect of differences in terms of the orthographic depth between the languages will be presented. Much of the relevant studies in the literature investigated consistent and inconsistent grapheme-to-phoneme mappings. Studies conducted on the effects of writing systems on phonology by far have considered three main points of view: script type, transparency, and congruence. As Hayes-Harb and Barrios (2021, p. 298) specified, studies on the writing systems can be conducted

considering (1) script type (logographic languages such as Japanese Kanji and Mandarin Hanzi and phonographic languages such as alphabetic English and syllabic Japanese Hiragana), (2) transparency (transparent orthographies such as Turkish and Spanish and opaque orthographies such as English and French), and (3) congruence (mappings of sounds between languages such as the grapheme <H> is the sound /h/ in English but /n/ in Russian).

When studies concerning orthographic depth are examined, three main ways of collecting data emerge: pseudowords, picture-naming tasks, and studies in different levels of orthographic and phonological input. For the studies conducted with pseudowords, the studies by Hayes-Harb, Nicol, and Barker (2010), Escudero, Simon, and Mulak (2014), and Bürki, Welby, Clement, and Spinelli (2019) can be given as examples. Hayes-Harb, Nicol, and Barker (2010) showed that native English speakers had difficulty acquiring a set of English-like nonwords under three different word learning conditions: congruent orthography, incongruent/congruent orthography, and auditory-only. The congruent group observed written forms that were consistent with English spelling rules. Those in the auditory-only group were given visual cues (pictures) besides auditory input. The incongruent/congruent group was also exposed to written forms, many of which did not adhere to standard English spelling rules. These forms fell into two categories: incongruent-extra-letter and incongruent-wrong-letter. The nonwords fell into one of three categories: congruent (their spellings are in keeping with standard English), incongruent-wrong-letter, or incongruent-wrong-sound. Participants in the incongruent/congruent group were more likely to accept the incorrect pronunciation than participants in the other two groups, suggesting an influence of the word learning condition on the incongruent-wrong-letter items. Thus, Hayes-Harb et al. (2010) showed that if there are discrepancies between the spelling patterns of an L2 and the native language, students may incorrectly recall the phonetic forms of words.

In another study, the effect of exposure to written forms was predicted by Escudero, Simon, and Mulak (2014) to be moderated by the degree to which different languages had different correspondences between graphemes and phonemes. They hypothesized that training with orthographic input would aid in word identification when grapheme-phoneme correspondences between L1 and L2 were similar but would impede recognition when the correspondences differed. 73 Spanish listeners with different proficiency levels in Dutch were taught Dutch pseudowords including Dutch vowels. Only half of the

participants heard auditory input, while the other half heard and saw the words both. Participants were asked to select the correct picture during the test to match the sound they heard. Target words were minimal or non-minimal pairs including contrasts to be simple or complex for Spanish speakers to process. Furthermore, incongruent and congruent grapheme-phoneme correspondences were used to classify challenging minimal pairs. Exposure to written forms had an effect on performance, but only if the grapheme-phoneme correspondences between the L1 and L2 were the same.

Native French speakers' ability to pick up English pseudo words was investigated by Bürki, Welby, Clement, and Spinelli (2019). 26 French-speaking participants who spoke English as a second language were instructed to visualize the meanings of the auditory pseudowords. Each participant was randomly assigned to one of two conditions: an audio-only presentation of the words or an audio-ortho presentation of the words, in which they would also see the spellings of the words. After that, they were asked to recall the words by naming pictures. The audio-ortho condition resulted in faster reaction times and more precise word naming. Although orthographic input may help with some aspects of word learning, it could hinder the development of target-like pronunciation, as evidenced by acoustic analyses of the productions showing that words in the audio-ortho condition were produced with more effects of French style rather than targetlike English pronunciations.

Using artificial languages or pseudowords, as stated by Bassetti and Atkinson (2015), enables researchers to control confounding variables and address the learning of a larger range of phonemes. However, when researchers only look at new speakers, people learning a new language, and those using pseudowords, they might be overestimating the impact of orthographic changes on phonology, thus, they recommend using real words in studies.

Previous research methods revealed a heavy reliance on picture-naming tasks. However, these analyses have mostly ignored other factors contributing to a language's orthographic influence. The following is a brief review of the research that has used the picture-naming tasks.

Participants in a study by Young, Scholten, Akita, and Cross (1999) were asked to match novel words with Polish consonant clusters to pictures in two conditions: Picture (hearing the word followed by seeing a picture of its meaning) and Word (hearing the word followed by seeing the word written). After that, they had two tasks: (1) identify the

pictures (without seeing the text) and (2) read the words. The results showed that the native Japanese speakers epenthesized more frequently than the native English speakers, both native language groups epenthesized more frequently than deleted consonants in the 'Word' condition, and all participants epenthesized more frequently than deleted when the written forms of the words were available at test time. The researchers take this to mean that epenthesis is encouraged by orthography.

Rafat (2015) studied how non-Spanish speakers of English pronounced Spanish assibilated/fricative rhotics. Participants were exposed to Spanish words with the assibilated/fricative rhotic in the word-final position (such as /aumař/) and their visual meanings. Those in the auditory-orthographic group also saw the written forms of the words. Participants were asked to give the names of the pictures. Based on his research, Rafat (2015) concluded that having access to the written forms affected participants' realization of the segments as rhotics. The hypothesis that the acoustics of the auditory forms encountered during training modulated the orthographic input effect was seen to be valid. These results show that native English speakers' capacity to learn Spanish assibilated/fricative rhotics is influenced by both the acoustic qualities of the input and the presence of written forms in the input. Thus, exposure to orthography has a significant impact on second-language word pronunciation.

In another study, Rafat (2016) specifically looked at the impact of grapheme-phoneme correspondences and different training and test settings on orthography-induced phonological transfer in the L2. 40 non-Spanish speakers of English completed a picture-naming task involving Spanish words with phonemes that are either the same as or different from their English counterparts. Training and testing settings included orthography during training and test, orthography during training, orthography during test, and auditory-only. The hypothesis was that orthographic input would encourage L1 phonological transfer in different grapheme-phoneme correspondences, not in the same grapheme-phoneme correspondences. Rafat (2016) found that the number of non-target-like pronunciations that could be attributed to orthography-induced transfer was higher for the three orthographic conditions than for the auditory-only condition. In addition, the number of non-target-like products varied between the orthography conditions, and the orthography during training and test and orthography during training groups yielded more non-targetlike pronunciations than the orthography during test group. Participants in the orthographic conditions showed orthography-induced transfer effects in L2 production

only when there were differences between the grapheme-phoneme correspondences in Spanish and English, as was hypothesized.

Polish speakers at an intermediate to advanced level learning German were investigated by Nimz and Khattab (2020) to determine how orthography affected the vowel length and quality of vowels they produced. The question was whether or not Polish students of German are better able to distinguish between long and short vowels when using orthographic signals for vowel length. In a picture-naming test, 18 Polish speakers learning German identified 48 words containing the three pairs of long and short vowels. Vowel length indicators existed in half of the words. Vowel length and quality were measured acoustically. When clues to vowel length were provided in the orthographic representation of the German words, the researchers found that Polish learners created a bigger difference between short and long vowels than when no cues to vowel length were present. They also proposed that a combination of auditory and orthographic information can create a new sound that is not present in either the first or the target language.

Studies using the picture-naming task have only examined one component of the orthography effect, such as consonant clusters or vowel length. The picture-naming task may not be adequate for more in-depth understanding of how orthoghraphy affects pronunciation. Research in this area has made use of a wide range of orthographic and phonological input levels and activities. Interfering effects of exposure to orthographic input have been shown in a number of investigations some of which are presented below.

Erdener and Burnham (2005) looked into how written input and audiovisual speech cues influenced the ability to pronounce novel words with non-native speech sounds. Participants were from both transparent and opaque orthographies: native Turkish and Australian English. These speakers who had never studied Spanish or Irish produced nonwords in those languages after being exposed to four different audiovisual conditions: auditory-only, auditory-visual, auditory-orthographic, and auditory-visual-orthographic. Their focus was on how the opacity of the learner's first language orthographic system affected the effectiveness of audiovisual speech cues. Although it was observed that orthographic input helped with the production of non-native speech sounds in general, it interacted with the group in such a way that Turkish speakers benefited from orthography when learning Spanish but made more mistakes when learning Irish. Australian English speakers showed minimal variation in their proficiency in Spanish and Irish. This shows

the transparency effect between the languages (see Orthographic Depth Hypothesis in this chapter).

The vowel difference between the French letters <u> and <y> was studied by Simon, Chambless, and Kickhöfel Alves (2010). Participants in the sound-spelling group were taught the spelling of the word in addition to hearing the sound and seeing the visual during the word learning phase. In the sound discrimination task, participants were asked to listen to a set of three novel words and then choose which of two vowels in words matched the sounds. There was no significant difference in performance between the sound-spelling and sound-only groups, demonstrating that in this instance, native English speakers' ability to discern the particular French vowel contrast was not affected by having access to written forms during word learning.

Most of the research above centered on acquiring pseudo words or novel word learning. Still, in order to prevent orthographic effects from being overgeneralized, Bassetti and Atkinson (2015) proposed that it was necessary to work with real students and words that were already familiar to them. The following is a summary of Bassetti and Atkinson's (2015) substantial work with real students and real language items, as opposed to the research mentioned above. This research with Italian students from a transparent orthography is a valuable resource for the current study with Turkish EFL students.

To provide a systematic view of the phenomenon, Bassetti and Atkinson (2015) conducted a series of studies with native Italian-speaking adolescents who had experience with the English language for several years. They ran a series of experiments to examine the impact of orthographic rules on the phonology development of experienced instructed Italian learners of English who had received formal instruction in the English language. As Erdener and Burnham (2005) pointed out in their study with Turkish natives and Australian English natives, native speakers of phonologically transparent orthographies like Italian may rely on orthographic forms more than native speakers of less transparent orthographies. Since Turkish has a transparent orthography as well, it stands to reason that similar outcomes will be observed, and the two sets of findings can be compared for further insight. In the Bassetti and Atkinson (2015) study, different linguistic aspects were analyzed to determine the consequences of the orthography effect. Four experiments took place including segments, morphemes, and words. They investigated the effect of orthography on silent letters in the first experiment, vowel length in the second, past tense marker <ed> in the third, and homophonic words in the fourth.

In the first experiment with silent letters, participants read words and completed an immediate word repetition task in which they saw the orthographic form of the word followed by its disappearance before hearing its pronunciation. Each word was analyzed by a skilled phonetician, who then assigned it a target-like or non-target-like classification. Findings revealed that while reading aloud, 86% of participants pronounced each target word with an additional phone, while only 56% did so in the word repetition task. This finding shows an obvious effect of orthography on learners' pronunciation including the grapheme, which was not present in the auditory input.

With the hypothesis that the number of vowel letters in an orthographic form of a word influences spoken vowel duration in the word-formation of L2 English speakers, Bassetti and Atkinson (2015) conducted a second experiment testing the orthographic effects on vowel duration. Vowel length in words like *scene* and *seen*, which both have the vowel /i:/ /si:n/ but in distinct orthographic forms (<e> and <ee>). Seven word pairs in English were used as targets, each of which had two words with the same target long vowel but different spellings. In this experiment, the participants only received a read-aloud task. Findings indicated that when the target long vowel was spelled with a digraph, participants produced it with a longer duration than when it was spelled with one vowel letter. This demonstrates that vowel length in the production of L2 speakers in a read-aloud activity is influenced by the orthographic forms of L2.

In the third experiment examining morpheme-level effects, the orthographic influences on the pronunciation of the past tense marker <ed< were investigated. The morpheme is always written with <ed>, and its three allophonic forms are not displayed in this spelling. Participants were given a printed sheet with the base form of 21 ordinary verbs and asked to produce the past simple. Analysis of the data using a nativelikeness criterion revealed that there is a correlation between the orthographic form of the past tense markers and the pronunciation of English L2 learners. The vowel epenthesis in /d/- and /t/-verbs and the voicing of /t/ are two possible causes of orthographic and phonological discrepancies.

The final experiment for the word-level effects evaluated the influence of orthographic form on the pronunciation of homophonic English words to see if their creations maintained the homophony. Different orthographic forms in transparent orthographies stand in for various phonological categories. Thus, it is reasonable for a second-language speaker to believe that two English words with different spellings must

have different pronunciations. Participants engaged in orthographic and auditory word reading aloud and word repetition. Words like *sun-son* and *aloud-allowed* were among the 12 pairs of homophones studied. Each pair of words was then coded as homophonic or non-homophonic depending on the results of an accuracy analysis. Reading aloud resulted in twice as many non-homophonic pairs as word repetition with orthographic and auditory input, and participants created non-homophonic versions of 40% of word pairs on average. Due to grapheme-to-phoneme correspondence in transparent orthographies, Italian EFL learners mapped different graphemes in homophonic words with different sounds.

Studies on the effect of orthography on pronunciation are listed above, taking into account the transparency between languages. As a broad literature review, the studies on the orthography effect are presented in Table 2.1 below.

Table 2.1. *Review of the studies on orthography effect on pronunciation*

Researchers	Study group	Target aspects	Tasks	Findings
Young-Scholten et al. (1999)	Native English and native Japanese speakers	Novel words with Polish consonant clusters	Two tasks Picture naming and read aloud	Orthography promotes epenthesis
Erdener & Burnham (2005)	Turkish speakers and native Australian-English speakers	Spanish and Irish new words	Novel word learning four experimental tasks: auditory-only, auditory-visual, auditory-orthographic, and auditory-visual-orthographic	Orthography-induced phonological transfers were observed for both groups of L1 backgrounds
Escudero, Hayes-Harb & Mitterer (2008)	Native speakers of Dutch	English words containing /ɛ/ and /æ/	Novel word learning with auditory forms and pictured meanings	Orthographic input supported the participants' encoding of the difficult contrast
Ziegler, Ferrand & Montant (2004)	Adult native speakers of French	French words in different grapheme-to-phoneme consistency levels	Three experiments including lexical decision, rime detection, and auditory naming	Substantial orthographic influences on phonological awareness task performance
Davidson (2010)	Adult native speakers of English and Catalan	Nonwords including initial consonant clusters	Word repetition with orthographic and acoustic input	Words presented with both orthographic and acoustic input were more accurate

Hayes-Harb, Nicol & Barker (2010)	Adult native English speakers	Non-words	Word-picture matching task in three groups: auditory-only, consistent auditory-orthography, inconsistent auditory-orthography	There is a relationship between orthographic and phonological representations for newly-learned words
Tyler & Burnham (2010)	Adult native speakers of Australian English	English words	Phoneme deletion task	There is a direct relationship between phonemic awareness and orthographically mismatched stimulus
Simon et al. (2010)	Native speakers of English	French vowel contrast in non-words	Word learning in two conditions: sound-only and sound-spelling	Access to written forms neither helped nor hindered discriminating vowel contrasts
Nimz (2011)	Turkish high school students	German vowels	Production task	Orthographic inconsistency between native and target languages affected learners
Vokic (2011)	Native Spanish speakers	English flap	Read-aloud	Participants produced the words using their native language grapheme-phoneme correspondence
Silveira (2012)	Adult native speakers of Brazilian Portuguese	Consonant-vowel-consonant (CVC) words in English	Sentence reading task	Orthography-induced L1 transfer
Escudero, Simon & Mulak (2014)	Native Spanish speakers in two groups: Dutch learners and naïve listeners with no exposure to Dutch	Dutch pseudowords	Listening task on minimal pairs	Exposure to orthographic input affected differently with congruent and incongruent grapheme-to-phoneme correspondences
Bassetti & Atkinson (2015)	Italian young adults	segments (silent letters and vowel length), morphemes (pronunciation of	Read-aloud Immediate word repetition	Orthography effect on pronunciation of segments,

		the past tense and past participle markers), and words (production of homophonic pairs)		morphemes, and words
Rafat (2015)	Native English speakers	Spanish rhotics	Novel word learning in two conditions: auditory-only and auditory-orthography Picture naming task	Availability of auditory input modulated the effect of orthography
Rafat (2016)	Native English speakers with no prior experience in Spanish	Spanish words containing either the same or different grapheme in English	Picture-naming task in four conditions: orthography during training, orthography during training and test, orthography during training, orthography during test, and auditory only	Different grapheme-to-phoneme correspondences in two languages resulted in orthography-induced transfer effects in L2 production
Nimz (2016)	Native Polish speakers	German vowel length	Judgement test with and without explicit length markers	No difference in performance
Veivo, Jarvikivi, Porretta & Hyona (2016)	Finnish native speakers	French words	Matching spoken words to written forms (their eye movements were recorded)	The effect of orthography differed depending on the participants' L2 proficiency level
Bassetti (2017)	Italian high school students	English consonants spelled with single and double letters	Read-aloud	Orthography-induced L1 transfer
Shea (2017)	Native English speakers	Spanish stops and approximants	Lexical decision task with orthographic and phonological input	In the presence of written forms, participants displayed more orthography effect
Zjakic (2017)	Native speakers of Australian English	Nonnative consonant clusters in newly-learned words	Word-picture matching test with audio form and repetition with audio and orthographic	Facilitative effect of orthography in consonant cluster learning

			form, phoneme deletion test	
Bassetti, Sokolovic-Perovic, Mairano & Cerni (2018)	Italian high school students	English homophones	Sentence reading	Different pronunciation of homophones
Bürki, Welby, Clement & Spinelli (2019)	Native speakers of French	English pseudowords	Auditory input matching to pictures in two conditions: auditory-only and audio-ortho	Orthographic input interfered with the development of target-like production
Nimz & Khattab (2020)	Native Polish speakers	German words including long and short vowels	Picture naming task with and without the presence of orthographic form	L1 grapheme-to-phoneme transfer

2.9. Studies including interventions on orthography effect

Although inquiry into how written language affects spoken language is a relatively new area of research, as a recent review of the literature by Hayes-Harb and Barrios (2021) shows, it has seen fast growth in recent years and now has a solid empirical base. The relationship between orthography and phonology, or phonological acquisition, has attracted the attention of researchers across the field of linguistics. Hayes-Harb and Barrios (2021) intended to compile studies that took different approaches to the issue of how phonology and orthography are related and what that would mean for first and second language acquisition. Several compelling findings, particularly those pertaining to the consequences of incongruent L1-L2 grapheme-phoneme correspondences, should inspire the research needed to ascertain the implications of this research for language teaching and learning. In addition, there is a dearth of studies that evaluate the effectiveness of treatments in detail. The studies that are relevant to this study have only examined short, laboratory-based therapies, and not incorporated instructional strategies aimed at reducing the detrimental effects of orthographic input on second language learners.

Studies on how orthography affects pronunciation are scarce, and even fewer have specifically examined the effectiveness of therapies or instructional strategies targeted at minimizing the negative impacts of orthographic input. With the effects of transparent and opaque orthography backgrounds, the studies showed that second or foreign language literate learners are affected by the orthography on pronunciation. Thus, specific

interventions are needed to help learners become aware of the discrepancies between written and spoken languages.

According to Kenworthy (1987), students who have trouble adapting to oral imitation during drills of repetition and imitation may not learn enough of the target language's sound system. The importance of having good ears for succeeding in oral imitation is emphasized by O'Connor and Fletcher (1989), who argue that those with bad ears may be unable to repeat the heard sounds accurately while imitating them. This suggests the need for additional strategies that rely less on students' aural abilities and more on the clarity of course materials and instructional methods. Teachers need to take into account the conceptual qualities of sounds so that students can understand the conceptual patterns of the sounds in the target language, as also pointed out by Geylanioğlu and Dikilitaş (2012, p. 39).

To determine whether students could accelerate their acquisition of word-final devoicing in German, Brown (2015) investigated the efficacy of phonetic training or explicit instruction on pronunciation. Four groups of native English speakers were formed at random: the spell-instruction group, the spell-no instruction group, the no spell-instruction group, and the no spell-no instruction group. Six minimal pairs of German nonwords were taught, each with a different final consonant. Students in the spell groups were shown the words in writing, while students in the instruction groups were given explicit instructions on how to pronounce the words. The participants in the spell groups and were less likely to devoice targets with voiced final consonants, suggesting a link between exposure to spelled forms and the failure to learn word-final devoicing. Finally, there was no statistically significant difference in the rates at which students in the instruction groups and students in the no spell groups devoiced voiced word-final consonants, indicating that instruction provided no obvious benefit for acquiring word-final devoicing.

Researchers Hayes-Harb, Brown, and Smith (2018) conducted an experiment to determine if educating students on the potential deceptiveness of written forms would help them overcome the effect. The interference of orthographic input could not be avoided despite the intervention. In a sepeate experiment, they tried to mitigate the effect of orthography by informing participants beforehand that the written versions of the words were deceptive, but this had no positive effect on the pronunciation accuracy.

Together, these results suggest that orthographic input has a significant impact on lexical-phonological development in L2, one that is difficult to counteract by intervention alone.

In addition to these brief interventions, Showalter (2020) tested whether textual enhancement and explicit instruction could mitigate the effects of incongruent orthography on the performance of naive native English speakers learning Russian words. However, neither condition resulted in an improvement in test scores.

Table 2.2 provides a summary of studies investigating the effect of intervention. As this is an area that is relatively new, there are not many research on how to mitigate orthographic influences on pronunciation.

Table 2.2. *Review of the studies implementing specific interventions for orthography effect*

Researchers	Study group	Target aspects	Intervention	Findings
Brown (2015)	Native English speakers	German minimal pairs	Explicit instruction on word-final devoicing	instruction provided no clear benefit for acquiring word-final devoicing
Showalter (2020)	Naive native English speakers	Russian words	Explicit instruction, textual enhancement	Neither of these brief interventions improved participants' performance at test
Hayes-Harb, Brown & Smith (2018)	Native English speakers	German-like words	Explicit information regarding the misleading nature of the written forms	No beneficial effect on their pronunciation accuracy

It is underlined in this chapter that more research needs to be done on the topic of orthography effect on pronunciation, as it is a relatively new discipline. Overgeneralization of orthographic effects is especially risky due to the fact that studies typically involve the same sort of study group and the same type of tasks. Studies using real students and language in more realistic situations are needed to better understand orthography-pronunciation relation, as suggested by Bassetti and Atkinson (2015) and Hayes-Harb and Barrios (2021). Taking into account the definition of orthography effect, prominent theories in speech learning, and prior investigations, this study seeks to provide a comprehensive study on orthography effect.

3. METHODOLOGY

This chapter presents the methodology utilized in the current study. Prior to the main study, two pilot studies were conducted to ensure that the pronunciation variations of Turkish students learning English are orthography-induced. Therefore, two pilot studies and their findings are reported first. Then, the methodology of the current study which is built on the findings of the pilot studies is described.

3.1. Criteria for determining the effect of orthography

To ensure that mispronunciations are due to orthography and not to other factors, the five criteria Bassetti (2008, p. 6) suggested for selecting the test words were reviewed and exemplified considering the differences between Turkish and English. The five criteria for choosing the words and their explanations for Turkish EFL learners are presented below:

- Pronunciations which do not exist in the L2 acoustic input: This property refers to mispronunciations due to a grapheme which is present in the orthography but not in the pronunciation of the native speakers, called a silent letter. For example, Turkish learners of English never hear the word *wrap* /ræp/ as /wræp/, or the word *answer* /ænsər/ as /ænswər/ in English speakers' speech. The pronunciation of the word *mosque* /mɒsk/ never occurs as /mɒskju:/ in the native speech. Due to the effect of the transparent orthography that Turkish has, Turkish learners of English tend to pronounce all the graphemes in a word presented to them through written input. Thus, the production of silent letters in pronunciation is due to orthography.
- Pronunciations which cannot be attributed to the influence of L1 phonology: This property refers to non-targetlike pronunciations that cannot be explained with the phonological rules and/or phonotactics of L1. For example, how Turkish learners pronounce morphemes for the past tense and past participle can be attributed to the phonology of Turkish. The past tense of regular verbs is spelled with <ed> in English, and this spelling does not correspond to any of the morpheme's three possible allophonic expressions: /t/, /d/, and /ɪd/. Turkish learners of English pronounce the <ed> marker for past tense always as /t/ due to the final devoicing rule in Turkish. In Turkish, voiced non-continuants (i.e., stops and affricates) are realized as their voiceless counterparts in word, or more specifically, syllable final

position. The constant pronunciation of /t/ in the places where it should be pronounced as /d/ or /ɪd/ cannot be explained by the orthographic effect but by the phonotactics of the Turkish language. As Turkish does not allow voiced stop /d/ word-finally, past tense forms with /d/ in English would most likely be realized as /t/ and never with /d/. On the other hand, the pronunciation of plural and third person singular <s> would be realized as /s/ even in the places where it should be pronounced as /z/ or /ɪz/. The effect of orthography can explain this as Turkish allows /z/, voiced fricative, in word-final position. Thus, Turkish EFL learners tend to have no problems pronouncing words ending in /z/ such as <*quiz*>. If Turkish learners can produce /z/ at the end of <*quiz*> but not at the end of <plays>, for example, then this would suggest such mispronunciation is due to orthography.

- Pronunciations which do not occur in the early phonologies of native-speaking children: This property refers to the phonological processes and developmental stages in EFL learners that are different from and not seen in the first language acquisition stages of English. As children acquire the sounds of their L1, they follow an order. As Ohala (2008, p. 32) states, certain sounds are just more difficult to properly pronounce (for example, /ð/ and /r/) thus, they are acquired late, which is also true for English consonant acquisition. In English, for example, /v/ sound is uncommon and typically acquired later while /w/ sound develops earlier. As Edwards and Zampini (2008) state, gliding occurs in many early words such as the substitution of the liquid sounds /r/ with /w/ and /l/ with /j/. For example, they might say "*the /*jaiˌjən/ *wawed"* instead of "*the lion roared",* or they might say "*wabbit"* instead of "*rabbit"* (https://www.babycenter.com/child/development/speech-and-language-problems-ages-2-to-4_65591). However, Turkish learners of English replace /w/ only with /ʋ/ (labiodental central approximant) due to the effect of orthography as Turkish does not have /w/, and /ʋ/, which is represented with the grapheme <v>, is the closest equivalent in their language. Even though /w/ sound is an early-acquired sound, Turkish learners substitute it with /ʋ/, which suggests that the problem that Turkish learners have with this sound is not due to acquisition order but orthography. Therefore, /w/ sound was included in this study. Interdental fricatives /θ/ and /ð/, on the other hand, were not included in this study, although they are problematic sounds for Turkish learners. /θ/ and /ð/ are late-acquired sounds which are not universally common and as a result, they are usually

substituted with other sounds by both children acquiring English as a first language and learners of English. Turkish learners of English replace /θ/ sound with /t/ and /ð/ sound with /d/, while speakers of other languages replace them with /s/ and /z/, respectively (Lombardi, 2003). The pronunciation problem of /θ/ and /ð/ for Turkish speakers, then is not due to orthography but the problem of /w/ can be explained with orthography.

- Pronunciations which are not traceable to universals of phonological acquisition: This property refers to non-targetlike pronunciations that cannot be explained with the universal acquisition order of sounds or markedness theory (Eckman, 1984). It is a universal tendency that marked features, meaning the ones that are not very common, are acquired later than unmarked features. The example of plural and third-person singular <s> mentioned above can also be shown as an example of this property. Since the voiceless consonant /s/ is less marked than the voiced consonant /z/ in word-final position, and therefore, /z/ might be realized as /s/ due to the markedness theory (Eckman, 1984). However, from the perspective of interlanguage, certain things cannot be attributed to either L1 or L2 as /s/ is acquired earlier than /z/ in the acquisition order of phonology. Unlike <ed> endings mentioned in the second property above, Turkish allows /z/ sound at the end of the words, and the pronunciation of <s> at the end of the plural words can be taken as a category to test the effect of orthography in pronunciation.

- Pronunciations which reflect L1 grapheme-phoneme conversion rules: This property refers to mispronunciations due to grapheme-to-phoneme correspondences in L1 and the rules determining their pronunciation. In Turkish, there is a one-to-one grapheme-phoneme correspondence. For example, due to the tendency to pronounce words the way they are spelled, Turkish learners of English realize each grapheme as a separate phoneme. They pronounce the <au> vowel digraph in the word *daughter* as /au/ instead of /ɔː/ and <ui>vowel digraph in the word *fruit* as /uɪ/ instead of /u/. These mispronunciations can be explained by the effect of orthography as they would not happen if learners of L2 were not already literate in L1.

In summary, taking these five criteria Bassetti (2008, p. 6) proposes as the starting point, mispronunciations by the learners of English can be explained by the effects of orthography when they do not exist in L2 acoustic input, are not affirmed in early

phonology of first language acquisition and cannot be explained in terms of effects of L1 phonology or universals of phonological acquisition. Instead, these can be explained by the fact that L2 orthographic input is recoded into phonological form in a way that is not targetlike.

3.2. Pilot studies

Two pilot studies were conducted based on the description of the orthography effect and the methodologies of previous studies exploring the orthography effect in pronunciation. Both studies are presented below with their purposes, procedures, and results.

3.2.1. Pilot study 1

Considering the orthography-phonology relationship between Turkish and English, the categories where Turkish EFL learners are assumed to be affected by English orthography were formed. The main categories were named based on the grapheme-to-phoneme correspondence in English. The first pilot study was conducted including 6 main categories and 18 subcategories. The main categories and subcategories are listed below with their inclusion criteria.

1. One grapheme – zero sound

Some words in the English language have silent letters in their orthographic forms. L2 learners of English may produce sounds for silent letters (e.g., climb) that the phonological input of native speakers does not have. The phenomenon of adding a sound where there is a grapheme but no corresponding sound is called orthography-induced epenthesis or orthography-induced phone addition (Bassetti and Atkinson, 2015; Hall, 2011). The silent letters that are used in the first pilot study are listed below:

<b>

Turkish learners might pronounce the word *bomb* /bɒm/either as /bɒmb/ or / bɒmp/. The pronunciation of <b> when it should not be pronounced is the effect of orthography – an orthography-induced phone addition or spelling pronunciation (Bassetti, 2008). However, pronunciation of /b/ as /p/ might stem from either markedness, which states that word-final voiced obstruents are marked (Eckman,

1984) or the phonotactics of Turkish as Turkish does not allow voiced stops (and affricates) at the end of words. Whether <b>, as in this example, is pronounced as /b/ or /p/ is irrelevant to the discussion of this study. Silent <b> was included to be investigated in word-medial and word-final positions.

<c>

Turkish learners might pronounce the word *scent* /sɛnt/ as /skɛnt/. The pronunciation of <c> with /k/, which is the closest letter they may map in their minds, is the effect of orthography.

<k>

Turkish learners might pronounce the word *knack* /næk/ as /knæk/. The pronunciation of <k>, where it should not be pronounced, is an orthography-induced phone addition.

<p>

Turkish learners might pronounce the word *pseudo* /suːdo/ as /psuːdo/ or /psedo/. The pronunciation of <p> where it should not be pronounced results from spelling pronunciation.

<l>

Turkish learners might pronounce the word *talk* /tɔk/ as /tɔlk/. The pronunciation <l> where it should not be pronounced is a spelling pronunciation.

<t>

Turkish learners might pronounce the word *castle* /kæsl/ as /kæstl/ or the word *glisten* /glısn/ as /glıstən/. The pronunciation of <t> where it should not be pronounced is an orthography-induced phone addition or spelling pronunciation, as Bassetti (2008) defines.

<w>

Turkish learners realize the semi-vowel <w> as a consonant and pronounce it as /ʋ/ which is the closest counterpart in Turkish. Thus, Turkish learners are expected to pronounce *wrap* /ɹæp/ as /ʋɹæp/, *answer* /ænsəɹ/ as /ænsʋəɾ/, and *law* /lɔ/ as /lʌv/. Major (2008) refers to such examples as sound substitution and states that learners substitute the closest L1 correspondent in the L2. Such substitutions can also be explained by the Speech Learning Model by Flege (SLM, 1995) and Perceptual Assimilation Model by Best (PAM, 1995). SLM predicts that the novel sounds will be easy to perceive and produce, while similar sounds between two languages will

be harder to perceive and produce. Similarly, since the sounds of one's native language can act as magnets, as Kuhl's Perception Magnet Effect (1992) suggests, PAM predicts that sounds can be integrated into a native category. The pronunciation of <w> was investigated in word-initial (*wrap)*, word-medial (*answer*), and word-final (*law*) positions.

2. One grapheme – multiple sounds

- Plural and third-person <s>

From the three pronunciations of plural, possessive, and third-person singular <s>, /z/ and /ɪz/ might be affected by the orthography (e.g., *fans* /fænz/ as /fæns/ or *kisses* /kɪsɪz/ as /kɪsɪs/. Although Turkish allows /z/ sound, which is a voiced obstruent at the end of the words, /z/ might be realized as /s/ due to the markedness theory (Eckman, 1984). To determine whether the realization of <z> as /s/ is due to markedness or orthography, words such as "quiz" were used as a control word. If Turkish learners can produce /z/ at the end of <quiz> but not at the end of <plays>, for example, then this would suggest such mispronunciation is due to orthography.

3. Two graphemes – one sound

- Vowel digraphs

Due to the tendency to pronounce words the way they are spelled, Turkish learners realize each grapheme as a separate phoneme. For example, they pronounce the word *fruit* /fɹuːt/ as /fruit/. The vowel digraphs included <ie> and <ui>.

- Consonant digraphs

Turkish learners pronounce the word *king* /kɪŋ/ as /kɪng/ or /kɪnk/. The pronunciation of the grapheme <g> is an orthography-induced phone addition. Learners map <n> and <g> as two separate phonemes instead of one -- nasal /ŋ/. The pronunciation of /g/ might turn into /k/ as a result of either phonotactics of Turkish or the markedness theory (which is irrelevant to the discussion of this study). The presence of /g/ or /k/ would indicate an orthography effect.

4. Two graphemes – no sound

- <ue>

Due to the same tendency mentioned in the previous category, Turkish learners tend to pronounce almost all the graphemes in a word. For example, Turkish learners pronounce the word *mosque* /mɒsk/ as /mɒskju:/.

5. No grapheme – one sound

- Palatalization

Palatalization refers to a phonological process whereby a sound develops palatal articulation. The reason for mispronunciations in words including palatalized consonants might be the absence of a grapheme in the spelling of the word. For example, Turkish learners pronounce the word *cube* /kjub/ as /kub/. Phonetically, palatalized consonants have a coloring on the sounds similar to /j/ (Demirezen, 2005, p. 43). Many Turkish learners of English have trouble pronouncing common English words like *cube, cute, huge, human, humid,* and *popular*. This category was added to determine whether the cause of mispronunciation in such cases might be due to the absence of a grapheme in the spelling displaying the necessity for the articulation of the invisible /j/ in the orthographic form.

6. Different graphemes – same sound

- Homophonic words

L2 learners may map different phonological forms onto homophonic words as they are spelled differently. For example, Turkish learners might pronounce the word *aloud* /əˈlaʊd/ correctly, while they pronounce its homophone *allowed* as /əˈllaʊvd/ with a tendency toward spelling pronunciation due to the presence of <w> in the spelling.

These 6 main categories and 18 subcategories, as also presented in Table 3.1 below, were included in the first pilot study. To determine whether the learners' pronunciation is affected by the orthography as assumed, a word list was prepared with words for each category including familiar, less familiar, and unfamiliar words as Fender (2008) proposes. The criterion of word familiarity was based on the Oxford Learners Dictionary wordlists of Oxford 3000 at the levels of A2 and B1. The study was conducted only with a "read-aloud" task as it was one of the most well-known and widely used methods to detect the effects of orthography on pronunciation. In the read-aloud task, only the orthographic input is provided, and the participants are asked to read the words. 10 students of A2 level were randomly selected from prep classes at the School of Foreign Languages, Ataturk University, and individual Zoom meetings were arranged for each student in March 2021. The reason for conducting the pilot study via Zoom meetings was that the Turkish government decided to continue with online education for universities from March 2020 to October 2021, as in many countries around the world, due to the pandemic caused by the new coronavirus (Covid-19) break out in the first months of the

year 2020. Each student joined the Zoom meeting and read the words on the PowerPoint Presentation with one word on each slide. The order of the words presented was randomly determined, each student saw the same set of words on the screen in the same order, and their pronunciations were audio-recorded. Following the completion of the task by all the students, the researcher listened to the recordings and decided whether the words were pronounced with the sign of orthography or not considering the reasons for the categories given above. Table 3.1 presents the words chosen for Pilot Study 1 and the results, along with the numbers of orthography-induced pronunciations by the students.

Table 3.1. *The results of pilot study 1*

Categories	**Familiar**		**Less Familiar**		**Unfamiliar**	
	Word	***f***	**Word**	***f***	**Word**	***f***
<b> (word-final)	bomb	10	thumb	10	crumb	10
<b> (word-medial)	debt	10	doubtful	9	subtle	10
<c>	science	0	scissors	2	scintillant	4
<k>	knife	1	knit	0	knapped	5
<p>	psychology	1	pseudo	9	psalmody	7
<l>	would	9	folk	10	palm	5
<t> (tle)	castle	4	wrestle	6	hustle	8
<t> (ten)	listen	0	often	0	glisten	5
<w> (word-initial)	write	0	wrap	2	wrist	3
<w> (word-medial)	answer	8	playwright	0	sword	10
<w> (word-final)	saw	10	law	10	flaw	10
<s>	books	0	plays	10	prizes	10
	laughs	0	fans	10	changes	10
Homophonic words	hire	1	which	0	sauce	10
	higher		witch		source	
<ie>	friend	0	field	5	shield	6
<ui>	fruit	6	guitar	4	guilt	5
<ue>	tongue	4	unique	2	plaque	4
Palatalization	Europe	0	beauty	1	cube	6
<ng>	sing	10	nothing	8	bringing	7

As can be seen from the table, the orthography effect was mostly found in the categories of what is called “silent letters” (<b>, <p>, <l>, <w>, <t>), the plural suffix <s> for /z/ and /ɪz/ sounds, vowel digraphs, consonant digraph <ng>, and mostly in less familiar and unfamiliar words.

Upon completing the read-aloud task, each student was asked the questions below to get an insight into their pronunciation learning background and the strategies they use for pronunciation with the aim that the replies might contribute to the methodology of the main study:

Questions for background information

1. At what age and at what grade did you begin learning English?
2. How long have you been learning English?

3. What is your educational background?
4. How did you learn English in your primary and secondary education?
5. Did you take any courses on pronunciation?
6. What is difficult in learning the pronunciation of English words? What causes trouble for you?
7. What is your perception of yourself in terms of pronunciation?

Questions about pronunciation strategies

1. What strategies do you use when you have to pronounce an unfamiliar word?
2. When you encounter a new vocabulary item, how often do you check its pronunciation?
3. How do you check the pronunciation of a new vocabulary item?
4. Do you check the pronunciation of the words you believe you already know?
5. Do you use any websites to practice pronunciation? If yes, which ones?

The results showed that the students in the prep classes at Ataturk University have been learning English for almost ten years starting from the 4th grade at the age of ten. In their final year of high school, English lessons were replaced by other lessons to allow them to focus on studying for the university entrance exam. Listening, speaking, and pronunciation were neglected throughout their period of learning English, and therefore they were mostly exposed to written input. This suggests, as Bassetti and Atkinson (2015) state, Turkish EFL learners who are instructed learners continuously exposed to written input in the first years of learning a language, are likely to show the effects of orthography in their pronunciation. For the question asking about the difficulty in English pronunciation, most students reported that the spelling and pronunciation of the words are different, and this difference causes difficulties for them. For the question asking about their strategy to pronounce an unfamiliar word, the most common answers were: "I try to pronounce them based on the words that I already know", "I try to pronounce them by likening them to the sounds of some specific letters put together", "I pronounce them the way they are spelled". These answers give an insight into the learners' reliance on orthography in pronunciation. To learn the pronunciation of new words, students reported that they listen to the pronunciation in online dictionaries "I check them by listening to the pronunciations on online dictionaries such as Tureng or Cambridge". Three students added that even if they listen to the pronunciation of the words, sometimes they cannot figure out what the sound actually is, and they said, "If I had known phonetic alphabet, I would learn the correct form of pronunciation." These answers to the questions for background information and pronunciation strategies were considered while planning the intervention to be applied in the main study.

Based on these results, the test words and categories were reconsidered, and some revisions were made for the second pilot study. New categories and new tasks were added

to be tested on the orthography effect. The changes and new applications are presented below in the second pilot study.

3.2.2. Pilot study 2

The findings of pilot study 1 revealed that Turkish EFL learners' pronunciation is affected by the orthography of English in the read-aloud task where only the orthographic input was provided. The second pilot study included a word-repetition task with auditory input as Bassetti and Atkinson (2015) suggested, in addition to "read-aloud" task. The aim of including auditory input was to determine whether the orthography effect was similar in the two tasks with different inputs.

Two tasks, including read-aloud (orthographic input) and word repetition (auditory input), were used by Bassetti and Atkinson (2015) to examine the orthographic effects on the pronunciation of the same words. They believed that the influence of orthography could be mitigated by exposing participants to a native speaker's model production of the word just before production. A second pilot study was conducted to test this hypothesis with Turkish EFL learners and also to test the new categories added considering the results of the first pilot study.

The second pilot study included the same 6 main categories as in the pilot study 1 but 22 subcategories with additional 4 new subcategories. The added subcategories were as follows:

- <c> (word-medial) was added to the category of *one grapheme-zero sound.*
- <s> plural suffix was divided into two subcategories as /z/ and /ɪz/ under the category of *one grapheme-multiple sounds.*
- <au> subcategory was added to the vowel digraphs under the category of *two graphemes-one sound.*
- <ng> subcategory was divided into two as <ng> (word-final) (words ending with <ng> as in *long* /lɒ/ɔŋ/*)* and <ng> (word-final (ing)) (words ending with <ing> morpheme as in *warning* /woɹnɪŋ) as consonant digraphs under the category of *two graphemes-one sound.*

A native speaker of American English with two years of experience as an English language instructor in Turkey audio recorded the pronunciation of each test word. Individual Zoom meetings were arranged for each student in April 2021. Instructions were provided orally in Turkish. All participants saw the same series of 75 words on the

computer screen in the same order. The order of the words in the list was determined randomly.

20 students who did not participate in the first pilot study participated in the second pilot study. The 20 students were divided into two groups randomly to test the effect of orthographic and auditory input. The students in the first group were asked to read the words presented in written form in the first stage, then in the second stage, they heard the words pronounced by a native speaker with the written form still visible before reading the words. These two tasks followed one another for each word. The students in the second group were asked to read the word presented in the written form in the first stage as the students in the first group, but in the second stage, the word disappeared and they heard the native speaker's pronunciation and repeated the word without seeing the written form (as in Bassetti and Atkinson's (2015) study).

The recordings were evaluated in terms of being orthography-induced or not by the researcher and by the native speaker who produced the auditory inputs. Table 3.2 presents the categories and the words used in the second pilot study and the findings with the number of orthography-induced pronunciations by the students in each group. The number on the left shows the numbers of the orthography-induced pronunciations in the read-aloud task, and the number on the right shows the word repetition task.

Table 3.2. *The results of pilot study 2*

Category	**Familiar**			**Less Familiar**			**Unfamiliar**		
	Word	**1**[1]	**2**[2]	**Word**	**1**	**2**	**Word**	**1**	**2**
<b> (word-final)	bomb /bɒm/[3] /bɒmb/[4]	10-6	9-7	limb /lɪm/ /lɪmb/	10-9	8-5	crumb /krʌm/ /krʌmb/	9-3	10-7
<b> (word-medial)	debt /det/ /debt/	9-7	10-10	doubt /daʊt/ /daʊbt/	10-4	10-6	subtle /sʌtl/ /sʌbtl/	9-7	10-10
<c> (word-initial)	scissors /sɪzərz/ /skɪzərz/	5-1	6-3	scent /sent/ /skent/	4-0	3-0	scintillant /sɪntɪlənt/ /skɪntɪlənt/	4-0	3-0
<c> (word-medial)	muscle /mʌsl/ /mʌskl/	4-0	3-0	obscene /əbsɪːn/ /əbskɪːn/	4-1	6-1	crescent /kresnt/ /kresknt/	3-1	2-0

[1] Group 1: Read-aloud - word repetition after the audio with the word still visible
[2] Group 2: Read-aloud - word repetition after the audio with the word invisible
[3] Correct pronunciation
[4] Orthography-induced pronunciation

<k>	knock /nɑ:k/ /knɑ:k/	0-0	0-0	knit /nɪt/ /knɪt/	0-0	0-0	knead /nɪ:d/ /knɪ:d/	3-0	2-0
<p>	psychology /saɪkɑ:lədʒɪ/ /psɪkɑ:lədʒɪ/	0-0	0-0	pseudo /su:doʊ/ /psu:doʊ/	9-6	9-8	psalmody /sɑ:mədɪ/ /psɑlmədɪ/	5-0	4-0
<l>	would /wʊd/ /wʊld/	10-3	7-4	folk /foʊk/ /fɔlk/	9-4	10-8	palm /pɑ:m/ /pɑlm/	10-3	10-5
<t> (tle)	castle /kæsl/ /kæstl/	5-1	6-3	hustle /hʌsl/ /hʌstl/	0-0	0-0	apostle /əpɑ:sl/ /əpɑ:stl/	4-1	4-2
<t> (ten)	listen /lɪsn/ /lɪstən/	0-0	0-0	often /ɔ:fn/ /ɔ:ftən/	0-0	0-0	glisten /glɪsn/ /glɪstən/	3-1	2-1
<w> (word-initial)	wrong /rɔ:ŋ/ /vrɔ:ng/	0-0	0-0	wrap /ræp/ /vræp/	0-0	0-0	wrist /rɪst/ /vrɪst/	2-0	2-0
<w> (word-medial)	answer /ænsər/ /ænsvər/	5-3	8-6	grown /grəʊn/ /grɔvn/	3-0	3-0	sword /sɔ:rd/ /svɔ:rd/	10-7	9-7
<w> (word-final)	saw /sɔ:/ /sʌv/	10-3	9-4	law /lɔ/ /lʌv/	10-3	9-2	flaw /flɔ:/ /flʌv/	10-4	10-3
/z/	plays /pleɪz/ /pleɪs/	8-5	9-5	bees /bi:z/ /bi:s/	0-0	0-0	deals /dɪ:lz/ /dɪ:ls/	8-4	9-4
/ɪz/	buses /bʌsɪz/ /bʌsɪs/	8-4	9-4	dishes /dɪʃɪz/ /dɪʃɪs/	8-4	9-4	prizes /praɪzɪz/ /praɪzɪs/	9-4	9-3
Homophonic words	hear here /hɪə(r)/	0-0	0-0	aloud allowed /əlaʊd/	10-5	9-2	caught court /kɔ:t/	7-4	8-2
<au>	daughter /dɔ:tə(r)/ /dautə(r)/	3-3	3-2	exhausted /ɪgzɔ:stɪd/ /egzaustɪd/	6-4	4-2	caution /kɔ:ʃən/ /kauʃən/	4-0	3-0
<ie>	piece /pɪ:s/ /pɪəs/	0-0	0-0	field /fɪ:ld/ /fɪeld/	5-1	3-0	shield /ʃɪ:ld/ /ʃɪeld/	4-0	2-0
<ui>	fruit /frʊ:t/ /frʊɪt/	8-2	6-2	guitar /gɪtɑ:r/ /gʊɪtɑ:r/	4-0	2-1	guilt /gɪlt/ /gʊɪlt/	6-0	8-3
<ue>	mosque /mɒsk/ /mɒskju:/	7-1	8-1	tongue /tʌŋ/ /tɔngu:/	7-2	5-0	opaque /əʊpeɪk/ /ɔpeɪku:/	9-2	8-1

Palatalization	duty /djuːtɪ/ /dutɪ/	4-2	3-1	huge /hjuːdʒ/ /hudʒ/	0-0	2-0	cube /kjuːb/ /kub/	3-0	3-0
<ng> (word-final)	long /lɒŋ/ /lɔng/	10-10	10-10	young /jʌŋ/ /jʌng/	10-10	10-10	along /əˈlɒŋ/ /ælɒng/	10-10	9-8
<ng> (word-final (ing))	sing /sɪŋ/ /sɪng/	9-9	9-9	painting /peɪntɪŋ/ /peɪntɪng/	7-6	5-3	bringing /brɪngɪŋ/ /brɪngɪng/	8-3	5-2

As can be seen in the table, there was more orthography effect in the read-aloud task than in the word-repetition task. However, some categories in the word repetition task also showed a high number of orthography-induced pronunciations. The students heard the correct pronunciation, but when they repeated the words, orthographic effects were still realized in their repetitions as they may have paid attention to the written form of the words at the beginning of the process.

The notable findings of the second pilot study are as follows:

- *daughter*: this word was put in the category for vowel digraph, but the study showed that the students had problems with the consonant digraph <gh> trying to pronounce it as /g/. Therefore, <gh> consonant digraph was added as an additional subcategory in the main study.

- *laughs*: this word was put in the category for plural <s> as a control word, but the study showed that the students tried to pronounce all vowels and consonants. Both vowel <au> and consonant digraphs <gh> were pronounced.

- *pseudo*: this word was put in the category for silent <p>, but the study showed that the students pronounced the word the way it was written including both vowels in the vowel digraph. For this reason, the words were analyzed further to ensure they do not show the effects of other categories.

- *subtle*: almost all students pronounced this word as /sʌbtl/. When they heard the correct pronunciation, they realized that one consonant was silent but were not sure which one and pronounced it as /sʌbl/. For this reason, in the main study, a new task was added in which the learners pronounced the word after watching a native model pronounce it.

Considering these findings, <gh> was added as a subcategory for consonant digraphs both in word-medial and word-final positions under the category *two graphemes-no sound*. The words such as *high* and *neighbor* contain <gh> consonant

digraph, but these two consonants are not pronounced. However, Turkish learners might pronounce the word *high* /haɪ/ as /haɪg/ and the word *neighbor* /nebəɹ/ as /negbəɾ/. <gh> subcategory was also added in the word-final position under the category *two graphemes-one sound.* Turkish learners might pronounce the word *laugh* /læf/ as /laug/ and force themselves to pronounce the /h/ sound. In addition to these consonant digraphs, when Turkish learners' efforts to pronounce all vowels were seen in vowel digraphs, the vowel trigraph <iou> was added as a new subcategory, and it constituted a main category named *three graphemes-one sound (or two sounds).* For example, Turkish learners may pronounce the word *gorgeous* /gɔɹdʒəs/ as /gɔɾdʒɪəs/ or /gɔɾdʒɪos/.

The two pilot studies conducted utilizing the methodologies of the previous studies revealed that, although with a limited number of participants, Turkish EFL learners' pronunciations are affected by the orthography of English. To further investigate the effects of orthography on the pronunciation of Turkish EFL students, the main study was expanded to include a larger group of students and a total of 26 subcategories of possible orthography effects. Additionally, two new tasks that differed from those used in previous studies were incorporated into the current study.

3.3. The main study

3.3.1. Research design

In the previous studies investigating the effect of orthography on pronunciation, generally, quantitative research has been used. In the current study, a quantitative approach has also been employed to explore the effect of orthography on the pronunciation of Turkish EFL learners in a number of different categories. Additionally, a qualitative design was included to gain further insights into the effects of an awareness-raising intervention given to the participants. As such, a mixed-methods research design was applied to answer the research questions of this study. One key advantage of this approach is, as Creswell (2009) stated, it allows researchers to draw on the strengths of both quantitative and qualitative methods while minimizing their weaknesses.

3.3.2. Participants

The participants consisted of 79 Turkish-native participants aged 18-20 who had been learning English since primary school.

A convenience sampling technique was utilized, and prep-class students at Ataturk University School of Foreign Languages were selected to be the sample of the study. In the selection of the student participants, a number of criteria were used. At the beginning of the fall semester, students were placed into two proficiency levels -- elementary and pre-intermediate – based on their scores in the placement test. To ensure that the level of the students was comparable (as some students did not take the exemption exam or left early), a CEFR test was given to the students at four elementary-level classes, and students at the A2 level were chosen. Then, those students were given a demographic information questionnaire on educational experiences (see Appendix-1), and students with similar backgrounds were chosen and invited to participate in the study. The primary inclusion criterion for the participants was to have received nearly ten years of English language instruction experience at schools in Turkey and mostly through written input. Therefore, the demographic information questionnaire included questions such as the school backgrounds and resources utilized in the English lessons.

Prior to data collection tasks, information about the study was provided to the participants, and they were asked to sign a consent form (see Appendix-2).

3.3.3. Categories and test words

Based on the results of the two abovementioned pilot studies, the categories and subcategories designed for the main study are as follows:

1. One grapheme-zero sound: *silent letters (12 sub-categories)*
2. One grapheme-multiple sounds: *plural <s> (2 sub-categories)*
3. Two graphemes-one sound: *vowel digraphs, word-final <gh> and <ng> (6 sub-categories)*
4. Two graphemes-no sound: *<ue>, word medial and word-final <gh> (3 sub-categories)*
5. Three graphemes-one sound (or two sounds): *vowel trigraphs (1 sub-category)*
6. No grapheme-one sound: *palatalization (1 sub-category)*
7. Different graphemes-same sound: *homophonic words (1 sub-category)*

Following the categorization, a word list of real English words was formed for each category. For each category, three words with different familiarity levels were chosen.

Prior to the study, students were asked to provide information on the books they used in their English classes and which skills they focused on. The majority of the students said that listening, speaking, and pronunciation were neglected throughout their period of learning English and that they were mostly exposed to written input. About the books, most of the students said that they used the books that were given by the Ministry of Education, only a small number used books from Oxford University Press.

Upon reviewing the references in Ministry of Education textbooks, it was found that the primary sources cited, especially for vocabulary were Oxford University Press, Longman, and Cambridge University Press. Thus, the levels of familiarity were determined based on the word lists defined for each CEFR level in these sources. The words at the levels of A1 and A2 included in the Oxford Learners Dictionary wordlist of Oxford3000 and the Longman Communication 3000 were scanned. The reasons for the inclusion of 3000 words are explained by Oxford and Longman as follows.

Oxford Learners Dictionary defines this list as follows:

> The Oxford 3000 is a list of the 3,000 core words that every learner of English needs to know. The words have been chosen based on their frequency in the Oxford English Corpus and relevance to learners of English. Every word is aligned to the CEFR guiding learners on the words they should know at the A1-B2 level. The words in the list have been selected based on two criteria: the frequency of the words in the Oxford English Corpus, a database of over 2 billion words from different subject areas and contexts which covers British, American and world English and the relevance of the words to English language learners, measured by their frequency in a specially created corpus of Secondary and Adult English courses published by Oxford University Press. This means that the lists cover the words that learners will come across in class and their study texts (Oxford Learners Dictionary).

Longman Communication 3000 is defined below:

> The Longman Communication 3000 is a list of the 3000 most frequent words in both spoken and written English, based on a statistical analysis of the 390 million words contained in the Longman Corpus Network – a group of corpora or databases of authentic English language. The Longman Communication 3000 represents the core of the English language and shows students of English which words are the most important for them to learn and study in order to communicate effectively in both speech and writing. The words that are in the Longman Communication 3000 in red are accompanied by special symbols: **W1**, **W2**, and **W3** for words that are in the top 1000, 2000, and 3000 most frequent words in written English, and

S1, **S2,** and **S3** for the top 1000, 2000 and 3000 most frequent words in spoken English (Longman Dictionary of Contemporary English).

From these lists, the words firstly at A1 and A2 level in Oxford3000 and the words included in the first two frequency groups in the Longman Communication 3000 were checked and the words showing the characteristics of each category were chosen for the familiar category. For example, for the silent <b> subcategory, the word *climb* exists at A1 level in Oxford3000 and W2 in Longman, thus selected for the "familiar" group. No words with silent <b> exist at A2 level. The word *bomb* occurs at B1 level in Oxford3000 and W3 in Longman, thus selected for the "less familiar" group. The word *crumb* is not included in any of the levels in either of the lists. Therefore, *crumb* was selected for the "unfamiliar" group. Table 3.3 presents the categories and words chosen for the main study.

Table 3.3. *Test words chosen for the main study*

Category	**Familiar**	**Less Familiar**	**Unfamiliar**
1.One grapheme – zero sound (no corresponding sound)			
<b> (word-final)	climb A1[5] – W2[6] /klaɪm/	bomb B1 – W3 /bɒm/	crumb /kɹʌm/
<b> (word-medial))	doubt B1 – W1 /daʊt/	debt B2 – W2 /dɛt/	subtle /sʌtl/
<c> (word-initial)	science A1 – W1 /saɪəns/	scent A2 – W2 /sɛnt/	scintillant /sɪntɪlənt/
<c> (word-final)	muscle B1 – W3 /mʌsl/	ascent /əˈsɛnt/	crescent /krɛsnt/
<k>	knock A2 – W3 /nɑk/	knit /nɪt/	knead /nid/
<p>	psychology B2 – W3 /saɪˈkɑlədʒɪ/	pseudo /sudo/	psalmody /sɑmədi/
<l>	talk A1 – W1	calm B1 – W3	palm /pɑm/

[5] A1, A2, B1, B2: from the Oxford3000 wordlist

[6] W1, W2, W3, S3: from the Longman Communication 3000 wordlist

	/tɔk/	/kɑm/	
<t> (ten)	listen A1 – W1 /lɪsn/	fasten B1 /fɑsən/	glisten /glɪsn/
<t> (tle)	castle A2 – W3 /kæsl/	hustle /hʌsl/	apostle /əˈpɑsl/
<w> (word-initial)	wrong A1 – W1 /ɹɔŋ/	wrap B2 – S3 /ɹæp/	wreak /ɹik/
<w> (word-medial)	answer A1 – W1 /ænsəɹ/	grown B1 – W2 /gɹəʊn/ or /gɹon/	sword /sɔɹd/
<w> (word-final)	law A2 – W1 /lɔ/	flaw B1 – W3 /flɔ/	crew /kɹu/
2. One grapheme – multiple sounds			
/s/	books A1 – W1 /bʊks/	plates A2 – W2 /plets/	cliffs /klɪfs/
/z/	plays A1 – W1 /plez/	bees B1 /biz/	crabs /kɹæbz/
/ɪz/	buses A1 – W2 /bʌsɪz/	prizes A2 – W2 /praɪzɪz/	witches /wɪtʃɪz/
Control words	dose doze /dəʊs/ (/dos/) /dəʊz/ (/doz/)	fuss fuzz /fʌs/ /fʌz/	cease seize /sis/ /siz/
3. Two graphemes – one sound			
Vowel digraphs			
<au>	daughter A1 – W1 /dɔtə(ɹ)/	exhausted /ɪgˈzɔstɪd/	caution /kɔʃən/
<ie>	piece A1 – W1 /pis/	belief B1 – W2 /bɪˈlif/	shield /ʃild/
<ui>	fruit A1 – W3 /fɹut/	guilt B1 – W3 /gɪlt/	bruise /bɹuz/

Consonant digraphs			
<gh> (word-final)	laugh A1 – W2 /læf/	rough B1 – W3 /ɹʌf/	tough /tʌf/
<ng> (word-final (ing))	during A1 – W1 /dʊɹɪŋ/	warning B1 – W2 /wɔɹnɪŋ/	being B2 – W3 /biɪŋ/
<ng> (word-final)	long A1 – W1 /lɒŋ/	along A2 – W1 /əˈlɒŋ/	gang B2 – S3 /gæŋ/
4. Two graphemes – no sound			
<ue>	colleague A2 – W2 /kɑlig/	tongue B1 – W3 /tʌŋ/	oblique /oˈblik/
<gh> (word-final)	high A1 – W1 /haɪ/	though B1 – W2 /ðo/	sigh /saɪ/
<gh> (word-medial)	neighbor A1 – W2 /neɪbəɹ/	straight A2 – W3 /stɹet/	frighten /fraɪtən/
5. Three graphemes – one sound (or two sounds)			
<iou>	religious B1 – S2 /rɪˈlɪdʒəs/	conscious S2 – W3 /kɑnʃəs/	gracious /gɹeɪʃəs/
6. No grapheme – one sound			
Palatalization	huge A2 – W2 /hjudʒ/	duty B1 /djutɪ/	humid /hjumɪd/
7. Different graphemes – same sound			
Homophonic words	hear here A1 – W1 /hi(ɹ)/	allowed aloud A2 – W1 /əˈlaʊd/	caught court /kɔːt/[7]

[7] The pair *caught* and *court* are homophonic in British English (BrE) but not homophonic in American English (AmE). Still, the pairs can be tested on the effects of vowel and consonant digraphs to check the homophony.

3.3.4. Data collection procedure

3.3.4.1. Preparing the stimuli

A native speaker of Received Pronunciation created voice and video recordings pronouncing each of the 90 test words. In the voice recordings, the speaker pronounced all of the 90 words one after the other with 5-second intervals in between. This recording did not include any visuals. In the video recordings, on the other hand, the face of the speaker zooming on the mouth was visible as the speaker pronounced the 90 words at 5-second intervals. The purpose was for students to see the mouth movements as the speaker pronounced the words. The reason for the 5-second intervals in both types of recording was for the researcher to manage the student recordings.

3.3.4.2. Recording sessions

The data was collected via individual sessions in three different recordings. The students were asked to attend all three recording sessions. All the sessions took place in a quiet classroom at the School of Foreign Languages, Ataturk University. Shure MV7 Podcast Microphone was used for all recordings, and the voice files were stored on Apple MacBook Pro. The tasks in the recording sessions included the same test words but in a different order for each task. The order of the tasks was as they were numbered (i.e., Task 1, Task 2, Task 3) and the same for all students. The details of the three tasks are presented below:

Task 1: *Immediate word repetition with audio form only*

In the first task, students heard the voice of the native speaker pronouncing the test words and were asked to repeat the word without seeing the orthographic form. The voice recordings of each word were presented in sequence after the student repeated the word. The order of the words was randomly determined. The reason for this task was to avoid any possible orthography effect on students' pronunciation, thus, students only heard the word they were to repeat without a visual stimulus, i.e., the orthographic form. This is in contrast to Task 2.

Task 2: *Read-aloud and immediate word repetition after the audio*

This task included two parts: read-aloud (orthographic form) and immediate word repetition (auditory form).

a. Read aloud: Participants were presented with the orthographic form of words and asked to pronounce the words they saw on the screen. The words appeared on PowerPoint Presentation on the computer screen with one word on each slide. The order of the words in the list was randomly determined. All participants saw the same series of words in the same order.

b. Immediate word repetition: Following the read-aloud task, the word disappeared (the orthographic form was removed), and the participants heard the pronunciation of the word produced by the native speaker. The participants were asked to produce the word immediately after they heard it.

These two tasks followed each other for individual words. For each word, first, the read-aloud was performed and then the immediate word repetition task was completed. The reason for this task was to compare orthographic effects on the production of the words with orthographic and phonological input; to determine whether the phonological input would reduce the orthography effect.

Task 3: *Immediate word repetition with the video form*

The third task needed a time interval as the participants saw the orthographic form and heard the correct pronunciation of the test words in Task 2. Similar studies mostly conducted all recordings in one session; however, this study separated the recording sessions to ensure that the participants would not remember the correct pronunciation performed by the native speaker in the second task and to reduce the effect of memory. Thus, the third task was conducted one week after the second task. As one week is considered appropriate for test-retest reliability (Marx et al., 2003, p. 730), a one-week break was given and not longer to minimize other interfering factors such as learning the words in other settings.

In this task, for each word, the participants saw the orthographic form, watched the mouth movements of the native speaker pronouncing the word then repeated the word. This task aimed to determine the effect of visual and phonological input in reducing orthography-induced pronunciations.

At the end of the data collection procedure, out of 79 students invited to participate in the study, 76 students completed the first task, 73 students completed the second, and 67 students completed the third task.

3.3.4.3. Intervention

67 students (48 females, 19 males) who completed all three tasks agreed to participate in the intervention. They were divided into two groups and received face-to-face intervention at Ataturk University School of Foreign Languages for 6 weeks, and each week included two sessions (1 hour on Wednesdays and 1 hour on Fridays). Thus, each group received 2 hours of instruction per week; 12 hours in total. The initial meeting began with instruction on the phonetic alphabet and transcription exercises. Each week, a new focus (one category of the study) was introduced. Table 3.4 presents the schedule of the intervention.

Table 3.4. *The schedule of the intervention*

Weeks	Topic
Week 1	**Phonetics** (IPA, Phonetic Transcription Exercises)
Week 2	**One grapheme-zero sound**
	Silent Letters
Week 3	**One grapheme-multiple sounds**
	plural <s>
	Different graphemes-same sound
	homophonic words
Week 4	**Two graphemes-one sound**
	vowel digraphs
	consonant digraphs
Week 5	**Two graphemes-no sound**
	vowel digraphs
	consonant digraphs
Week 6	**Three graphemes-one sound (or two sounds)**
	vowel trigraphs
	No grapheme-one sound
	palatalization

The intervention organized for this study involved awareness-raising activities that aimed to sensitize learners to the differences between the orthographic form and the pronunciation of the words in the selected target categories shown in Table 3.4. A sample

lesson plan used in one of the intervention sessions is given in Appendix-3. Structured activities focused on the difficulties identified in previous studies and explicit information on phonetics was provided. The primary objective was to help students become more conscious of their own interlanguage.

In each session, the students were presented with an explanation of the topic first, followed by practice. The practice part consisted of words from the corpora prepared for each category with recognition and production activities utilizing such pronunciation training methods such as conceptualization by Fraser (2001). Websites specifically for pronunciation instruction including text-to-speech tools such as *Natural Reader* and *ToPhonetics* were also utilized. Using *Natural Reader*, the participants saw the words both in isolation and within sentences and listened to the audio of a native speaker pronouncing them. Then, by using *toPhonetics*, the participants saw the words and their phonetic transcriptions side by side and listened to a native speaker's pronunciation within that website and repeated each word. The reason for using phonetic transcriptions in pronunciation teaching is explained by Celce-Murcia et al. (2005) as follows:

> While in dealing with pronunciation errors, which are specifically due to orthographic interference, phonetic transcription is a useful tool not only for teachers in teaching pronunciation but for creating some psychological distance between the English sound system and the writing system. Such separation helps both in teaching pronunciation and in presenting the correspondences between the English writing system and the English sound system. It is also useful for presenting some of the conventions of English spelling, which has many rules that are based in part on sounds (p. 270).

Reading phonetic transcriptions, as suggested by Celce-Murcia et al. (2005), can help students see the components of correct pronunciation, complementing their auditory understanding. Thus, phonetic transcriptions serve an important function in helping Turkish students separate their auditory impressions of English phonemes from their written representations. For example, the appropriate pronunciation of /ə/, which does not appear in Turkish, can be acquired through broad exposure to phonetically transcribed words. As stated by Cook and Bassetti (2005, p. 8), phonetic transcriptions are the only type of writing that accurately captures spoken language through direct correspondence between sounds and symbols.

The exercises in the intervention were presented by the listen-and-repeat approach, even though it is the oldest approach, it has been continually used in the teaching of

pronunciation. As Pennington (1996) states, focused listening improves oral production, and practice in oral production improves auditory perception.

3.3.4.4. Post Reflection Questionnaire

A questionnaire consisting of 8 statements on a 5-point Likert scale and 5 open-ended questions was prepared to determine students' perceptions about the effectiveness of the intervention (See Appendix-4). Three experts, one in the field of pronunciation teaching, one in the field of English Language teaching, and one in developing questionnaires in education were consulted and revisions were done based on their feedback. The questionnaire was administered online through google forms to all the students who participated in the intervention.

The items included reflections about the intervention and the open-ended questions attempted to receive a more in-depth reflection of what they learned and their perception of the learning that occurred during the intervention. Although the pronunciation of the students may not change in the short term, they may feel that they are more aware of the pronunciation-orthography relation in English which is the main objective of pronunciation teaching.

3.3.4.5. Post-intervention test

A post-intervention test was prepared in read-aloud format to determine whether the participants benefited from the intervention and gained awareness of the misleading sides of orthography. As the necessary time between the pre-test and post-test should be no less than 7 weeks in single group pre-and post-test design studies (Marsden & Torgerson, 2012, p. 589), the post-intervention was administered two weeks later via individual Zoom meetings. As the time for the post-test was the winter-break time and the students had no chance to perform the post-test face to face, Zoom meetings were chosen as the best alternative. The pilot studies were conducted via Zoom meetings due to the pandemic and no problems had occurred in data collection. Consequently, the post-intervention test was administered online (rather than waiting for students to return to school after the winter break) at the scheduled time to minimize external factors that may have arisen if the interval between the intervention and post-test had been longer.

The post-intervention test consisted of the same test words as in the three tasks and additional two new words for each category (a total of 134 words). These additional words were among the words that had not been practiced during the intervention and are not included in Oxford3000 and Longman3000 word lists, therefore, they are assumed to be unfamiliar to the participants. The students were asked to pronounce all the words presented with their orthographic forms to determine whether they gained awareness of the pronunciation of certain forms. All participants saw the same series of words on the computer screen in the same order. The researcher took observational notes on whether the participant hesitated and how long it took for s/he to produce the test words and then asked them about these words upon completing the test.

3.3.4.6. Data analysis: transcription of recordings

Of the 67 students who participated in the three data collection sessions and the intervention, 61 completed the post-intervention test. Therefore, the data for this study consisted of the voice recordings of 61 students from three sessions and one post-intervention test.

A total of 26,962 word recordings (4 tasks x 61 participants x 78 words = 19,032 + 7930 post-intervention test) were transcribed using IPA. A second rater trained in phonetic transcription transcribed 30% of the data (5832 words from the tasks and 2430 words from the post-intervention test data of 18 participants). Before the second rater began transcriptions, a training session in which five recordings were transcribed together was organized to familiarize her with the transcription process and use the same key to transcription (Appendix-5). Upon the completion of the transcription by the second rater, the transcriptions were analyzed to determine orthography-induced pronunciation. Transcriptions of words were analyzed only in terms of orthography-induced pronunciation and not mispronunciation due to other factors.

The next step was to determine the correct and incorrect pronunciation of each word, then whether the incorrect pronunciations were orthography-induced. The criteria for orthography-induced pronunciations had already been determined prior to data collection (e.g., if the pronunciation of the word *ascent* /əsɛnt/ includes the letter <c> as /k/ the pronunciation will be evaluated as orthography-induced, other incorrect pronunciation such as mispronunciation of *ascent* /əsɛnt/ as /ɛsənt/ will not be evaluated as orthography-induced). Then, the transcriptions by the researcher and the second rater

were compared and the discrepant ones were re-listened and re-transcribed together. To provide the reliability of the transcription of these words, a native speaker was consulted and a mutual ground was reached.

The discrepancies occurred in the categories of /ɪz/ and /z/, silent <b>, silent <l>, <w> ending, and <ng> ending. The inter-rater reliability was calculated for all categories. Cohen's Kappa was used to determine the amount of agreement between the raters for each category (orthography-induced or not). The results for the categories where discrepancies occurred are given in Table 3.5 below:

Table 3.5. *Inter-rater reliability for the discrepant categories between raters*

Category	Interrater Reliability
<b> (word-final)	,863
<b> (word-medial)	,954
<l>	,869
<w> (word-final)	,843
<ng>	,824
/z/	,856
/ɪz/	,948

As can be seen in Table 3.5, interrater reliability was found to be above .82 across categories which is considered high indicating a reliable agreement between the raters.

3.3.4.7. Data analysis

For the statistical analysis, each category determined for this study was evaluated with the sub-categories.

Frequency analysis as a descriptive statistical method was utilized to answer the research questions. The reason for this preference was that obtaining frequency and percentages of the orthography-induced pronunciations would be more meaningful answering the research questions of this study.

Statistical analyses were performed with the IBM SPSS 20 statistical analysis program. For all research questions, first, frequency and percentages were calculated and the number of orthography-induced pronunciations was obtained. After obtaining the descriptive results, to interpret the data in terms of significance in familiarity levels and tasks, the normal distribution of continuous variables was evaluated with the Shapiro Wilk-W test, Kolmogorov-Smirnov test, Q-Q plot, skewness and kurtosis. In the first

research question, the Kruskal-Wallis test was used to compare the familiarity level and tasks as the data was not homogenous. Post hoc tests were performed using Tamhane's T2 test. For the third research question, an additional Wilcoxon analysis was performed to interpret the results in terms of statistical significance. The statistical significance level was taken as $p<0.05$.

3.3.4.7.1. Post-reflection questionnaire

61 completed questionnaires were included in the analysis. First, frequency and percentages were calculated for the Likert scale. The aim of the Likert scale was to obtain the overall opinions of the participants about the intervention. Following the Likert scale in the questionnaire, five open-ended questions aimed to determine the participants' opinions about the intervention in depth, and content analysis was performed for these questions. In the content analysis, first, answers to the five questions were documented one by one for each question. The researcher carefully reviewed the answers several times to identify codes and then combine them into relevant categories, and finally reach broader themes. Then, five documents were loaded into MAXQDA 22, a software that enables qualitative data analysis, and were read multiple times, and coding was initiated. The coding was carried out using the open coding method which made it possible to determine the codes, themes and categories and identify the differences and similarities.

Table 3.6 summarizes the methodology of this study including the procedures of data collection in the main and pilot studies.

Table 3.6. *Methodology of the study*

Study	Participants	Material	Task	Data analysis
Pilot 1	10	6 main categories with 18 subcategories (57 words)	-Read-aloud	-Transcription of words -Frequency analysis
Pilot 2	20	6 main categories with 22 subcategories (66 words)	-Read-aloud -Word repetition	-Transcription of words -Frequency analysis
Main study	76	7 main categories with 26 subcategories (78 words)	-Task 1: immediate word repetition with audio form only -Task 2/a: read-aloud -Task 2/b: immediate word repetition after the audio	-Transcription of words -Frequency analysis -Kruskal Wallis analysis

			-Task 3: immediate word repetition with the video form	
Intervention	67	-	-	-
Post-reflection questionnaire	61	Likert scale and open-ended questions		-Frequency analysis -Content analysis
Post-intervention test	61	7 main categories with 26 subcategories and added 2 new words for each subcategory (134 words)		-Transcription of words -Frequency analysis -Wilcoxon analysis

4. RESULTS

This chapter presents first the statistical results obtained through the frequency analysis of the orthography-induced pronunciations after the transcriptions of the voice recordings and then content analysis results for the post-reflection questionnaire.

4.1. Orthography-induced pronunciations

To answer the first research question, whether English orthography has an effect on Turkish EFL learners' pronunciation, a total of 19,032 words from 61 participants were transcribed and analyzed. 4,166 (21%) of the total words showed orthography-induced pronunciation. As this result is across categories and word familiarity levels, further analysis was conducted for category, word familiarity level (familiar, less familiar, unfamiliar), and task variable (task 1: immediate word repetition with audio form only; task 2/a: read-aloud; task 2/b: immediate word repetition after the audio; task 3: immediate word repetition with the video form). To answer the first sub question, the frequency and percentages were calculated for each familiarity level. The results are presented in Table 4.1.

Table 4.1. *Orthography-induced pronunciations within familiarity levels*

	n	***f***	**%**
Familiar	6344	1267	20
Less familiar	6344	1322	20.8
Unfamiliar	6344	1577	24.9

As seen in Table 4.1, the number and percentages of orthography-induced pronunciations differ based on familiarity level; of the 6344 words, the pronunciation of 1267 (20%) words in the familiar level, 1322 (20.8%) words in the less familiar level, and 1577 (24.9%) words in the unfamiliar level were found to be orthography-induced. To determine whether the effect of familiarity level was statistically-significant, Kruskal Wallis was performed and the relationship among the three levels was found to be statistically not significant (p=.145). Although not significant, the percentages of orthography-induced pronunciations for the unfamiliar category are higher than the other two categories while the percentages for familiar and less familiar categories are similar. Figure 4.1 illustrates the distribution of orthography-induced pronunciations in percentages for the familiarity levels.

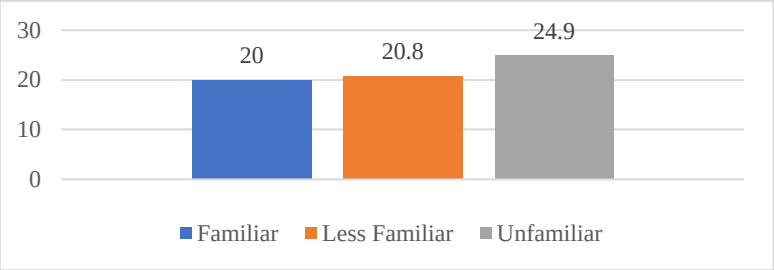


Figure 4.1. *The distribution of orthography-induced pronunciations for each familiarity level*

The second sub question concerned the effect of tasks. The results of the descriptive statistics for each task are presented in Table 4.2.

Table 4.2. *Orthography-induced pronunciations within tasks*

	n	***f***	**%**
Task 1	4758	415	8.7
Task 2/a	4758	2155	45.2
Task 2/b	4758	913	19.1
Task 3	4758	683	14.3

As seen in Table 4.2, the number of orthography-induced pronunciation differed for each task. Of the 4758 words in each task, 415 (8.7%) words in Task 1, 2144 (45.2%) words in Task 2/a, 913 (19.1%) in Task 2/b, and 683 (14.3%) in Task 3 showed an effect of orthography. To determine whether the effect of task was statistically-significant, Kruskal Wallis was performed. The result of the statistical analysis showed that the learners' performances in different tasks was statistically significant ($p<0,001$). Tamhane's T2 post hoc analysis was conducted to compare the four tasks in terms of orthography-induced pronunciations. The results showed a significant difference between Task 1[8] and Task 2/a[9], Task 1 and 2/b[10], Task 1 and Task 3[11], Task 2/a and Task 2/b, Task 2/a and Task 3. This suggests that hearing a native speaker's model production of the target word before production reduced the number of orthography-induced pronunciations. No statistically significant difference was found for Task 2/b and Task 3.

The comparison of orthography-induced pronunciation across tasks revealed several interesting findings. First, orthography effects were mostly found in Task 2/a (45.2%) in which students produced the written words. However, exposure to native

[8] Task 1: immediate word repetition with audio form only
[9] Task 2/a: read-aloud
[10] Task 2/b: immediate word repetition after the audio
[11] Task 3: immediate word repetition with the video form

speaker spoken input immediately before production and after removing the orthographic form from sight reduced the effects of orthography because the number of orthography-induced pronunciations was less in word repetition in Task 2/b and Task 3 than in the read-aloud task. The second highest effect was found in Task 2/b. The lowest number of orthography-induced pronunciations was found for Task 1 in which the orthographic form of the word was not included in the process. Figure 4.2 illustrates the distribution of orthography-induced pronunciations in percentages for the tasks with an apparent high percentage of Task 2/a.

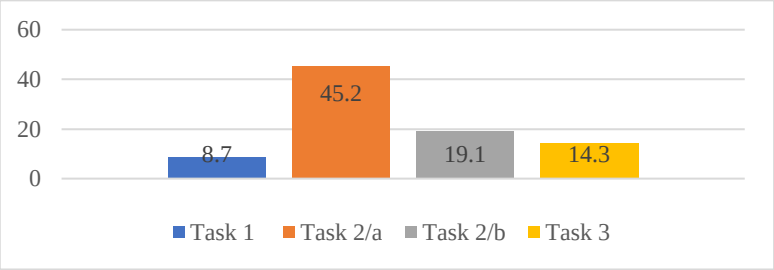


Figure 4.2. *The distribution of orthography-induced pronunciations for each task*

For the effect of the familiarity level in each task, a Chi-square was performed to show if there is an interaction between familiarity levels and tasks and the results indicated a significant effect of familiarity ($p<0.001$). The number and percentages of orthography-induced pronunciations for each task and familiarity level are presented in Table 4.3.

Table 4.3. *Orthography-induced pronunciations within tasks in each familiarity level*

	Familiar		**Less Familiar**		**Unfamiliar**	
	f	**%**	***f***	**%**	***f***	**%**
Task 1	152	36.6*	126	30.4	137	33
Task 2/a	591	27.4	708	32.9	856	39.7*
Task 2/b	281	30.8	302	33.1	330	36.1
Task 3	243	35.6*	186	27.2	254	37.2

*significant

Table 4.3 presents the number of orthography-induced pronunciations for each familiarity level in each task. As seen in the table, the number of orthography-induced pronunciations is high in the unfamiliar level for tasks 2/a, 2/b, and 3 while they are high in the familiar category for Task 1. The reason for this might be that the participants recalled the spelling of familiar words when they heard the pronunciation of them and were affected by their orthographies. The distribution of the orthography-induced

pronunciations in terms of familiarity levels of the words is illustrated for each task in Figure 4.3 below.

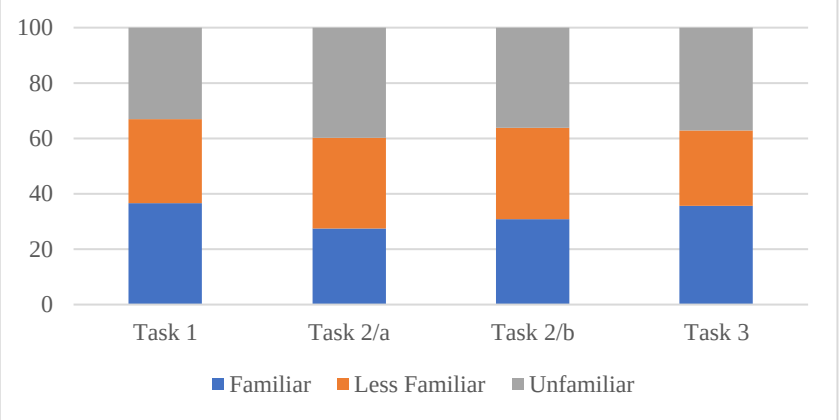


Figure 4.3. *The distribution of orthography-induced pronunciations within tasks in each familiarity level*

4.2. Orthography-induced pronunciations within categories

To answer the second research question concerning the effect of grapheme-to-sound correspondences on learners' orthography-induced pronunciation, the frequencies of orthography-induced pronunciations were calculated for each subcategory. The results for the main categories can only be discussed through the results of subcategories. Table 4.4 presents the results ordered from the highest to the lowest frequency.

Table 4.4. *Orthography-induced pronunciations within subcategories*

	n	***f***	**%**
/ɪz/	732	487	66.5
<w> (word-final)	732	431	58.9
/z/	732	358	48.9
<l>	732	339	46.3
<ng> word-final (ing)	732	312	42.6
<b> (word-medial)	732	302	41.2
<ng> (word-final)	732	296	40.4
<b> (word-final)	732	277	37.8
Homophonic words	732	159	21.7
<w> (word-medial)	732	153	20.9
<t> (tle)	732	152	20.7
<p>	732	128	17.4
<ui>	732	128	17.4
<t> (ten)	732	109	14.8
<au>	732	99	13.5
<ue> (word-final)	732	96	13.1
Palatalization	732	85	11.6
<c> (sc word-medial)	732	63	8.6

<iou>	732	55	7.5
<c> (sc word-initial)	732	33	4.5
<w> (word-initial)	732	30	4
<gh> (word-final silent)	732	23	3.1
<gh> (word-final)	732	20	2.7
<k>	732	16	2.1
<gh> (word-medial silent)	732	9	1.2
<ie>	732	6	0.8

As seen in Table 4.4, there are 26 subcategories under the main 7 categories of this study. The results show that the highest number of orthography-induced pronunciations occurred in the /ɪz/ subcategory (66.5%) followed by <w> (word-final) subcategory (58.9%) and /z/ subcategory (48.9%). The lowest number of orthography-induced pronunciations occurred in the <ie> subcategory (0.8%). Figure 4.4 below illustrates the distribution of orthography-induced pronunciations for each subcategory.

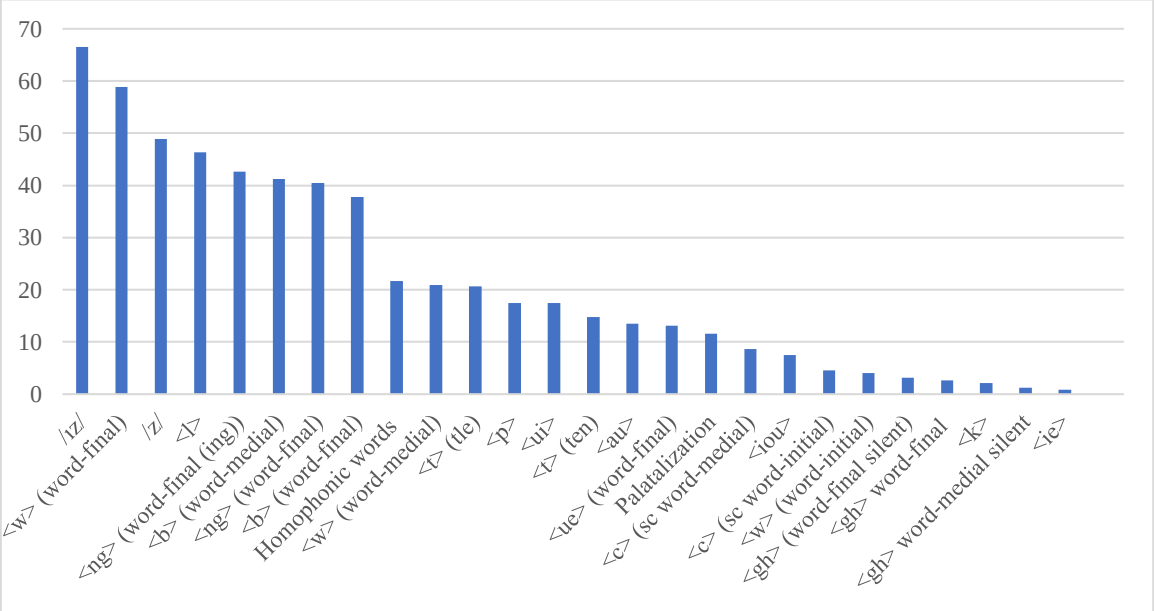


Figure 4.4. *The distribution of orthography-induced pronunciations within subcategories*

As seen in Figure 4.4, the first eight categories including /ɪz/ (66.5%), <w> (word-final) (58.8%), /z/ (48.9%), <l> (46.3%), <ng> word-final (ing endings) (42.6), <b> (word-medial) (41.2%), <ng> word-final (40.4%), and <b> (word-final) (37.8%) seem to affect the participants more than the other categories.

4.3. Orthography-induced pronunciations after awareness-raising intervention

For the third research question – whether an awareness-raising intervention has an effect on orthography-induced pronunciation - the number of orthography-induced pronunciations in Task 2/a (read-aloud) and post-intervention test were compared. As the post-intervention test included only read-aloud task, the results were compared to Task 2/a since both tests included the same task. Table 4.5 displays the comparison of the results of Task 2/a and the post-intervention test.

Table 4.5. *Orthography-induced pronunciations in task 2/a and post-intervention test*

		Task 2/a		**Post-intervention test**	
	n	***f***	**%**	***f***	**%**
Orthography-induced pronunciations	4758	2155	45.2	874	18.3

In Table 4.5, the number and percentages of orthography-induced pronunciations in Task 2/a and the post-intervention test are given. The results show that there is a great decrease in the orthography-induced pronunciations after an awareness-raising intervention. This suggests that the intervention helped the participants to become aware of the differences between spelling and pronunciation in English. After the intervention, 18.3% of the words showed orthography-induced pronunciations while this percentage was 45.2% before the intervention. To determine whether the difference in the orthography-induced pronunciations before and after the intervention was statistically significant, a Wilcoxon analysis was performed. The result showed that the difference between the participants' performance in Task 2/a (read-aloud) and post-intervention test was statistically significant ($p<0,001$). Thus, this finding suggests that the type of awareness-raising intervention utilized in this study was useful in reducing the participants' orthography-induced pronunciations.

To determine whether the number of orthography-induced pronunciations in the post-intervention tests have decreased across familiarity levels, the number and frequencies of orthography-induced pronunciations in Task 2/a and post-intervention were compared. The results are displayed in Table 4.6.

Table 4.6. *Orthography-induced pronunciations within familiarity levels for task 2/a and post-intervention test*

		Task 2/a		Post-intervention test	
	n	***f***	**%**	***f***	**%**
Familiar	1586	591	37.2	372	23.4
Less familiar	1586	708	44.6	270	17
Unfamiliar	1586	856	53.9	232	14.6

As seen in the table, the number of orthography-induced pronunciations in the post-intervention test are lower than those of Task 2/a in all three familiarity levels. However, while the number of orthography-induced pronunciations were highest for the unfamiliar group in Task 2/a, it was highest for the familiar group in the post-intervention test. Nonetheless, it is worth noting that awareness-raising intervention helped Turkish EFL learners become aware of the effects of spelling on pronunciation albeit more in less familiar and unfamiliar words. Figure 4.5 displays the distribution of orthography-induced pronunciations in Task 2/a and the post-intervention test for each familiarity level.

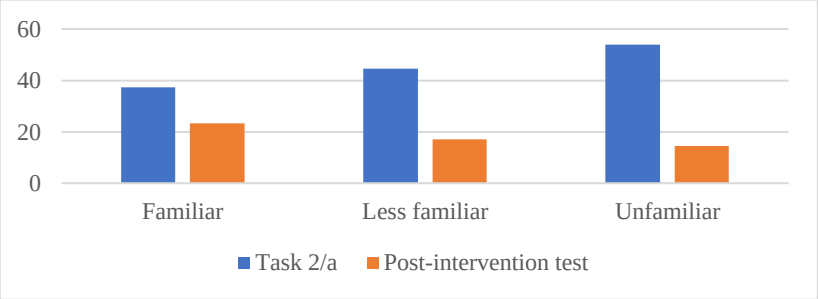


Figure 4.5. *The distribution of orthography-induced pronunciations in task 2/a and post-intervention test for each familiarity level*

As an apparent decrease in the number of orthography-induced pronunciations was observed in the post-intervention test, a detailed analysis was conducted to determine in which categories the orthography-induced pronunciations have decreased. Table 4.7 presents the orthography-induced pronunciations in Task 2/a and the post-intervention test within the subcategories of each main category.

Table 4.7. *Orthography-induced pronunciations within categories for task 2/a and post-intervention test*

		Task 2/a			Post-intervention test	
		n	***f***	**%**	***f***	**%**
One grapheme-zero sound	<b> (word-final)	183	126	68.8	32	17.4
	<b> (word-medial)	183	157	85.7	22	12

	<c> (sc word-initial)	183	33	18	24	13.1
	<c> (sc word-medial)	183	62	33.8	8	4.3
	<k>	183	16	8.7	4	2.3
	<p>	183	102	55.7	30	16.3
	<l>	183	152	83	30	16.3
	<t> (ten)	183	82	44.8	8	4.3
	<t> (tle)	183	101	55.1	14	7.6
	<w> (word-initial)	183	19	10.3	0	0
	<w> (word-medial)	183	95	51.9	39	21.3
	<w> (word-final)	183	160	87.4	89	48.6
One grapheme-multiple sounds	/z/	183	116	63.3	101	55.1
	/ɪz/	183	165	90.1	123	67.2
Two graphemes-one sound	<au>	183	89	48.6	75	40.9
	<ie>	183	4	2.3	0	0
	<ui>	183	85	46.4	32	17.4
	<gh> (word-final)	183	16	8.7	0	0
	<ng> (word-final (ing))	183	114	62.2	48	26.2
	<ng> (word-final)	183	122	66.6	59	32.2
Two graphemes-no sound	<ue> (word-final)	183	94	51.3	33	18
	<gh> (word-final silent)	183	15	8.1	0	0
	<gh> (word-medial silent)	183	9	4.9	0	0
Three graphemes-one sound	<iou>	183	54	29.5	30	16.3
No grapheme-one sound	Palatalization	183	57	31.1	7	3.8
Different graphemes-same sound	Homophonic words	183	110	60.1	66	36

As seen in the table, the number of orthography-induced pronunciations decreased in all of the categories and subcategories in the post-intervention test. When the subcategorized are analyzed, the highest number of orthography-induced pronunciations after the awareness-raising intervention occurred in the /ɪz/ subcategory (67.2%) followed by the /z/ subcategory (55.1%) and <w> (word-final) subcategory (48.6%). There were no orthography-induced pronunciations in the <w> (word-initial), <ie>, <gh> word-final, <gh> word-final silent, and <gh> word-medial silent subcategories. The highest decreases in the number of orthography-induced pronunciations belong to the one grapheme-zero sound category including the words with silent letters. Within this category, the order of the subcategories where higher improvement was observed are <b> (word-medial) (from 85.7% to 12%), <l> (from 83% to 16.3%), <b> (word-final) (from 68.8% to 17.4%), <t> (tle) (from 55.1% to 7.6%), <t> (ten) (from 44.8% to 4.3%). The categories where little improvement was observed are the subcategories of /z/ (from

63.3% to 55.1%) and <au> (from 48.6% to 40.9%). Figure 4.6 displays the distribution of orthography-induced pronunciations for each subcategory for Task 2/a and the post-intervention test. As seen in the figure, there is a clear trend of decreasing number of orthography-induced pronunciation in each subcategory.

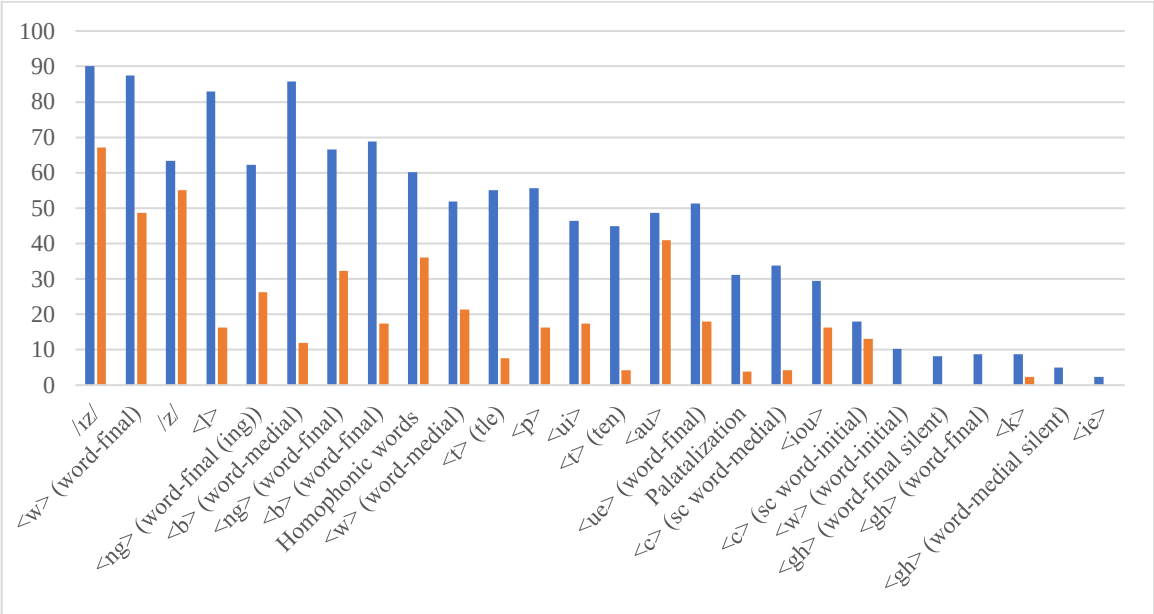


Figure 4.6. *The distribution of orthography-induced pronunciations within categories for task 2/a and post-intervention test*

In the post-intervention test, two new words which were not included in any of the tasks prior to or during the intervention were added for each subcategory. These two additional new words were highly infrequent thus assumed to be unfamiliar to the participants. The reason for the inclusion of these new words was to discern whether the participants could apply what they have gained/learned in the intervention to the new words they are assumed to not have seen before. The addition of two new words to each subcategory yielded a total of 3,172 words (2 new words x 26 subcategories x 61 participants). Frequency analysis was conducted and the results of the orthography-induced pronunciations of the new words are presented in Table 4.8.

Table 4.8. *Orthography-induced pronunciations in the new words after the intervention*

	n	***f***	**%**
Orthography-induced pronunciations	3172	746	23.5

As seen in the table, out of the 3,172 new words, 746 of them (23.5%) were found to be orthography-induced. This result suggests that the participants benefitted from the

intervention and were aware of the misleading aspects of the orthography of the words. To determine which subcategories posed difficulty for the Turkish EFL learners even after an awareness-raising intervention, the orthography-induced pronunciations for each subcategory were calculated. The results are presented in Table 4.9 ordered from the highest to the lowest.

Table 4.9. *Orthography-induced pronunciations in the new words within subcategories*

	n	***f***	**%**
/z/	122	85	69.6
<w> (word-final)	122	82	67.2
/ɪz/	122	77	63.1
<iou>	122	66	54
<w> (word-medial)	122	58	47.5
Homophonic words	122	41	33.6
<au>	122	37	30.3
<b> (word-final)	122	35	28.6
<ue> (word-final)	122	34	27.8
<ui>	122	32	26.2
<l>	122	26	21.3
<b> (word-medial)	122	24	19.6
<ng> (word-final)	122	20	16.3
<c> (sc word-initial)	122	19	15.5
<gh> (word-medial silent)	122	19	15.5
<p>	122	18	14.7
Palatalization	122	18	14.7
<ng> (word-final (ing))	122	15	12.2
<t> (ten)	122	12	9.8
<t> (tle)	122	9	7.3
<w> (word-initial)	122	8	6.5
<gh> (word-final silent)	122	4	3.2
<c> (sc word-medial)	122	3	2.4
<k>	122	2	1.6
<gh> (word-final)	122	2	1.6
<ie>	122	0	0

As seen in Table 4.9, the subcategories in which students made the most orthography-induced pronunciations for the new words were found to be /z/ (69.6%), <w> (word-final) (62.7), and /ɪz/ (63.1%). What is striking about this finding is that the order of most frequent orthography-induced pronunciation of the first and last three subcategories is exactly the same as those before the intervention (see Table 4.4). Thus, it is possible to state that the number of orthography-induced pronunciations after the intervention decreased but the order of the affected subcategories did not show a

considerable difference. Figure 4.7 illustrates the distribution of orthography-induced pronunciations in the new words for each subcategory.

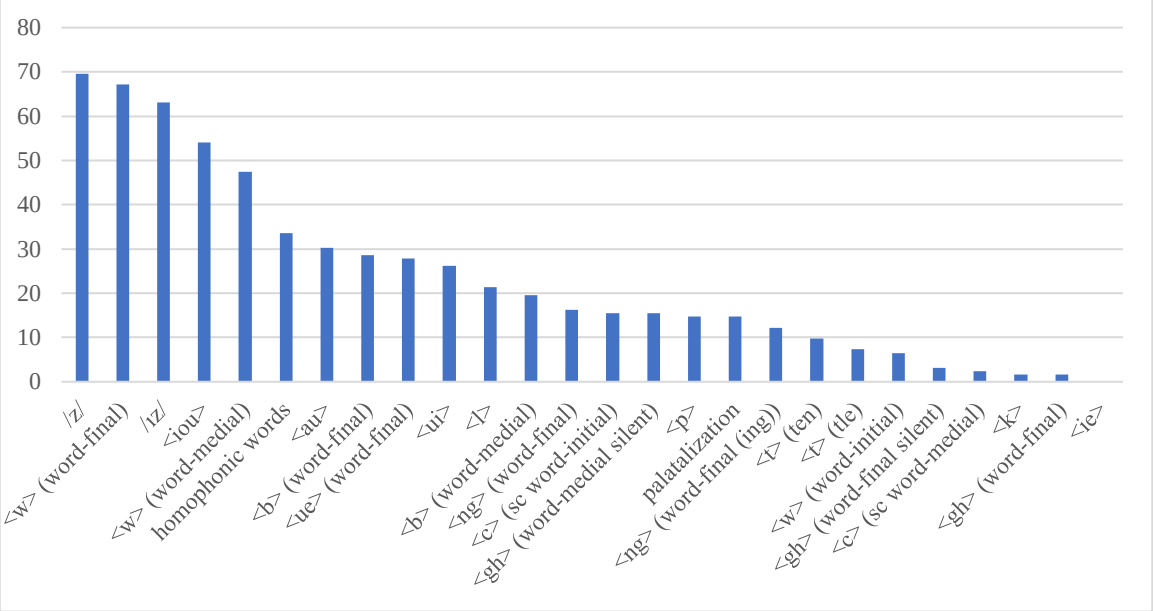


Figure 4.7. *The distribution of orthography-induced pronunciations in the new words within subcategories*

4.4. Post-reflection questionnaire results

To answer the third research question regarding the effect of awareness-raising intervention, a questionnaire was administered to the participants. The questionnaire was sent to the participants through google forms. All participants in the study group (61) completed and returned the questionnaire. The questionnaire consisted of 8 statements on a 5-point Likert scale and 5 open-ended questions. Frequency analysis was performed for the Likert scale items and content analysis was performed for the open-ended questions.

4.4.1. Likert scale results

For the 8 statements which contained a 5-point Likert scale from ‘strongly agree’ to ‘strongly disagree’, none of the participants answered ‘disagree’ or ‘strongly disagree’. All the participants expressed positive opinions about the intervention. The results are shown in Figure 4.8.

For the first statement, 57 participants said that the intervention helped them improve their pronunciation (29 strongly agree, 28 agree). Only 4 participants were neutral. For the second statement, 41 participants strongly agreed and 20 participants

agreed that the intervention increased their awareness of spelling and pronunciation differences. 33 participants strongly agreed and 25 participants agreed that the intervention helped them become aware of the effect of spelling on their own pronunciations (Statement 3). 3 participants said that they neither agreed nor disagreed with this statement. Regarding the 4th statement, 31 participants strongly agreed, 26 participants agreed that the intervention helped them understand the words that they hear while 4 participants said they were neutral. All the participants found the intervention helpful (49 responded 'strongly agree', 12 responded 'agree' to Statement 5). Except for 2 participants who were neutral, 47 (strongly agree) and 12 (agree) participants found the resources used in the intervention useful. Regarding Statement 7, 39 strongly agreed and 17 agreed that the intervention increased their motivation toward pronunciation learning. 5 participants' response was 'neutral'. 59 of the participants (50 'Strongly agree' + 9 'agree) said that they pay more attention to the pronunciation of the new words they learn. 2 of the participants were neutral.

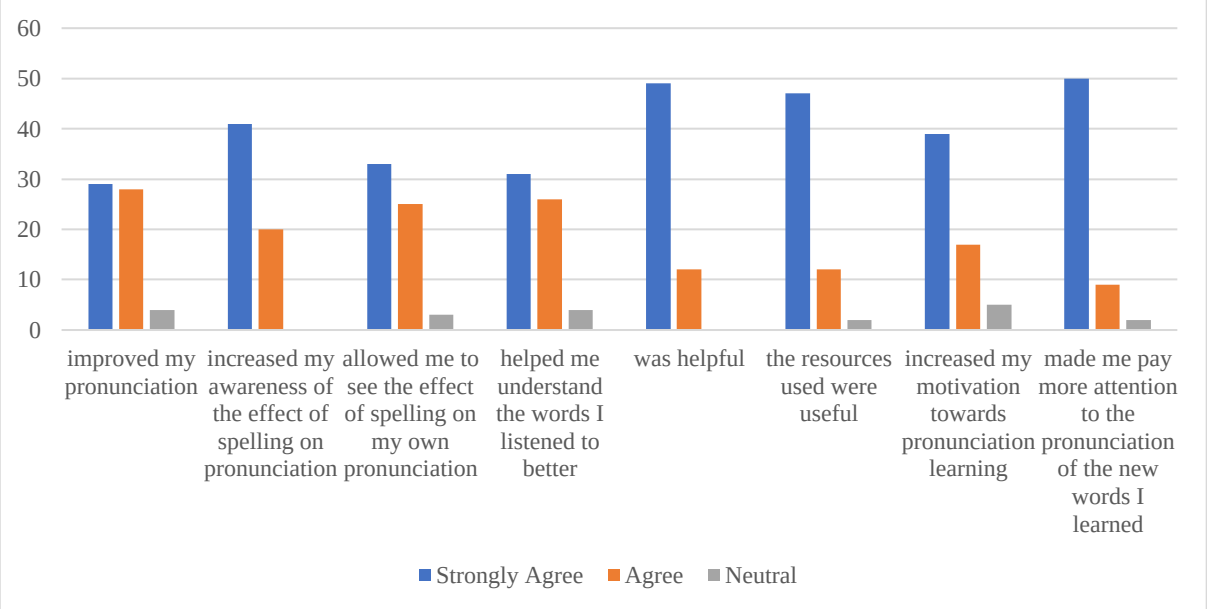


Figure 4.8. *Participants' perceptions of the awareness-raising intervention*

4.4.2. Content analysis results

Five open-ended questions in the questionnaire aimed to determine the participants' thoughts about the intervention in depth. At the end of the content analysis process, two main themes were obtained from the data; *the features of the intervention* and the

outcomes of the intervention. Table 4.10 illustrates the themes, categories, and codes attained through the content analysis utilized.

Table 4.10. *Results of the content analysis*

Themes	Categories	Codes
Features of the intervention	Benefits of the intervention	Informative
		Arousing interest
		Categorization
		Correcting mistakes
		Course materials
		Explaining with examples
		Fun
		Ability to distinguish words
	Shortcomings of the intervention	Short duration
		Not enough practice
		Large class size
		Not easy
		Boring
		Lack of variety of resources
Outcomes of the intervention	Individual gains	Raising awareness
		Improving pronunciation
		Building confidence

4.4.2.1. Features of the intervention

The features of the intervention were determined in positive and negative categories. Positive features were examined under the title of the benefits of the intervention and negative features under the title of shortcomings. For the benefits of the intervention, the codes were obtained from the answers given to the 10th (Did you find what you needed about pronunciation in intervention?) and 12th (What aspects of intervention did you like?) questions about the advantages of the intervention. For the shortcomings of the intervention, the codes were obtained from the answers given to the 11th (Could you make suggestions for improving the intervention?) and 13th (What aspects of intervention did you dislike?) questions. As the answers to these questions mostly mentioned the difficulty of the lessons, they were accepted as shortcomings. Table 4.11

presents the frequencies for the codes under the benefits and shortcomings of the intervention.

Table 4.11. *Benefits and shortcomings of the intervention*

		f
Benefits of the intervention	Informative	41
	Arousing interest	12
	Categorization	12
	Correcting mistakes	11
	Course materials	8
	Explaining with examples	7
	Fun	7
	Ability to distinguish words	2
Shortcomings of the intervention	Short duration	23
	Not enough practice	21
	Large class size	4
	Not easy	3
	Boring	2
	Lack of variety of resources	2

It is seen in the table that the most used expression for the intervention was being informative followed by arousing interest, categorization, correcting mistakes, providing access to course materials, explaining with examples, being fun, and providing the ability to distinguish words more easily.

As the table displays, the two most important shortcomings of the intervention were that the duration of the lessons was short and thus not enough time to practice. These two statements were repeated more than the other stated shortcomings (23 and 21, respectively). The mention of large class size, pronunciation being not easy, the lessons being boring, and the lack of variety of resources were not frequent (between 2 and 4). The two most repeated shortcomings show that the participants want more pronunciation lessons which suggests that they feel they need this training. In addition, they said they wanted to do more practice because they found the intervention productive, and they wanted to participate in the training for a longer time as they think it helped them improve themselves.

4.4.2.2. Outcomes of the intervention

Participants reported on the individual gains at the end of the intervention in question 9 (How did the training you received contribute to you in general?). The results are shown in Table 4.12.

Table 4.12. *Individual gains*

	f
Raising awareness	37
Improving pronunciation	33
Building confidence	3

The majority of the participants who responded to this item felt that the intervention contributed to them. Specifically, as seen in the table, the common view among the participants was that the intervention raised their awareness and improved their pronunciation. 37 of the participants expressed the contribution as making them aware of the differences between spelling and pronunciation, and 33 of the participants said that the intervention contributed to improve their pronunciation. Also, 3 participants specifically mentioned that the intervention helped them build self-confidence about their pronunciation/speaking skills.

In summary, the results revealed that the effect of orthography is evident in Turkish EFL learners' pronunciation in many categories and these learners are affected by the orthography in both perception and production. An intervention targeting those areas where the learners were likely to be affected by orthography resulted in improvement in pronunciation when both quantitative and qualitative data are evaluated together. According to the results of both quantitative and qualitative analysis, the participants not only improved their pronunciation in the words where orthographic forms might be misleading but they also gained specific knowledge on how to pronounce English sounds with less reliance on orthography.

5. DISCUSSION

This study was designed to investigate the effect of English orthography on Turkish EFL learners' pronunciation in words with different familiarity levels and tasks with diverse levels of orthographic and phonological input. In this chapter, the results of the current study are discussed. The chapter is divided into three main sections based on the three research questions. First, the effect of orthography on Turkish EFL learners' pronunciation will be discussed for each word familiarity level and the tasks across categories. This will be followed by a discussion of the effect of orthography in different categories. The last section will discuss the effect of the awareness-raising intervention on the learners' orthography-induced pronunciations.

5.1. Is there an effect of English orthography on Turkish EFL learners' pronunciation?

The aim of the first research question was to determine whether there is an effect of English orthography on Turkish EFL learners' pronunciation. The results showed that the pronunciation of 21% of the words was orthography induced. To determine whether the level of familiarity with the words and the task used in the study have an effect on the participants' performance answers to the two sub-questions were also sought.

a) Does the learners' performance vary depending on the level of familiarity with the words?

b) Does the learners' performance vary depending on the level of orthographic and phonological input?

There are studies that investigated the effect of familiarity with the writing systems on pronunciation (Bassetti, 2017; Bassetti et al., 2018; Nimz, 2011; Nimz, 2016; Nimz & Khattab, 2020; Silveira, 2012; Veivo & Jarvikivi, 2013; Vokic, 2011), and these studies discussed the pronunciation and recognition of the words that are already familiar to learners. Although extensive research has been carried out on the writing system familiarity effect, to the best of my knowledge, there are no studies investigating the effect of word familiarity on orthography-induced pronunciation. This study provides insight into the understanding of the effects of word familiarity on orthography-induced pronunciation.

Concerning the first sub-question, the participants were tested with words at different familiarity levels, such as familiar, less familiar, and unfamiliar. It was found that the learners' performance regarding the familiarity level of the words was not statistically different. However, the percentages of orthography-induced pronunciations for each familiarity level showed that the learners were affected by the orthography more in words at the unfamiliar level (24.9%), less at the less familiar level (20.8%), and even less at the familiar level (20%). Even though the differences are not statistically significant, the percentages of orthography-induced pronunciation of unfamiliar words are higher than that of the other two levels. This finding suggests that learners rely on orthography when they have to pronounce unfamiliar words. When the students were asked about the strategies they use when asked to pronounce an unfamiliar word, most of them replied "I pronounce them the way they are spelled".

Vokic (2011) studied the production of English flaps with Spanish speakers, which is common in both languages but represented with different graphemes in the two languages. The participants produced target-like flaps more often in high-frequency words than in low-frequency words. This suggested that the Spanish participants experienced orthographic interference in infrequent words similar to Turkish EFL learners' experience with more orthography-induced pronunciations in unfamiliar words.

For the second sub-question, orthographic effects were investigated across four tasks varying from tasks including only the phonological form to orthographic and phonological forms concurrently. The results showed that the difference in the participants' performance among the four tasks was statistically significant. When the tasks were compared, the orthography effect was strongest in the read-aloud task (Task 2/a) with 45.2%, followed by the immediate repetition task (Task 2/b) with 19.1%. A similar finding was also reported by Bassetti and Atkinson (2015) who tested adult Italian learners of English on silent letters <b>, <d>, and <l> in two tasks. In one task, the orthographic forms of words were presented (read-aloud) and in the other, first the orthographic form, then a native speaker model was presented (immediate word repetition). When they compared the results of read-aloud and immediate word repetition tasks, they found stronger effects in the read-aloud task, as they hypothesized. Hence, it could conceivably be argued that when the orthographic form is removed and the native model is provided, the orthography effect on pronunciation reduces.

Consistent with the literature, this study found that L2 orthography affects L2 phonology not only when L2 learners are exposed to the L2 orthographic representation but also in the absence of orthographic representations of phonology. As Bassetti (2008) reported, orthography-induced pronunciations occur not only when learners are reading but also when they are repeating after a native speaker model in a task, which was observed in this study as well. In another study with experienced Turkish EFL learners, Albağlar (2016) examined the pronunciation of diphthongs and triphthongs and utilized two tasks: read-aloud and blank-filling. In the blank-filling task, only the first letter of the target words was presented. Even though no significant difference occurred between the tasks, their pronunciations in the blank-filling task were more accurate as the participants were not provided with the written forms of the words. However, as he states, it would be wrong to say that the learners are free of orthographic influence when they do not see the written forms of words, which can be supported by the occurrence of the orthography-induced pronunciations in Task 1 (word repetition with audio form only), Task 2/b (immediate word repetition after the audio), and Task 3 (immediate word repetition with the video form) in the present study.

Ziegler and Ferrand (1998) found that words with higher consistency between spelling and pronunciation are processed faster than words with lower consistency in terms of orthographic depth, which they called the spelling probability effect. This finding is consistent with many decades of research on native language reading, which suggests that access to orthographic forms interacts with phonological development. Regarding orthographic depth, which is the consistency of correspondence between graphemes and phonemes, the present study shares similarities with many studies in the literature. To exemplify, Ziegler, Ferrand, and Montant (2004) looked into how spoken word recognition was affected by orthographic factors by native speakers of French. In three experiments with varying degrees of orthographic and phonological consistency, they tested the hypothesis that orthographic information influences auditory word recognition. They discovered that performance was better in the transparent condition and concluded that there are "substantial orthographic influences on phonological awareness task performance." According to the findings of numerous studies which investigated transparent and opaque conditions (e.g., Cutler, Treiman & Van Ooijen, 2010; Rastle et al., 2011; Seidenberg & Tanenhaus, 1979; Tyler & Burnham, 2006), orthographic forms can have similar impacts on a variety of phonological awareness tasks.

Differing from previous studies, the present study utilized two additional tasks. In one of the tasks only a native speaker model was presented (Task 1) without the orthographic representation and in the other, first orthographic form and then a native speaker video pronouncing the word was presented (Task 3). One of the reasons for including a native speaker model video in one of the tasks was to prevent a potential McGurk-like effect in production. The McGurk effect is a form of perceptual illusion triggered when listeners are presented with conflicting information (auditory /ba/ is paired with facial/visual /ga/) that leads to an integrated percept (a combination /bga/ or a fusion /da/) that is not present in either the auditory or visual information (McGurk & MacDonald, 1976). In this study, the participants produced some words displaying the McGurk effect in Task 1. In the task where only auditory input was provided, the participants pronounced the words *knock* /nak/ as /nap/, *oblique* /oʊˈblik/ as /oblit/, *knit* /nɪt/ as /nɪkt/, *wreak* /rik/ as /rɪp/, *wrap* /ræp/ as /ræk/, and *glisten* /glɪsn/ as /glɪtn/. McGurk-like effects were observed only for /k/, /t/, /p/, and /s/ sounds. No pronunciations with McGurk-like effects were found in the other tasks. This outcome is contrary to that of Rafat and Stevenson (2019) who found that the simultaneous presentation of auditory and orthographic input results in McGurk-like effects. In their study with English learners of Spanish investigating whether simultaneous exposure to auditory and orthographic input result in McGurk-like effects in L2 pronunciation, they divided the participants into four groups: orthography during training and test, orthography during training, orthography during test, and auditory-only. In addition to orthographically-induced transfer effects, they also detected McGurk-like effects in simultaneous exposure to auditory and orthographic input.

Regarding the number of orthography-induced pronunciations produced by the participants, Task 1 was the lowest (8.7%), and Task 3 was lower than Task 2/a and Task 2/b. The level of orthographic input in the tasks can explain these differences in the results. For example, the number of orthography-induced pronunciations in Task 1 was significantly lower than those of in the other tasks, as the participants were presented with only audio input and no orthographic input to interfere during their repetition of the model. However, even in this task, although small, orthographic effects were found. On the other hand, the most prominent finding to emerge from the analysis was that Task 2/a was the task where the participants produced orthography-induced pronunciations significantly more as they were presented with only the orthographic form and no

phonological form, i.e., audio/video input. The observed difference between the tasks where the participants were presented with the phonological form immediately after the orthographic form (the audio form in Task 2/b and video form in Task 3) could be due to the different cognitive requirements of repetition and imitation (Ghazi-Saidi & Ansaldo, 2017). As the number of orthography-induced pronunciations was higher in Task 2/b than in Task 3, a possible explanation for this might be that while repeating participants still realized the orthographic form even immediately after hearing a native speaker model, however seeing the model helped the participants imitate the pronunciation and reduced the orthography effect.

Erdener and Burnham (2005) conducted a similar study using several tasks to show the inferring effects of orthographic input during novel word learning. They investigated the effects of audiovisual speech cues and written input on the pronunciation of non-native speech sounds in new words. In their study, native Turkish speakers, and native Australian English speakers, were asked to produce Spanish and Irish nonwords in four different tasks: auditory-only, auditory-visual, auditory-orthographic, and auditory-visual-orthographic. The choice of participants was based on the orthographic background of the speakers -- Turkish has a transparent orthography whereas English has an opaque orthography. They found that orthographic input in Spanish was beneficial for the speakers of Turkish, as Spanish has a transparent orthography, but increased the error rates in Irish which has an opaque orthography.

When the interaction between word familiarity and the effect of tasks was analyzed, it was found that, apart from Task 1, the participants produced orthography-induced pronunciations mainly for the words at the unfamiliar level. However, in Task 1, the highest number of orthography-induced pronunciations belonged to the words at the familiar level. The observed difference in the word familiarity level in one task compared to the others might be explained by the learners' retrieval of the familiar words' orthographic form in their minds when they hear the words. As the participants were students learning English for almost ten years and had been probably using the familiar words more often, they may have had an image of the words' orthographic forms more at the familiar level. These images might be activated, defeating the native speaker's phonological input. In Task 2/a, the number of orthography-induced pronunciations in the unfamiliar level was significantly higher than in the other two levels suggesting that the participants rely on the orthographic form for the new words. A possible explanation

for this might be the lack of phonemic coding ability, as Bassetti (2008) suggests. Low phonemic coding ability is when learners' capacity is low to discriminate unfamiliar sounds and recall them from memory. As the participants of this study are instructed learners with nearly ten years of a language learning experience, mostly with written materials, hence exposed to orthographic input, they are likely to display stronger effects of orthography in their oral production of the words. In the tasks where both orthographic and phonological input were provided, as in tasks 2/b and 3, the familiarity-level variable played a minor role simply because they were imitating the native speaker's input.

As orthographic effects were noted in several auditory tasks (e.g., Slowiaczek et al., 2003; Ziegler, Ferrand & Montant, 2004), a comparison of the results with those of other studies confirms the effect of orthography on EFL learners' pronunciation. Dynamic Systems Theory (DST) (Van Geert, 1994) defines learners' language development as a dynamic process of self-adaptation and self-restructuring, in which "a set of variables that mutually affect each other's changes over time" (p. 50). Being literate in one language is critical for the successful learning of second language pronunciation, as it was emphasized in Erdener and Burnham's study with Turkish natives and Bassetti and Atkinson's study with Italian natives both of whom are from transparent orthography backgrounds.

According to Durgunoglu, Nagy, and Hancin-Bhatt (1993), pronunciation in L2 is influenced by learners' word recognition in L1 and their L1 phonological awareness. This situation might display a dynamic interaction between two languages due to features of one language, such as the relationship between orthography and phonology (Lowie, 2013). Strong evidence for the orthography effect in Task 2/a in this study and the influence of orthography in the other three tasks despite auditory input suggest that word recognition results from an activation within a highly interactive network representing various types of linguistic information, such as orthography and phonology. When there are discrepancies between these units, it takes longer for the system to reach a steady state. These networks are well equipped to consider the graded nature of the consistency effect since learning in these networks is sensitive to the spelling-to-sound mapping. While learning to read and spell, orthography and phonology become tightly linked.

Goswami (2002) states that the occurrence of orthographic effects in speech perception may also be explained by the fact that they originate from a developmental stage in which orthographic information modifies the characteristics of the phonological

representations themselves. The phonological restructuring model is the one that best describes this potential (Metsala, 1997; Metsala & Walley, 1998). The research suggests that when children learn to read and spell, orthographic information is used to reorganize, specify, and arrange lexical phonological representations, even though this model does not consider orthography effect. According to this theory, words with inconsistent spellings will not fully acquire phonological representations. As predicted by this theory, the degree of the consistency effect decreases as the task requires less and less access to lexical representations, as is the case in the present study.

According to Bassetti (2008), the possible explanation for orthography-induced pronunciations, in general, is that L2 orthographic input, reconstructed in accordance with the L1 rules on orthography and phonology, interacts with L2 acoustic input and results in non-targetlike phonological representations of L2 phonemes. However, it should be emphasized that describing the relationship between orthographic input and acoustic input may be significantly more complicated than contemplating the interaction between L1 and L2 orthography and phonology in isolation. Bassetti and Atkinson (2015) notes that foreign language learners, such as the Turkish participants in this study who have been learning English in schools for years, have a high probability of being exposed to orthography-induced non-targetlike pronunciations that are already present in the L2 spoken input in the classroom. Non-targetlike pronunciations that other learners produce as a result of the L2 orthographic representation become part of the acoustic input exposed to instructed learners. Furthermore, foreign language teachers, who constitute an undeniably significant portion of the spoken input to which instructed learners are exposed, may generate orthography-induced pronunciations that reinforce the learners' inaccurate recoding of the orthographic input. Second, due to excessive amount of orthographic input, learners' mental representations of L2 phonology may influence their perception, causing them to hear sounds not present in the acoustic input but represented in the orthography. This may explain the orthography-induced pronunciations produced by participants in Task 1 where only acoustic input was presented. Similarly, Matthews and Brown (2004) observed that Japanese learners of English perceived non-existent vowels in English perception tasks as a result of their L1 phonology. If L2 learners' mental representations contain an extra phoneme as a result of orthographic input, they could actually perceive the extra phoneme in the L2 acoustic input, as Turkish EFL learners demonstrated in this study.

For the first research question, it was found that Turkish EFL learners' pronunciations are affected by English orthography. There is a link between orthographic input and non-targetlike pronunciations. The categories investigated in this study will be discussed under the second research question below for a more detailed account of orthographic interference.

5.2. How do different categories of grapheme-to-sound correspondences affect orthography-induced pronunciation?

One of the principal differences between Turkish and English orthography is transparency, or grapheme-phoneme consistency. While Turkish has a transparent orthography, English has an opaque orthography. Cross-linguistic studies have shown that the differences in the level of orthographic transparency impact how learners make inferences about the phonological structure of the language from orthographic input (Roelofs, 2006). Considering the differences in the orthography and phonotactics of English and Turkish, 7 main categories, 26 subcategories, with differences in grapheme-to-sound correspondences, were formed to investigate the effects of English orthography on Turkish EFL learners' pronunciation. The second research question addressed whether Turkish EFL learners' orthography-induced pronunciation varied according to different categories. The results obtained for each category are described and discussed below.

5.2.1. One grapheme-zero sound

This category included the graphemes with zero sound correspondence, named *silent letters* in English pronunciation. In this study, the term *silent letters* (Carney et al., 1994) was preferred, although other terms, such as *orthography-induced epenthesis* (Bassetti & Atkinson, 2015; Hall, 2011), are also used. Silent letters might lead L2 learners to add sounds that do not exist in native speakers' phonological input. In the case of Turkish EFL learners, coming from a transparent orthography L1 background and learning the language mostly with written materials, strong effects of orthography were observed in their pronunciation. Turkish EFL learners with almost ten years of English language instruction produced high numbers of phone additions led by the orthography of English words containing silent letters.

In the current study, the effect of orthography on the pronunciation of silent letters in this category was examined under 12 sub-categories. The findings for each subcategory are discussed below.

5.2.1.1. <b>

The subcategory of silent <b> was investigated in two positions where the grapheme <b> was at the end of the word (word-final) and in the middle of the word (word-medial). The word-final position included the words *climb* /klaɪm/, *bomb* /bam/, crumb /krʌm/, and the word-medial included the words *doubt* /daʊt/, *debt* /dɛt/, and *subtle* /sʌtl/. The results showed that the grapheme <b> in word-medial position was the sixth with 41.2%, and <b> in word-final position was the eighth with 37.8% in terms of the most frequent orthography-induced pronunciations. Orthography effects were found in all tasks, especially in Task 2/a. In the read-aloud task, 68.8% of words with <b> in word-final position and 85.7% of words with <b> in word-medial position were pronounced with a /b/ sound. A great majority of the participants pronounced the words *climb* as /klaɪmb/ (or /klɪmb/), *bomb* as /bɒmb/, *crumb* as /krʌmb/, and *doubt* as /dobt/, *debt* as /dɛbt/, and *subtle* as /sʌbtl/. Providing auditory input before the pronunciation reduced the effect of orthography to 55.7% in word-medial and to 34.9% in word-final positions in Task 2/b. These results reflect those of Bassetti and Atkinson's study (2015) in which the effects of English orthography on adult Italian EFL learners' pronunciation were investigated. Italian learners of English with almost ten years of experience in learning English and coming from a transparent orthography background, as Turkish EFL learners, pronounced the silent <b> in all the words in the read-aloud task, but their orthography-induced pronunciations decreased in the word repetition task.

Providing only auditory input in Task 1 did not completely remove the effect of orthography as the participants pronounced silent <b> grapheme in the word-final position with 7.6% and the word-medial position with 9.2%. Orthography-induced pronunciations mainly occurred in familiar words. This could be interpreted as the participants recalling the image of spelling of the words in their minds thus paying less attention to the native speaker model in the audio. As they may not be as familiar with the spelling of the words in the less familiar and unfamiliar groups, they may not have been able to recall their spellings.

The most interesting finding for the <b> subcategory was observed for Task 3. While the percentage of orthography-induced pronunciations of <b> was higher when <b> was in the middle of the word, this result was the opposite in Task 3. The percentage of orthography-induced pronunciations of <b> in the word-final position (39.8%) was higher in Task 3 than <b> in the word-medial position (14.2%). Thus, experienced Turkish EFL learners tend to pronounce silent grapheme <b> in the middle position more than in the final position. However, seeing the model pronounce the words helped the learners recognize the silence of <b> in the middle position more than in the final position.

5.2.1.2. <c>

The subcategory of silent <c> was investigated in two positions -- at the beginning of the word and in the middle of the word after the grapheme <s>. The <sc> (word-initial) subcategory tested the words *science* /saɪns/, *scent* /sɛnt/, and *scintillant* /sɪntɪlənt/, and <sc> (word-medial) subcategory tested the words *muscle* /mʌsl/, *ascent* /əˈsɛnt/, and *crescent* /kɹɛsnt/. The results showed that <sc> in word-medial position was the 18th in the order of the most frequent orthography-induced pronunciations with 8.6%, and the <sc> in word-initial position was the 20th. Orthography effects were found only in Task 2/a. In the read-aloud task, silent <c> grapheme in the <sc> sequence was pronounced with a /k/ sound in 33.8% of words when in the word-medial position and 18% of words when in the word-initial position. Many of the participants pronounced the words *muscle* as /mʌskəl/, *ascent* as /ɛskɛnt/, and *crescent* as /kɾɛskənt/ in the word-medial position. In the word-initial position, sound addition occurred in less familiar and unfamiliar categories, and very few participants pronounced the words *scent* as /skɛnt/ and *scintillant* as /skɪntɪlənt/. Providing auditory input helped them realize the silence of /c/, thus no orthography effect was observed in the other tasks.

5.2.1.3. <k>

The silent <k> subcategory was investigated with the words *knock* /nak/, *knit* /nɪt/, and *knead* /nid/. The results showed that the <k> subcategory was the 24th most frequent orthography-induced pronunciations with 2.1%. Orthography effects were found only in Task 2/a with 8.7%. Very few participants pronounced the words *knock* as /knok/, *knit* as /knɪt/, and *knead* as /knid/. No orthography effects were observed in the other tasks.

The reason why Turkish EFL learners were not affected by silent <k> grapheme might be that the word *know* is one of the earliest words EFL learners are taught, and therefore it might be easier for them to apply the knowledge of the silence of <k> to the other words.

5.2.1.4. <p>

The silent <p> subcategory was investigated with the words *psychology* /saɪˈkalədʒɪ/, *pseudo* /sudo/ and *psalmody* /saməḍi/. The results showed that silent <p> was the 12th in the order of most frequent orthography-induced pronunciations with 17.4%. Orthography effects were found in less familiar and unfamiliar words in Task 2/a with 55.7% and Task 2/b with 14.2%. In the read-aloud task, more than half of the participants pronounced the word *pseudo* as /psudo/, and *psalmody* as /psʌlmodɪ/. No effects were observed in tasks 1 and 3, and therefore only-auditory and visual input helped the learners realize the silence of <p> grapheme.

5.2.1.5. <l>

The silent <l> subcategory was investigated with the words *talk* /tɔk/, *calm* /kam/, and *palm* /pam/. The results showed that the <l> subcategory was the fourth in the order of most frequent orthography-induced pronunciations with 46.3%. Orthography effects were observed in all tasks, especially in Task 2/a with 83% and in Task 2/b with 49.7%. The presence of <l> was seen considerably more in the read-aloud than in the word-repetition task with pronunciation of *talk* as /tolk/, *calm* as /kolm/, and *palm* as /polm/. A very similar result was observed in Bassetti and Atkinson's study (2015), as the percentage of orthography-induced pronunciations in the word repetition task was half of the read-aloud task.

Providing a native speaker model helped the participants realize the silence of <l> in the repetition task after the video more than the repetition after the audio. However, 33.8% of the participants still pronounced the words with an added /l/ sound. Besides, in Task 1, 18.5% of the words were pronounced with /l/ sound. This tendency might be explained by the fact that when the participants heard the word, the word's spelling as an image suppressed the auditory input provided.

5.2.1.6. <t>

The subcategory of silent <t> was investigated in two different grapheme sequences: <tle> and <ten>. <tle> was tested in the words *castle* /kæsl̩/, *hustle* /hʌsl̩/, and *apostle* /əˈpasl̩/, and <ten> was tested in the words *listen* /lɪsn̩/, *fasten* /fasn̩/, and *glisten* /glɪsn̩/. The results showed that in the most frequent orthography-induced pronunciations, <tle> sequence was 11th with 20.7%, and <ten> was 14th with 14.8%. Orthography effects were observed in all tasks, especially in Task 2/a with 55.1% of <tle> and 44.8% of <ten> words. This suggests more than half of the participants pronounced the words *castle* as /kæstəl/, *hustle* as /hʌstəl/, and *apostle* as /əpastəl/, and nearly half of the participants pronounced the word *fasten* as /fastən/ and *glisten* as /glɪstən/. Even though the participants' production did not show any orthography effect in the familiar word *listen*, this was not true for the other words in this subcategory.

The most striking result to emerge from this subcategory was that visual input in Task 3 reduced the effect of orthography much more than only-auditory input in Task 1. As in the subcategories of <b> and <l> graphemes results, in this category also, familiar words were pronounced with a phone addition in Task 1 but not in Task 3.

5.2.1.7. <w>

The subcategory of silent <w> was investigated in three positions: word initially, word medially and word finally. Words which contained <w> in word initial position were *wrong* /ɹɔŋ/, *wrap* /ɹæp/ and *wreak* /ɹik/; words that contained <w> in word-medial position were *answer* /ænsəɹ/, *grown* /gɹəʊn/ and *sword* /sɔɹd/; and words which contained <w> in word-final position were *law* /lɔ/, *flaw* /flɔ/, and *crew* /kɹu/. The results showed that among the most frequent orthography-induced pronunciations, word-final <w> was second with 58.9%, word-medial <w> was 10th with 20.9%, and word-initial <w> was 21st with 4%. The presence of <w> in spelling caused the least orthography induced pronunciation when it was in word-initial position and the effect of orthography was seen in Task 2/a with 10.3% and Task 2/b with 5.4%. The effect of orthography when <w> was in word-medial and word-final position was found in all tasks. For word-medial <w>, the effect of orthography was mostly observed in Task 2/a with 87.4%. The results suggest that auditory input helped reduce the amount of orthography influence as the percentage of orthography-induced pronunciations were 5.4% in Task 1, 15.8% in Task

2/b, and 10.3% in Task 3. Auditory and visual input did not seem to help the participants reduce the effect of orthography for word-final <w> as 40.9% of the words in Task 1, 62.2% in Task 2/b, and 44.8% in Task 3 were found to be orthography-induced pronunciations.

The noticeable result from this subcategory was that silent <w> in initial position was not pronounced by most of the participants, thus producing such words targetlike. One possible explanation for this is that words such as *write* are one of the earliest words EFL learners are taught and it is likely that learners deduce, even if they are not taught explicitly, that word initial <w> is not pronounced when it occurs before another consonant. And possibly, they generalize to other words with similar spellings.

The graphemes in the subcategories under the main category of *"one grapheme-zero sound"* so far were pronounced by the Turkish EFL learners in the same way they exist in Turkish. However, the grapheme <w> is different from the other silent letters in terms of the feature of the sound. The grapheme <w> is a semi-vowel and does not exist in Turkish. Therefore, Turkish EFL learners were expected to realize it as the consonant /ʋ/, the closest counterpart in Turkish. The present study showed that Turkish EFL learners with almost ten years of experience learning English displayed significant orthography effects in the pronunciation of words, especially with <w> (word-final) substituting the silent <w> with /ʋ/ sound. A similar result was found by Albağlar (2015) in his study with Turkish EFL learners at different levels on the pronunciation of diphthongs and triphthongs in English through read-aloud and blank-filling tasks. One notable result in his study was that the pronunciation of the word final <w> grapheme did not differ across the tasks. Even when the learners were not presented with the orthographic form, /ʋ/ was produced for <w> as in the following examples*:* /naʋ/ for *now*, /slɔʋər/ for *slower*, and /taʋəl/ for *towel*.

Pennington (1996) suggests that orthography may lead L2 learners to associate L1 and L2 sounds and notes that misleading associations between L1 and L2 might result from written language. If that is true, then Turkish EFL learners' substitution of the phone /w/ with /ʋ/ is a consequence of the presence of the grapheme <w> in the orthographic input. Major (2008) refers to such examples as sound substitution and states that learners substitute the nearest L1 equivalent in L2. Such substitutions can also be explained by Best's Perceptual Assimilation Model (PAM, 1995). The idea of PAM supports that non-native phonetic segments are perceptually assimilated to the most similar native

phonemes in articulation. From this perspective, Turkish EFL learners have difficulty discriminating the phones /w/ and /ʋ/ as they are assimilated phonetically and phonologically to one single L1 category of <v>. Similar to the proposition of PAM, Kuhl's Perception Magnet Effect (1992) argues that native language sounds can serve as magnets. The presence of <w> in any given word might lead learners to perceive and pronounce it as /ʋ/, especially if they lack the necessary training and knowledge of this particular sound.

The category of *one grapheme-zero sound* was designed to determine the Turkish EFL learners' phone additions for which there is no corresponding sound. From the most to the least, strong effects of orthography were observed in the subcategories of <w> (word-final), <l>, <b> (word-medial), <b> (word-final), <w> (word-medial), <t> (tle), <p>, <t> (ten), <c> (c word-medial), <c> (c word-initial), <w> (word-initial), and <k>. Strong orthography effects were observed in read-aloud (2/a) and immediate word repetition after the audio (2/b) tasks. The presence of <w> and <b> graphemes in both word-final and word-medial positions and <l> grapheme affected Turkish EFL learners' productions so strongly that audio (Task 1) (only the audio form) and video (Task 3) inputs did not help the participants notice the silence of the grapheme in pronunciation.

5.2.2. One grapheme – multiple sounds

This category aimed at testing the orthographic effect on the pronunciation of <s> morpheme. In English, regular singular nouns become plurals by adding the <s> morpheme (with some changes to the spelling of the stem). However, the spelling does not reflect the three allophonic realizations of the morpheme: /s/, /z/, and /ɪz/. To determine whether Turkish EFL learners distinguish the sounds /s/ and /z/ or devoice /z/ in word final position, word pairs *dose/doze, fuss/fuzz, and cease/seize* were included as control words. It was observed that Turkish EFL learners pronounced word final grapheme <z> with /z/ sound and <s> with /s/ sound. Therefore, it was concluded that as Turkish EFL learners do not devoice /z/, they have no difficulty pronouncing it. Thus, mispronunciation of /s/ instead of /z/ in the plurals would be due to orthography. Below, the results of the two versions of the plural <s> morpheme are discussed.

5.2.2.1. /z/

The subcategory of /z/ was investigated with the words *plays* /pleɪz/, *bees* /bɪːz/, and *crabs* /kræbz/. The results showed that /z/ was third most frequent orthography-induced pronunciations with 48.9%. Orthography effects were observed in all tasks, especially in Task 2/a with 63.3%, Task 2/b with 50.8%, and Task 3 with 54.6% of the words pronounced. More than half of the participants in these tasks pronounced the words *plays* as /pleɪs/ and *crabs* as /kræbs/ or /kræps/. Even in Task 1, where only auditory input was presented, the participants pronounced 26.7% of the words with /s/ instead of /z/.

An interesting result emerged for the word in the less familiar category *bees.* It was mostly targetlike in all tasks compared to the other two words in this subcategory. What is curious about this result is the final sound of the words. Before adding the grapheme <s>, the other two words in this subcategory end with a consonant (*play* and *crab*), while the word *bee* ends with a vowel. Targetlike pronunciations of the word *bees* and non-targetlike pronunciations of the words *plays* and *crabs* might be attributed to the final grapheme of the word (even though it ends with a vowel in pronunciation /ple/). Turkish does allow two-consonant clusters at the end of the words, but these clusters are devoiced if the second consonant is a non-continuant as in *ilk, dinç, sarp*. Word final fricatives, on the other hand, are not devoiced even if they occur in clusters as in *tarz, farz.* Therefore, due to the orthography, it is complicated for Turkish EFL learners to realize the voicing of <s> grapheme as /z/ sound.

5.2.2.2. /ɪz/

The subcategory of /ɪz/ was investigated with the words *buses* /bʌsɪz/, *prizes* /pɹaɪzɪz/, and *witches* /wɪtʃɪz/. The results showed that /ɪz/ had the highest percentage of orthography-induced pronunciations with 66.5%. Orthography effects were observed in all tasks, especially in Task 2/a with 90.1%. High percentages of orthography-induced pronunciations were also observed in Task 2/b (70.4%), and Task 3 (63.3%). More than half of the participants pronounced the words *buses* as /bʌsəs/, *prizes* as /praɪzəs/, and *witches* as /wɪtʃəs/ in these tasks. Even in Task 1, where only auditory input was presented, the participants pronounced 42% of the words with /əs/ instead of /ɪz/.

This category of one grapheme-multiple sounds included the highest number of orthography-induced pronunciations by Turkish EFL learners compared to the other

categories. Although Turkish allows /z/ sound which is a voiced obstruent at the end of the words, /z/ might be realized as /s/ due to the markedness theory (Eckman, 1984). However, the control words (*dose/doze, fuss/fuzz, and cease/seize)* chosen for this category clearly showed that the participants could pronounce <s> and <z> graphemes as in spelling. Therefore, it can be concluded that Turkish EFL learners' realization and production of the words with plural <s> is due to orthography effect. The auditory and visual input provided in the tasks did not help reduce the orthography effect in this category.

5.2.3. Two graphemes-one sound

This category was formed to test the orthographic effects on vowel digraphs and consonant digraphs, where two vowels or consonants are written together as two graphemes but pronounced as one sound. Turkish EFL learners, native users of phonologically transparent orthography, rely on orthographic forms and realize each grapheme in a consonant and vowel digraph as a separate phoneme. The vowel digraphs under this category included the <au> digraph for /ɔ/ sound, the <ie> digraph for /i/ sound, and the <ui> digraph for /u/ and /ɪ/ sounds. Consonant digraphs included the word-final <gh> digraph for /f/ sound and the <ng> digraph for /ŋ/ sound. The results for each digraph are discussed below.

5.2.3.1. <au>

The subcategory <au> was investigated with the words *daughter* /dɔtə(ɹ)/, *exhausted* /ɪgˈzɔstɪd/, and *caution* /kɔʃən/. The results showed that the <au> subcategory was the 15th most frequent orthography-induced pronunciation with 13.5%. Orthography effects were observed in Task 2/a with 48.6% of the words. Nearly half of the students realized each grapheme in the vowel digraph and pronounced the words *daughter* as /dautər/, *exhausted* as /ɛksaʊstəd/, and *caution* as /kaʊʃən/. Auditory input helped them reduce the orthography effect, and almost no effect was observed in the other tasks.

5.2.3.2. <ie>

The subcategory of <ie> was investigated with the words *piece* /pis/, *belief* /bɪˈlif/, and *shield* /ʃild/. The results showed that the <ie> subcategory was the last in the order of

orthography-induced pronunciations with 0.8%. Almost no orthography effect was observed for this digraph. On the other hand, the pronunciation of the word *shield* /ʃild/, categorized as an unfamiliar word in Task 2/a was surprising and inexplainable by orthographic effect. 19.6% of the students pronounced the word with /aɪ/ diphthong as /ʃaɪld/.

5.2.3.3. <ui>

The subcategory <ui> was investigated with the words *fruit* /fɹut/, *guilt* /gɪlt/, and *bruise* /bɹuz/. The results showed that <ui> was 13th among the most frequent orthography-induced pronunciations with 17.4%. Orthography effects were mainly observed in Task 2/a with 46.4% of the words. Nearly half of the participants realized each grapheme in the vowel digraph and pronounced the words *fruit* as /fruɪt/, *guilt* as /guɪlt/, and *bruise* as /bruɪz/. Auditory input helped the learners reduce the effects of orthography but did not remove them completely -- effects were observed in Task 3 (8.7%), in Task 1 (7.6%), and in Task 2/b (7.1%).

From the vowel digraphs chosen for the category of two graphemes-one sound, it was observed that for the digraph <ie>, Turkish EFL learners had almost no difficulty in producing the /i/ sound the digraph represents. On the other hand, the digraphs <au> for /ɔ/ sound and <ui> for the /u/ sound exhibited the effect of orthography.

The most surprising result for these subcategories was the pronunciation of the word *shield* /ʃild/ as /ʃaɪld/. This pronunciation can also be considered orthography-induced as the pronunciation of the grapheme <i> is generally /aɪ/ in English.

In a similar study conducted with Italian EFL learners, Bassetti and Atkinson (2015) investigated the effect of spelling on vowel duration, with the hypothesis that when English words are spelled with two adjacent vowel letters such as *seen* compared to *scene*, the vowel may be produced with a longer duration. 15 native Italian-speaking teens performed a read-aloud task where they were presented with English words differing in whether they contained one or two adjacent vowel letters, and their productions were analyzed for vowel duration. Words with double vowel letters elicited significantly longer vowel durations than those with single vowel letters. Similar to Turkish EFL learners' tendency to pronounce every single grapheme in a vowel digraph in words, Italian EFL learners, also native users of transparent orthography, rely on orthography to determine the length of English vowels. When two vowels follow each other and when a glide from

one vowel to another occurs in Turkish, both vowel sounds retain their individual qualities; that is, each vowel maintains its original sound.

5.2.3.4. <gh> (word-final)

The subcategory of <gh> in word-final position was investigated with the words *laugh* /læf/, *rough* /rʌf/, and *tough* /tʌf/. The results showed that the word-final <gh> was the 23rd in the ranking of orthography-induced pronunciations with 2.7%. Orthography effects were observed in Task 2/a with 8.7% of the words. A small number of the participants were affected by the orthographic form of this digraph and pronounced the word *laugh* as /laʊg/ or /louf/, *rough* as /roʊg/ or /rouf/, and *tough* as /toug/ or /touf/. A closer inspection of the mispronunciations of these words showed that the words chosen for this subcategory also showed the effect of vowel digraph pronunciation with /o/ and /u/ sounds together instead of /ʌ/ sound, which is a noticeable effect of orthography.

5.2.3.5. <ng> (word-final)

Word-final <ng> was investigated in two environments – words ending with <ng> as in *long* /lɒ/ɔŋ/, *along* /əˈlɒ/ɔŋ/, and *gang* /gæŋ/, and words ending with <ing> morpheme as in *during* /dʊrɪŋ/, *warning* /woɹnɪŋ/, and *being* /biŋ/. The results showed that word-final <ng> was the seventh with 40.4% and word-final <ing> was the fifth with 42.6% among the most frequent orthography-induced pronunciations. Orthography effects were observed for both types in all tasks but mostly in Task 2/a with 62.2% for <ing> and 66.6% for <ng>. More than half of the participants pronounced the word *long* as /lɒng/, *along* as /ɛlong/, *gang* as /gæng/, *during* as /dʊrɪng/, *warning* as /wɔrnɪng/, and *being* as /biɪng/. Even in Task 1, where only auditory input was provided, Turkish EFL learners displayed the effects of orthography with 24% of /ng/ pronunciation instead of /ŋ/ for <ing> and 16.9% for <ng>. No remarkable difference between the two types of <ng> subcategories was observed.

Pronunciation of the grapheme <g> in the <ng> consonant digraph is an orthography-induced phone addition. Turkish EFL learners map <n> and <g> as two different phoneme categories instead of one – velar nasal /ŋ/. In Turkish, /ŋ/ occurs as an allophone of /n/. Thus, it is a sound that Turkish EFL learners can produce. But because the sound /ŋ/ is represented as <ng>, it is produced as two sounds.

5.2.4. Two graphemes – no sound

This category attempted to test one vowel digraph and one consonant digraph –two vowels or consonants without a corresponding sound. The vowel digraph <ue> occurred at the end of words, and the consonant digraph was <gh> in word-final and word-medial positions. Turkish EFL learners were expected to pronounce these silent digraphs within the words, and the results for each digraph are discussed below.

5.2.4.1. <ue> (word-final)

The subcategory of <ue> (word-final) was investigated with the words *colleague* /kalig/, *tongue* /tʌŋ/, and *oblique* /oˈblik/. The results showed that word-final <ue> ranked 16th in orthography-induced pronunciations with 13.1%. Orthography effects were observed only in Task 2/a with 51.3% of the words mispronounced. More than half of the participants pronounced the word *colleague* as /kolɛdʒu/, /koləʤɪ/, *tongue* as /tongu/, and *oblique* as /oblıku/. Word familiarity played a role in this subcategory because some of the participants pronounced the word in the familiar category *colleague* as /kʌləʤ/ confusing it with the word *college*, and almost all participants mispronounced the word *oblique* in the unfamiliar category. Providing auditory input helped them reduce the number of orthography-induced pronunciations, and no orthography effects were observed in the other tasks.

5.2.4.2. <gh>

The subcategory of <gh> consonant digraph was investigated in two positions: word finally and word medially. Words with word-final <gh> were *high* /haı/, *though* /ðoʊ/, and *sigh* /saı/, and word-medial <gh> were *neighbor* /neıbər/, *straight* /streıt/, and *frighten* /fraıtən/. The results showed that word-final <gh>, with 3.1%, ranked 22nd and word-medial <gh>, with 1.2%, ranked 25th in orthography-induced pronunciations. Turkish EFL learners were affected by the orthography of <gh> mostly in Task 2/a when the digraph was in the word-final position (8.1%) than when in the word-medial position (4.9%). This suggests that very few of the participants pronounced the words *high* as /haıg/, *though* as /tog/, and *sigh* as /saıg/, and *neighbor* as /neıgbor/. Auditory input helped

them reduce the number of orthography-induced pronunciations, thus, no orthography effects were observed in the other tasks.

When the results of consonant and vowel digraphs (two graphemes-one sound and two graphemes-no sound) are compared, due to orthography effect, vowel digraphs appear to create more pronunciation problems than consonant digraphs for Turkish EFL learners.

5.2.5. Three graphemes – one sound (or two sounds)

This category attempted to test the orthographic effects of vowel trigraphs where three graphemes occur together but pronounced as one or two sounds. Due to Turkish EFL learners' realization of each grapheme as a separate phoneme, it was expected that they would pronounce each of the vowels in the trigraph. The vowel trigraph <iou> was chosen for this study and investigated in words *religious* /ɹɪˈlɪdʒəs/, *conscious* /kanʃəs/, and *gracious* /gɹeʃəs/. The results showed that vowel trigraph <iou>, with 7.5%, ranked 19th in orthography-induced pronunciations. Orthography effects were observed in Task 2/a with 29.5% of the words in less familiar and unfamiliar categories such as pronouncing the word *conscious* as /konsɪʊs/, /konsɪkɪʊs/, and /konsɪʃəs/ and *gracious* as /gɾɛsɪʊs/, /gɾadʒɪəs/, and /gɾʌʃɪəs/. Providing auditory input in the other tasks helped the participants reduce the effect of orthography thus, no effects were observed.

5.2.6. No grapheme – one sound

This category aimed to investigate Turkish EFL learners' realization of palatalization, a phonological process by which a non-palatal sound acquires a secondary palatal articulation. The word-initial alveolar nasal in the word *news*, for example, is palatalized by the addition of /j/ sound, resulting in /njuz/. Different from the previous categories, orthography-induced pronunciations in this category were caused by an additional sound without a corresponding grapheme. This process of palatalization was investigated in the words *huge* /hjudʒ/, *duty* /djutɪ/, and *humid* /hjumɪd/. The results showed that palatalization ranked 17th, with 11.6%, in the order of orthography-induced pronunciations. Orthography effects were observed primarily in Task 2/a with 31.1% of the words mispronounced -- many of the participants pronounced the word *huge* as /hudʒ/, *duty* /dutɪ/ (also /dʌtɪ/), and *humid* /humɪd/. Providing auditory input helped the learners

realize that there was an additional /j/ sound although not present in the orthographic form but did not entirely remove the effect of orthography in Task 2/b (6.5%), Task 1 (4.9%), and Task 3 (3.8%).

5.2.7. Different graphemes – same sound

This category examined Turkish EFL learners' pronunciations of homophonic words in English – words that are spelled differently but pronounced the same. To determine whether there is a difference in the pronunciation of homophonic words, the word pairs *hear/here* /hɪə(r)/, *allowed/aloud* /əˈlaʊd/, and *caught/court* /kɔːt/ were used in the study. The purpose was that if learners are affected by orthography, then the pronunciation of the pairs would be different. The results showed that the homophonic words, with 21.7%, ranked ninth in the order of orthography-induced pronunciations. Orthography effects were observed mostly in less familiar and unfamiliar words in Task 2/a (60.1%) followed by Task 2/b (18%), Task 3 (7.6%), and Task 1 (1%).

Due to the transparent orthography, Turkish EFL learners were expected to assume that two English words with different spellings also had different pronunciations, therefore map two different phonological forms to homophonic words. For example, for the pair *allowed/aloud,* the students pronounced *allowed* as /ɛlovd/ and *aloud* as /ɛloʊd/ rather than having the same pronunciation for both words. Almost no non-homophony was observed in Task 1. In contrast, more than half of the homophonous pairs in Task 2/a were produced with non-homophonous realizations as a result of the participants' orthography-induced pronunciation. The most common cause of non-homophony with the words used in this study was the desire to articulate every grapheme in consonant and vowel digraphs. For example, in Task 2/a, the learners pronounced *caught* as /kaʊt/, /kaʊtʃ/, or /kɔkt/, and the word *court* as /kort/. The participants actually pronounced the word *court* correctly in American English. However the mispronunciation of its pair *caught* included the effects of vowel and consonant digraphs.

Providing visual input in addition to orthographic form in Task 3 reduced the orthographic effects more than the auditory input in Task 2/b; however, the overall result for homophones for the task difference was that the number of non-homophonous realizations decreased when exposed to a native model before the production. These results corroborate the findings obtained by Bassetti and Atkinson (2015) in their investigation of the orthography effect on the production of English homophones in word

reading and word repetition tasks with Italian EFL learners. Italian participants produced 40% of the homophones as non-homophones more frequently when reading words than repeating words. Thus, Bassetti and Atkinson (2015) concluded that Italian participants mispronounced the homophonous pairs because of their different spellings.

The second research question attempted to find which of the 7 categories displayed more orthography-induced pronunciations through the findings of 26 subcategories. It can be concluded that the category of *one grapheme-multiple sounds* was the first category to affect Turkish EFL learners' pronunciation with its two subcategories taking the order in the first (/ɪz/) and third (/z/) places. Having defined the orthography effect of English on Turkish EFL learners' pronunciation and determined the categories that interfered the most and the least, it is now necessary to discuss the probability of reducing these effects, which will be discussed under the third research question.

5.3. Does awareness-raising intervention have an effect on orthography-induced pronunciation?

The findings of the current study revealed that the pronunciation of Turkish EFL learners, with almost ten years of experience in learning English at schools (instructed learners), is affected by English orthography. This being the case, the third question addressed whether the effect of orthography could be reduced through an awareness-raising intervention. To be able to answer this question, a 6-week intervention which included explicit instruction regarding the misleading nature of the written form was designed. At the end of the intervention, the participants were administered a post-intervention test, the same as Task 2/a (read-aloud) with additional two highly infrequent words for each category. The purpose of the post-intervention test was to determine if the intervention helped reduce orthography effect.

Comparison of the findings of Task 2/a and that of the post-intervention test showed that the percentage of orthography-induced pronunciations decreased significantly after the intervention. In Task 2/a, 45.2% of the words were produced with signs of orthographic forms, while this percentage decreased to 18.3% in the post-intervention test. This finding is not in accordance with the findings of previous research, where no evidence of improvement was found.

Very few studies on the effects of orthography on pronunciation have explicitly examined the effectiveness of specific interventions or instructional strategies aimed at

reducing the potential negative effects of orthographic input. Using textual enhancement in one condition and explicit instruction in another, Showalter (2020) attempted to mitigate the negative effects of incongruent orthography on naive native English speakers learning Russian words. However, neither of these brief interventions improved the participants' test performance. Brown (2015) and Hayes-Harb, Brown, and Smith (2018) also attempted to prevent the negative impact of written input on the acquisition of final devoiced consonants in German with native English speakers. Participants were informed that the final letters in words could be deceiving, and they were told: "A <b> will be pronounced /p/, a <g> will be pronounced /k/ and a <d> will be pronounced /t/ when at the end of the word" (p. 558). Despite this explicit instruction, participants' pronunciation of devoiced consonants did not improve. In both instances, researchers attempted only modest interventions, which took place during one-hour experimental sessions where participants also learned and were tested on new words.

The significance of this study, as specified above, is to provide data about the efficacy of instructional strategies designed to counter the negative effects of orthographic input, which, thus far, no study has investigated. Previous studies have only looked at brief interventions conducted in laboratory settings. As there is not enough research yet that directly examines the efficacy of practices, as reported by Hayes-Harb and Barrios (2021) also in their review of the studies on orthographic interference, this study attempted to fill this gap by designing a 6-week raising-awareness intervention to help Turkish EFL learners overcome specific orthographic influences in a real-world instructed setting. As a result of the intervention that took place in an instructed setting employing instructional techniques with adult Turkish EFL learners, the percentage of orthography-induced pronunciations in a read-aloud task decreased from 45.2% to 18.3%, suggesting that Turkish EFL learners developed an awareness of orthographic effects in pronunciation.

Although the overall results showed that Turkish EFL learners benefitted from the intervention and became aware of the misleading aspects of English orthography, it is essential to determine in which categories the intervention was most and least helpful. The order of the highest and lowest orthography-induced pronunciation categories was almost the same as that of pre-intervention. The highest percentage of orthography-induced pronunciations were found in categories /ɪz/, /z/, and word-final <w> before the intervention. After the intervention, the highest percentage of orthography-induced

pronunciations again occurred in these categories –/ɪz/ with 67.2%, /z/ with 55.1%, and word-final <w> with 48.6%. The categories with the least number of orthography-induced pronunciations were <k>, <gh> (word-medial silent), and <ie> before the intervention. After the intervention, there were no orthography-induced pronunciations in five subcategories: <w> (word-initial), <ie>, <gh> (word-final), <gh> (word-final silent), <gh> (word-medial silent). These results are significant in terms of identifying which categories of English orthography result in orthography-induced pronunciation for Turkish EFL learners. And, the categories being in almost the same order in terms of orthography-induced pronunciation before and after the intervention enhance the purpose of the study by determining the most and least problematic aspects of English orthography for Turkish EFL learners.

To determine for which categories Turkish EFL learners developed awareness and produced the words more target-like with less effect of orthography, performances in Task 2/a before the intervention and the post-intervention test were compared for each subcategory and the results showed that the participants utilized the intervention mostly for the main category of *one grapheme-zero sound*. The highest decrease in the orthography-induced pronunciations are <b> (word-medial) (85.7% in Task 2/a - 12% in post-intervention test), <l> (83% in Task 2/a - 16.3% in post-intervention test), <b> (word-final) (68.8% in Task 2/a - 17.4% in post-intervention test), <t> (tle) (55.1% in Task 2/a - 7.6% in post-intervention test), <t> (ten) (44.8% in Task 2/a - 4.3% in post-intervention test), all of which are included in the category of *one grapheme-zero sound*, in other words, the words containing silent letters. This finding suggests that explicit instruction on the rules of silent letters such as the silence of <b> when preceded by <m>, silence of <l> when preceded by <k> and <m>, silence of <t> when followed by <le> gave the participants an insight into the nature of silent letters in English. However, the grapheme <w> was the one that displayed the least improvement under this category including word-medial <w> (51.9% in Task 2/a – 21.3% 41 in post-intervention test), and word-final <w> (87.4% in Task 2/a – 48.6% in post-intervention test). Turkish EFL learners still realized the grapheme <w> as /ʊ/.

Although there was a decrease in the percentage of orthography-induced pronunciation in the category *one grapheme-multiple sounds*, more than half of the participants still pronounced the words with the /s/ sound instead of /z/ or /ɪz/ after the intervention. Before the intervention, this category had the highest number of

orthography-induced pronunciations. After the intervention albeit with slight improvement, it remained as the category with the highest percentage of orthography-induced pronunciation (/z/: 63.3% in Task 2/a – 55.1% in post-intervention test; /ɪz/: 90.1% in Task 2/a – 67.2% in post-intervention test).

When the pre-intervention results for the vowel and consonant digraphs in the categories of *two graphemes-one sound* and *two graphemes-no sound* are compared, vowel digraphs (<au>, <ie>, <ui>, and <ue>) were found to be more problematic for Turkish EFL learners than the consonant digraphs (<ng> and <gh>). Post-intervention test results showed that improvement in the pronunciation of vowel digraphs was relatively lower than that of consonant digraphs. The percentage of orthography-induced pronunciation of vowel digraphs for pre- and post-intervention are <au>: 48.6% in Task 2/a – 40.9% in the post-intervention test; word-final <ui>: 46.4% in Task 2/a – 17.4% in the post-intervention test; and <ue>: 51.3% in Task 2/a – vs. 18% in the post-intervention test. Before the intervention, the pronunciation of the vowel digraph <ie> was found not to be very problematic, and after the intervention, all the words with this digraph were produced target-like by all the participants. Turkish EFL learners did not show improvement in the vowel digraph <au> as almost half of the participants pronounced the words with an /a/ and /u/ sequence instead of one sound /ɔ/. They showed similar improvement on the digraphs <ui> and <ue>.

The consonant digraphs word-final, word-final silent and word-medial silent <gh> were found to be not very problematic for Turkish EFL learners even before the intervention, and the participants pronounced the words containing these digraphs target-like after the intervention. The consonant digraph Turkish EFL learners had difficulty was found to be word-final <ng> and word-final (-ing) <ng>. Although improvement was observed after the intervention (word-final <ng>: 66.6% vs. 32.2%; word-final (-ing) <ng>: 62.2% vs. 26.2% in Task 2/a vs. post-intervention test, respectively), the effect of orthography did not disappear completely. The two variations of <ng> digraph were analyzed further to determine if orthography-induced pronunciations differed depending on whether the words end with <ng> or contain <ing> morpheme. Before the intervention, there was not a considerable difference between these two subcategories, but after the intervention, the participants pronounced the words containing <ing> morpheme more target-like. The observed increase in the target-like pronunciation of <ing> morpheme could partly be attributed to the salience of the morpheme at the end of the words

compared to the digraph <ng> and thus, it was easier for the learners to apply the rule they learned during the intervention.

An improvement was observed in the vowel trigraph <iou> in the category of *three graphemes-one sound (or two sounds),* as the orthography-induced pronunciations decreased from 29.5% in Task 2/a to 16.3% in the post-intervention test. However, this improvement is not high as the decrease is less than 50%. On the other hand, the pronunciation of the palatalized word in the category of *no grapheme-one sound* improved considerably as the orthography-induced pronunciations decreased from 31.1% in Task 2/a to 3.8% in the post-intervention test.

For the homophonic words in the category of *different graphemes-same sound*, it was observed that the participants were affected by the orthography producing the words differently because of the difference in spelling. The orthography-induced pronunciations decreased also for this category from 60.1% in Task 2/a to 24.1% in the post-intervention test. This category is different from the others as there were some rules that were explicitly taught during the intervention to raise their awareness about the misleading effects of spelling on pronunciation. The goal of the intervention for the homophonic words was to show the learners that in English, two words with different spelling might be pronounced the same way, and that they should not depend solely on the orthography in the pronunciation of a word. The post-intervention test results revealed a slight improvement in homophonic words suggesting that Turkish EFL learners continue to rely on orthography.

To investigate the effect of the intervention further and to answer the question of whether the effect of orthography could be reduced by raising awareness, two highly infrequent words were added to each category in the post-intervention test. The results showed that 23.5% of these 52 (26 categories x 2 new words) new words were produced with the effect of orthography.

It should be noted that the infrequent and unfamiliar words are more open to change since the learners mostly produced orthography-induced pronunciation in the familiar words after the intervention, as mentioned above. At this point, the concepts of fossilization and interlanguage should be emphasized. Fossilization, where the development of linguistic abilities stops, is core to interlanguage. According to Selinker (1972), fossilization is a linguistic mechanism that speakers tend to keep in their interlanguage. The developmental side of phonology acquisition, as well as orthographic

factors, influence the process learners go through. For learners who have been learning English for almost ten years with written materials, instructed learners, familiar words appear to be more resilient to changes in pronunciation.

When the categories for the added new words were examined, it was seen that the order of the categories in terms of frequency of orthography-induced pronunciation was almost the same before and after the intervention, especially in the first and last groups of subcategories. This finding provides further evidence for the categories and subcategories found to be more and less effective for Turkish EFL learners regarding orthographic interference in pronunciation.

During the administration of the post-intervention test, the words that the participants thought for a while or hesitated before pronouncing were noted and upon the completion of the task, each student was asked why they paused or hesitated before the production. The words which caused hesitation were common across the participants and included the words *scintillant, scilicet, mutiny, vicious, judicious, discern, psilosis, psoas, psalmody, sluice, chasten, scion, subtle, neigh, circuit,* and *conscious*. The answers were similar across words and participants. For example, for the vowel trigraphs, the reason for one participant's hesitation before pronouncing the word *vicious* was as follows:

> *"There were too many vowel letters, and I could not decide, and I wanted to think which ones to pronounce together and which ones to pronounce alone."* (P12, Post-intervention test).

For the participants who hesitated before pronouncing the words containing silent <c> grapheme, the reasons for pausing were the same. One student hesitated before pronouncing the words *scintillant* and *scilicet* and when the reason was asked, he stated:

> *"I know that one of the letters either <s> or <c> is silent but I needed time to think which one was the silent one."* (P23, Post-intervention test).

Another participant who hesitated before pronouncing the words *sluice* and *circuit* – containing <ui> vowel digraph, explained the reason as follows:

> *"I learned that one of the vowels here will not be pronounced but I needed to think a while before correct pronunciation."* (P37, Post-intervention test).

These statements suggest that the participants gained awareness of the mismatch between English spelling and pronunciation. To explore the participants' opinions about the intervention, they were asked to fill out a questionnaire after the intervention. The purpose of this post-reflection questionnaire was to discern participants' opinions about the intervention -- whether they benefited from the intervention and what they have learned.

The items in the Likert-type questionnaire contained positive statements, and none of the participants replied with *disagree* or *strongly disagree*, suggesting that the participants' opinions about the intervention were positive. For the items "*the intervention increased my awareness of the effect of spelling on pronunciation*", and "*the intervention was helpful*", all the participants expressed either agreement or strong agreement with the majority strongly agreeing. A few of the participants were neutral for some items; four participants for the item "*the intervention improved my pronunciation*", three participants for the item "*the intervention allowed me to see the effect of spelling on my own pronunciation*", four participants for the item "*the intervention helped me understand the words I listened to better*", two participants for the item "*the resources used in the intervention were useful*", five participants for the item "*the intervention increased my motivation towards pronunciation learning*", and two participants for the item "*the intervention made me pay more attention to the pronunciation of the new words I learned*". In short, all the participants indicated positive attitudes and perceived the intervention as beneficial and helpful. For an in-depth analysis of their attitudes, five open-ended questions were asked and analyzed through content analysis.

The content analysis of the open-ended questions revealed two broad themes each containing its categories and codes. The themes were defined as "the features of the intervention" and "individual gains". The theme "the features of the intervention" included two categories, namely "the benefits of the intervention" and "the shortcomings of the intervention". The category of "the benefits of the intervention" emerged in the analysis of the questions "*Did you find what you needed about pronunciation in intervention?*" (Q10) and "*What aspects of intervention did you like?*" (Q12), and the category of "the shortcomings of the intervention" came up in the analysis of the questions "*Could you make suggestions for improving the intervention?*" (Q11) and "*What aspects of intervention did you dislike?*" (Q13).

For the category of the benefits of the intervention, 41 participants, a significant majority, found the intervention highly informative. The reports of some participants are presented below:

> "Yes, while reading words, I learned certain rules or situations in which some letters should be read silently. If I look at it from this perspective, I received very good training in pronunciation." (P3, Q10).
>
> "There were so many rules I did not know and I think I found what I needed as we covered those rules and more." (P7, Q12).

"It created awareness for us to learn the rules and exceptions." (P12, Q10).

"It was a very informative training to improve my pronunciation. I am very happy to have participated." (P46, Q12)

"It was a very educational training, I will definitely use what I learned." (P54, Q10).

For the second benefit of the intervention, 12 participants felt that the intervention arose their interest in learning pronunciation. For example, one participant said:

"I noticed words we mispronounced before and it increased my attention to these words." (P19, Q12).

The third benefit was dividing grapheme-to sound correspondence discrepancies into categories, and 12 participants reported that the division into categories was helpful in the intervention. For example, the responses included:

"It was very helpful to learn by categorizing." (P21, Q10).

"I learned a new category every week." (P29, Q12).

The fourth benefit was correcting mistakes as they became aware of their own mistakes in pronunciation, and 11 participants indicated that they found the intervention beneficial for learning the correct pronunciation of the words. For example, one participant reported:

"I had the opportunity to learn the correct pronunciation of many words that I mispronounced." (P4, Q10).

The fifth benefit was the course materials, 8 of the participants liked the materials and resources utilized in the intervention as the responses from two participants indicate:

"We have new material every week." (P50, Q12).

"Use of materials such as video or audio recordings." (P1, Q12).

The sixth benefit was the intervention being fun, and 7 of the participants specifically stated that they had fun in the intervention. Some of the responses included:

"First of all, it was fun and I was surprised about the pronunciation of words, on the other hand, the thought of having the right pronunciation made me happy." (P9, Q10).

"The lessons were fun and helpful." (P32, Q12).

The last benefit reported was gaining the ability to distinguish words. This benefit was mentioned by only 2 participants:

I can distinguish words better now. (P38, Q10).

It helped me improve my pronunciation and distinguish the rules and pronunciation differences in the words I heard. (P21, Q12).

As for the shortcomings of the intervention, the first and most reported one was the short duration of the intervention. 23 participants found the intervention short, as exemplified below:

"It was short." (P6, Q13).

"It's short duration. Like I said, I wish there were a lesson like this." (P11, Q11).

"I did not like the short duration." (P58, Q13).

The second shortcoming reported was having not enough practice as commented by 21 participants. Some statements by the participants included:

"Listening and reading can be practiced more." (P5, Q11).

"More practice needs to be done." (P14, Q11).

As discussed in the results, these statements show that the participants are aware they need this type of training and want to practice more and for a longer duration. This suggests that they want to participate more because they found the intervention productive. Therefore, these statements could be interpreted as a desire to attend the intervention longer rather than as a shortcoming of the intervention itself.

The other shortcomings reported by only a very few participants are large class size (four participants), not being easy (three participants), being boring (two participants), and lack of variety of resources (two participants). As very few of the participants mentioned these as shortcomings, it may not be generalizable to the perceptions of all the participants towards the shortcomings of the intervention.

The second theme reached in the study was the outcomes of the intervention, and three individual gains were determined. The category of "individual gains" emerged based on the statements of the participants in the analysis of the question "*Did you find what you needed about pronunciation in intervention?*" (Q10).

The first individual gain was raising awareness, and 37 participants reported that they gained insight into the spelling and pronunciation differences in English. Some statements by the participants are presented below:

"Yes, I think I learned how to pronounce words more accurately and I pay more attention to my pronunciation." (P11, Q10).

"It definitely helped me. I learned the correct pronunciations of the words I had thought to be correct, and I gained a new perspective." (P12, Q9)

"It made me realize personally how important role the pronunciation plays in learning English in general. Now I think about the pronunciations more meticulously." (P23, Q9)

The second individual gain was improved pronunciation and 33 participants felt that their pronunciation improved because of the intervention. The responses included the following:

> "Yes, because my pronunciation has improved thanks to training. I learned that most words have a different pronunciation than I thought, and I also think that this training helped me speak English more accurately and properly." (P10, Q9)
>
> "It helped me pronounce words more accurately and understand a word I hear more clearly." (P25, Q9)

The final gain was building confidence. Only a small number of participants particularly indicated that they gained confidence in their pronunciation with the intervention they received. The responses of the three participants who mentioned building confidence specifically in their responses are given below:

> "I am more confident in my pronunciation now." (P37, Q9)
>
> "Thanks to the training I received, I act more confidently when pronouncing something, I am now using what I have learned and this had a positive effect." (P28, Q9)
>
> "After learning how the word is pronounced, I liked that we read that word because I think it increases self-confidence." (P54, Q9)

The individual gains that the participants reported are valuable regarding affective issues in pronunciation teaching. In an experimental study by Kralova et al. (2017), the anxiety level of the learners significantly decreased after receiving pronunciation training for 12 weeks. As Hişmanoğlu (2006) emphasized, emotional factors such as self-confidence and less anxiety contribute to learners in pronunciation learning. As the present study revealed, the participants' answers to the question "*Did you find what you needed about pronunciation in intervention?*" showed that what they needed in pronunciation was mostly becoming aware of their mistakes and then improving their pronunciation, which ended up giving them self-confidence in their pronunciation.

To summarize the whole discussion of this study, it can be stated that Turkish EFL learners are affected by English orthography in pronunciation. Participants in this study were affected by the orthography in several ways: they added sounds corresponding to so-called silent letters, produced plural and third person markers with voiceless consonants, pronounced both vowels and consonants in vowel and consonant digraphs where they were not supposed to, pronounced the vowels in vowel trigraphs, did not pronounce the sound that was not presented in the orthographic form, and produced homophonic word pairs with non-homophonic realizations reflecting their different orthographic forms. What is essential is, therefore, to be aware of these strategies and try to suggest possible ways to prevent orthography effects. Given the pervasive effects of orthography found in this study among experienced learners, as Bassetti and Atkinson (2015) propose, phonological development models should consider orthography as an

important variable affecting L2 speech production, which has mostly not been done so far. This study has implications for curriculum developers, material designers, and teachers, and the next chapter will provide the conclusion of the study with the pedagogical implications.

6. CONCLUSION

This chapter provides a summary of the study and the conclusions reached based on the findings which are discussed in the implications section. Finally, given the limitations of this study, suggestions for further research are presented.

6.1. Summary of the study

The present study aimed to measure the effects of the orthographic forms of English words on the pronunciation problems of Turkish EFL learners. Through years of exposure to written materials in a foreign language learning setting, the orthographic form of the words is the primary source of material for Turkish EFL learners. To unveil the orthography effect in pronunciation, firstly, the orthography effect was defined and the categories were formed considering the phonotactics of English and Turkish based on the classification of the characteristics of orthography-induced non-targetlike pronunciations suggested by Bassetti (2008, p. 196). Considering the differences in the orthographic depth of these two languages, 7 main categories and 26 subcategories assumed to have possible effects on Turkish EFL learners' pronunciations were determined and three words of different familiarity levels were tested for each subcategory.

The target group of study was experienced language learners who had been learning English at schools for nearly ten years mostly through written materials. A convenience sampling technique was utilized, and prep class students at a state university in Turkey were chosen as the participants of the study. To determine the orthography effect on their pronunciation, the participants were asked to complete four oral production tasks including diverse levels of orthographic and phonological input.

For the first research question asking whether there is an effect of orthography on Turkish EFL learners' pronunciation, with sub-questions of the effect of familiarity level of the words and the level of orthographic and phonological input, the results revealed that Turkish EFL learners were affected by the orthography of English. Orthographic effects were mainly observed in less familiar and unfamiliar words. In addition, orthographic effects were found across tasks, whether the target sounds were presented in phonological form (task 1: immediate word repetition with audio form only), orthographic form (task 2/a: read-aloud), orthographic and phonological form (task 2/b: immediate word repetition after the audio), or visual form (task 3: immediate word

repetition with the video form). Different from previous studies, this study utilized two additional tasks (Task 1 and Task 3) for oral production. When the findings for each task are compared, orthography effects were stronger in read-aloud. Removing the orthographic form and providing a native model to imitate, reduced but did not eliminate completely the orthographic effects on word production. The effect of orthography was observed even in Task 1 where no sign of orthographic input was presented. As Bassetti (2008, p. 196) states, L2 orthography affects L2 phonology not only while L2 learners are being exposed to the L2 orthographic representation but also in the absence of orthographic representations of phonology; orthography-induced non-targetlike pronunciations occur not only when learners are reading, but also when they are repeating spoken words in a task. This study has also shown that orthographic input has somehow moved from the page to the learners' minds as the orthography-induced pronunciations occurred even in Task 1 and were mainly in familiar words.

For the second research question addressing how different categories of grapheme-sound correspondences affect orthography-induced pronunciations, the results showed that participants were affected by orthography in several ways: they added sounds corresponding to so-called silent letters, produced plural and third-person markers with voiceless consonant /s/, pronounced both vowels and consonants in vowel and consonant digraphs where they represented single sounds, pronounced all the vowels in vowel trigraphs, did not pronounce the sound that was not presented in the orthographic form, and produced homophonic word pairs with non-homophonic realizations reflecting their different orthographic forms. This study has been one of the first attempts to thoroughly examine the effect of English orthography on Turkish EFL learners' pronunciation. The findings reported here have provided a deeper insight into the learners' potential to be affected by English orthography. The study contributes to the existing knowledge of the orthography effect phenomenon by categorizing the difficulties English orthography presents to learners who come from a language with transparent orthography such as Turkish.

The categorical evaluation showed that the degree of orthography effects was different depending on the category. While the effect was more evident in some subcategories under the main categories of *one grapheme-multiple sounds*, *one grapheme-zero sound*, and *two graphemes-one sound* such as /ɪz/, <w> (word-final), /z/, /l/, <ng> (word-final (ing endings)), <b> (word-medial), <ng> (word-final), and <b>

(word-final). Some subcategories displayed minimal effect of orthography such as <c> (sc word-initial), <w> (word-initial), <gh> (word-final silent), <gh> (word-final), <k>, <gh> (word-medial silent), and <ie>.

For the third research question investigating whether awareness-raising intervention has an effect on orthography-induced pronunciations, a six-week intervention specifically designed to raise learners' awareness about the ramifications of English orthography was provided. Upon the end of the intervention, participants were given a post-intervention test including a read-aloud task to determine if there were any improvements in their pronunciation as a result of the intervention. The comparison of the post-intervention test and Task 2/a showed that the intervention helped learners to become aware of the orthography effect as the number of orthography-induced pronunciations decreased. In the post-reflection questionnaire following the intervention, the participants indicated that they found the intervention beneficial and that it improved their pronunciation.

Table 6.1 summarizes the results of the research in a broader sense including the research questions, data sources, data analysis, and results.

Table 6.1. *A summary of the study*

Research questions	1. Is there an effect of English orthography on Turkish EFL learners' pronunciation? a) Does learners' performance vary depending on the level of familiarity with the words? b) Does learners' performance vary depending on the level of orthographic and phonological input? 2. How do different categories of grapheme-to-sound correspondences affect orthography-induced pronunciation? 3. Does awareness-raising intervention have an effect on orthography-induced pronunciation?
Data sources	Quantitative data: a. The frequency of orthography-induced pronunciations uttered by the participants b. A post-reflection questionnaire in order to understand the participants' perceptions of the awareness-raising intervention and themselves Qualitative data: Five open-ended questions to obtain information from the participants for an in-depth evaluation of the intervention.
Data analysis	For quantitative data, frequency analysis was utilized. For qualitative data, content analysis was performed.
Results	A weak link was found between the word familiarity and the orthography effect, but the percentages of orthography-induced pronunciations for the unfamiliar level were higher than the other two levels. Significant differences in the number of orthography-induced pronunciations were found among the tasks. Exposure to a native speaker's spoken input

	model immediately before production and after removing the orthographic form reduced the effects of orthography. The number of orthography-induced pronunciations was higher for the unfamiliar level for tasks 2/a, 2/b, and 3, and for the familiar level for Task 1. The highest number of orthography-induced pronunciations occurred in the /ɪz/ subcategory, followed by <w> (word-final) subcategory and /z/ subcategory. The categories that seem to affect the participants more than the other categories included /ɪz/, <w> (word-final), /z/, <l>, <ng> word-final (ing endings), <b> (word-medial), <ng> word-final, and <b> (word-final). Vowel digraphs posed more challenges than consonant digraphs. A decrease was observed in the number of orthography-induced pronunciations after an awareness-raising intervention. The intervention helped Turkish EFL learners become aware of the effects of word spelling in unfamiliar and less familiar words. The highest decreases in orthography-induced pronunciations were observed in the main category of one grapheme-zero sound including the words with silent letters. The highest number of orthography-induced pronunciations after the awareness-raising intervention occurred in the /ɪz/ subcategory, followed by the /z/ subcategory and <w> (word-final) subcategories. The first and last three subcategories in the order of the number of orthography-induced pronunciations before and after the intervention were the same. In the post-reflection questionnaire, the majority of the participating students expressed positive attitudes about the intervention. According to both quantitative and qualitative results, the learners not only improved their pronunciation in the words where orthographic forms might be misleading but also gained specific knowledge on pronouncing sounds of the English language with a decreased effect of orthography.

The findings showed that the pronunciation of Turkish EFL learners is affected by the orthography of English suggesting that the differences in the orthographic depth play a role in pronunciation. To mitigate the effects of orthography on pronunciation, learners need to be made aware of the mismatch between spelling and pronunciation in English. Although intervention has helped reduce orthography-induced pronunciation, it has not eliminated it completely. The reasons for this need to be explored in more detail perhaps by cognitive scientists.

6.2. Implications

This section offers both theoretical and pedagogical implications based on the findings of the current study and the related literature. We believe that the findings of this study will be beneficial to both the classroom applications and help advance the field of orthography research and language teaching in general.

The first implication of this study is a theoretical one for acquisition models of L2 phonology. Flege's Speech Learning Model (1995) and Best's Perceptual Assimilation Model (2007), as indicated by Bassetti et al. (2018, p. 591), do not take into account

orthographic input. However, the results of this study and previous studies show that orthographic input significantly influences determining which phonological contrasts L2 speakers make. Because L2 speakers can create two categories in their own system where the target language has only one, models of L2 phonological development need to include the role of orthography in establishing phonological contrasts.

The other implications generated from this study are for curriculum developers, material designers and pedagogical implications for teachers. An issue that needs to be addressed is the curriculum design which incorporates pronunciation classes to help language learners acquire stronger phonological abilities in the target language. A lack of pronunciation instruction was a common complaint among the participants and their classmates. Similarly, they mentioned that during their own schooling, professors prioritized other skills above teaching pronunciation. Participants in this study favored and benefited from the intervention, and they agreed on the need for pronunciation lessons, as evidenced by their eagerness to participate. That is why curriculum developers must consider the value of teaching proper pronunciation. Since most language education programs focus on enhancing skills such as grammar and vocabulary while neglecting the pronunciation component, they need to make adjustments to the intensity and quantity of time given to teaching pronunciation.

Another implication is for material designers mostly textbook writers as textbooks are commonly used in language teaching. However, textbooks used in language classes may not solely help students improve their pronunciation. Therefore, they should be updated to include lessons on English phonological forms and patterns, be consistent with the proposed pronunciation teaching methods, and provide sufficient opportunities for students to practice phonological forms through listening and speaking exercises. Certain phonemes that present particular difficulties for the students can be pointed out for further attention. Such phonemes could be emphasized during vocabulary instruction to help students remember the words they learn.

6.2.1. Pedagogical Implications

The present study made an effort to highlight some of the difficulties Turkish EFL students have with the English orthography and pronunciation. As was already established, the two languages in question are considerably different from one another in terms of orthographic depth. The fundamental issue arises from the fact that in Turkish, there is one-to-one correspondence between the graphemes and sounds, but in English, this is not the case. Khalilzade (2014, p. 14) states that a student will have no trouble picking up the pronunciation if he or she is just exposed to spoken English without coping with the written version. Bassetti (2008, p. 196) also notes that such pronunciation errors resulting from orthographic input would not occur if learners were solely exposed to acoustic input.

The principal implication of this study is that, for language teachers, being aware of the contexts in which such pronunciation errors might occur and preparing the lesson plan accordingly is essential. Rafat and Perry (2019) proposed two lesson plans to counteract the impact of orthographic differences on the learning of Spanish by English speakers. To prevent confusion caused by inconsistent grapheme-phoneme correspondences, the first lesson plan recommends teaching students how to pronounce Spanish words before exposing them to their written counterparts. They suggest this method may be utilized for the most troublesome graphemes. The second lesson plan recommends providing learners with a list of words containing the target grapheme-phoneme inconsistencies and asking them to decide which sound would fit in each.

Much of the research discussed here inform language teachers about the possible drawbacks of orthographic input (Bassetti, 2008; Geylanioğlu & Dikilitaş, 2012; Hayes-Harb & Barrios, 2021; Rafat & Perry, 2019) and suggest that language teachers should take more active role in pronunciation teaching by producing the correct sounds instead of simply going through the pronunciation rules.

The findings of this study also have the potential to raise language teachers' understanding of not only the importance of pronunciation instruction but also how to plan pronunciation lessons to help improve pronunciation instruction for Turkish learners. According to the findings, it is crucial to incorporate pronunciation instruction into the curriculum. The participants all agreed that their formal schooling lacked proper pronunciation instruction. They also said that, in their own experience, teachers had put

the needs of the curriculum and classroom management before teaching pronunciation in language classes. The results showed that theoretical considerations offered by scholars and researchers on pronunciation often contradict actual issues affecting pronunciation in language teaching settings in Turkey. Since most language education programs focus on enhancing skills like grammar, reading, and vocabulary mainly using written materials and exposing students to the orthographic forms of the words, there are discrepancies in the quality and the intensity of pronunciation instruction provided, and the amount of time devoted to pronunciation teaching in the early years of education.

It may be difficult for teachers to provide students with the phonological forms and patterns of English in separate pronunciation lessons while teaching younger kids in overcrowded classrooms. Pronunciation instruction in this context may and should be a natural part of classes on listening and speaking. In other words, students should acquire pronunciation training through integrated skills, such as those that combine phonological instruction with practice in speaking and listening, even if they do not have access to programs devoted only to pronunciation. Constant adjustments to pronunciation pedagogy require the assistance of the government and policymakers. Curriculums for teaching English as a second language should be based on current and widely accepted theories and methodologies in the field, rather than on traditional practices. In the post-reflection questionnaire, the majority of the participants favored the intervention and found the time devoted to it short, which gives the impression that they want to participate in pronunciation lessons longer.

The ideas offered by the participants should be attentively considered in relation to the methods used to teach pronunciation. Teachers can gain more insight into effective classroom activities by considering participant recommendations. Teachers can guide their students more effectively if they thoroughly understand the learners' needs and difficulties in this area. Some participants noted that they learned the distinctions between English spelling and pronunciation through explicit instruction. As they frequently uttered, "practicing is needed for better perception and production of problematic sounds of English," the students want their teachers to provide them with a solid foundational understanding of English pronunciation to help them succeed in their future studies.

Based on the assumption that the distinction between phonological and orthographic input in second language learning has not been thoroughly explored, Bassetti (2008, p. 201) conducted investigations on the impact of orthographic input on

pronunciation. This developing area of study considers the effect of L2 learners' being literate in another language and therefore investigates how the L2 acoustic input is altered by the presence of another phonological and orthographic systems in their minds. Teachers of a second language should be aware that their students may be influenced in critical ways by both the orthographic and phonological input they receive. The second research question of this study attempted to reveal where Turkish EFL learners are struggling with the English orthographic system and pronunciation. By providing specific categories, this research aimed to identify the most challenging aspects of English orthography for Turkish EFL learners. Teachers can use this research to help their students become aware of the differences in spelling and pronunciation between the two languages.

6.3. Limitations and suggestions for further study

This study was based on a mixed methods research design. For the purposes of this study, qualitative and quantitative data were collected from prep-class students at a state university in Turkey. One of the possible limitations of this study may be related to gathering qualitative data. Instead of in-person interviews, this study utilized open-ended questions. This is a limitation since in-depth interviews usually provide broader results.

The results of the study point to potential new research areas. To begin, the scope of the investigation can be broadened. The same research design can be used in other educational environments, including high schools or other universities. This will allow for a more thorough collection of data, which, when analyzed, will provide a deeper and more detailed understanding of the effect of orthography. Additional methods of data collection, such as observations or focus-group interviews, could also be used for future research, as they were not part of the current study's design. The expansion of the data source can help apply results to the Turkish EFL classroom setting as a whole. Longitudinal classroom observations can shed light on how orthography and phonology are actually implemented in the real world, revealing any discrepancies between claims and practice.

Using the findings of prior research, this study made an effort to understand the relationship between Turkish and English orthography and phonology. In the stage of phonological development, the grapheme-phoneme mappings in the learners' minds are critical to their ongoing development. Phonological realizations of graphemes in the

words in this study were almost entirely caused by orthographic forms, and they cannot be predicted based on what is known about L2 phonology and L1 phonology transfer. According to Bassetti and Atkinson (2015, p. 88), adding /b/ in the word *lamb* would be unattainable due to L1 phonological transfer. Because of this, studies focusing on orthographic effects can contribute to our understanding of L2 phonology from a strictly phonological viewpoint. It is argued that models of L2 phonological development should account for orthography as an essential factor affecting L2 speech production in light of the common effects of orthography revealed in this study among experienced instructed learners.

In conclusion, studies of how orthography affects second language phonology are progressing rapidly. The results will be useful for theorists in language acquisition and theory and researchers working on phonological development and L2 acquisition in general. The findings may also provide helpful insight into how languages will be taught. It is hoped that this endeavor will grow and that other researchers will join this new field of phonology research.

REFERENCES

Alario, F. X., Perre, L., Castel, C., & Ziegler, J. C. (2007). The role of orthography in speech production revisited. *Cognition*, *102*(3), 464-475.

Albağlar, N. A. (2015). *An analysis of Turkish university level EFL learners' pronunciation of the diphthongs and triphthongs in English*. MA Thesis. Ankara: Middle East Technical University, Graduate School of Social Sciences.

Baker, A. (2014). Exploring teachers' knowledge of second language pronunciation techniques: Teacher cognitions, observed classroom practices, and student perceptions. *TESOL Quarterly*, 48(1), 136-163.

Bassetti, B. (2006). Orthographic input and phonological representations in learners of Chinese as a foreign language. *Written Language and Literacy*, 9(1), 95–114.

Bassetti, B. (2007). Effects of hanyu pinyin on pronunciation in learners of Chinese as a foreign language. In A. Guder, X. Jiang, & Y. Wan (Eds.), *The cognition, learning and teaching of Chinese characters* (pp. 156–179). Beijing, China: Beijing Language and Culture University Press.

Bassetti, B. (2008). Orthographic input and second language phonology. In T. Piske, & M. Young-Scholten (Eds.), *Input matters in SLA* (pp. 191–206). Clevedon, UK: Multilingual Matters.

Bassetti, B. (2009). Effects of adding interword spacing on Chinese reading: A comparison of Chinese native readers and English readers of Chinese as a second language. *Applied Psycholinguistics*, *30*(4), 757-775.

Bassetti, B. (2017). Orthography affects second language speech: Double letters and geminate production in English. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 43(11), 1835–1842.

Bassetti, B., & Atkinson, N. (2015). Effects of orthographic forms on pronunciation in experienced instructed second language learners. *Applied Psycholinguistics*, 36(1), 67–91.

Bassetti, B., Sokolovic-Perovic, M., Mairano, P., & Cerni, T. (2018). Orthography-induced length contrasts in the second language phonological systems of L2

speakers of English: Evidence from minimal pairs. *Language and Speech*, 61(4), 577-597.

Bassetti, B., Mairano, P., Masterson, J., & Cerni, T. (2020). Effects of orthographic forms on second language speech production and phonological awareness, with consideration of speaker-level predictors. *Language Learning*, *70*(4), 1218-1256.

Bayraktaroğlu, S. (2008). Orthographic interference and the teaching of British pronunciation to Turkish learners. *Dil ve Dilbilimi Çalışmaları Dergisi*, 4(2), 1-36.

Bekleyen, N. (2007). An investigation of English teacher candidates' problems related to listening skill. *Elektronik Sosyal Bilimler Dergisi*, *6*(21), 91-105.

Bekleyen, N. (2011). Pronunciation problems of the Turkish EFL learners. *Electronic Journal of Social Sciences*, *10*(36), 94-107.

Best, C. T. (1995). A direct realist view of cross-language speech perception. In Strange, W. (Ed.), *Speech Perception and Linguistic Experience: Issues in Cross-Language Research* (pp. 171–204). Baltimore: York Press.

Best, C. T., & Tyler, M. D. (2007). Nonnative and second-language speech perception. Commonalities and complementarities. In Bohn, O.-S.; Munro, M. J. (Eds.), *Language Experience in Second Language Speech Learning: In Honor of James Emil Flege* (pp. 13–34). Amsterdam: John Benjamins Publishing Company.

Brown, C. A. (1998). The role of the L1 grammar in the L2 acquisition of segmental structure. *Second Language Research*, 14 (2), 136-193.

Brown, H. D. (1994). *Principles of language learning and teaching*. (3rd edition). Upper Saddle River, NJ: Prentice Hall.

Brown, K. E. (2015). *The influence of explicit instruction on failure to acquire a phonological rule due to orthographic input: The case of native English speakers learning German*. MA Thesis. Salt Lake City, USA: University of Utah.

Bürki, A., Welby, P., Clement, M., & Spinelli, E. (2019). Orthography and second language word learning: Moving beyond “friend or foe?”. *Journal of the Acoustical Society of America*, 145(4), 265-271.

Carney, B. W., Latham, D. W., Laird, J. B., & Aguilar, L. A. (1994). A survey of proper motion stars. 12: An expanded sample. *The Astronomical Journal*, *107*, 2240-2289.

Carr, T. H., Posner, M. I., Pollatsek, A., & Snyder, C. R. R. (1979). Orthography and familiarity effects in word processing. *Journal of Experimental Psychology*: *General*, 108, 389-414.

Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read?. *Cognition*, *91*(1), 77-111.

Carreiras, M., Perea, M., Vergara, M., & Pollatsek, A. (2009). The time course of orthography and phonology: ERP correlates of masked priming effects in Spanish. *Psychophysiology*, *46*(5), 1113-1122.

Celce-Murcia, M., Brinton, D. and Goodwin, J. (2005). *Teaching Pronunciation: A Reference for Teachers of English to Speakers of Other Languages*. Cambridge: Cambridge University Press.

Celce-Murcia, M., Brinton, D. M., & Goodwin, J. M. (2010). *Teaching pronunciation: A course book and reference guide*. Cambridge: Cambridge University Press.

Cheung, H., Chen, H. C., Lai, C. Y., Wong, O. C., & Hills, M. (2001). The development of phonological awareness: Effects of spoken language experience and orthography. *Cognition*, *81*(3), 227-241.

Cook, V. J., & Bassetti, B. (2005). An introduction to researching second language writing systems. In V. J. Cook & B. Bassetti (Eds.), *Second language writing systems* (pp. 1 – 67). Clevedon, UK: Multilingual Matters.

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. (3rd edition). California: Sage Publications.

Cutler, A., Treiman, R., & Van Ooijen, B. (2010). Strategic deployment of orthographic knowledge in phoneme detection. *Language and speech*, *53*(3), 307-320.

Dalton, C., & Seidlhofer, B. (1994). *Pronunciation*. Oxford University Press.

Davidson, L. (2010). Phonetic bases of similarities in cross-language production: Evidence from English and Catalan. *Journal of Phonetics*, 38(2), 272–288.

Demirezen, M. (2005). Palatalization in English: An articulation problem for Turkish teacher trainees. *Journal of Language and Linguistic Studies, 1*(1), 43-52.

Derwing, T. M., & Munro, M. J. (2005). Second language accent and pronunciation teaching: A research-based approach. *TESOL Quarterly*, 39(3), 379-397.4

Detey, S., & Nespoulous, J.-L. (2008). Can orthography influence second language syllabic segmentation? *Lingua*, 118(1), 66–81.

Durgunoglu, A., Nagy, W., & Hancin-Bhatt, B. (1993). The development of vocabulary in English as a second language children and its role in predicting word recognition ability. *Journal of Educational Psychology, 85*, 453-465.

Eckman, F. R. (2004). From phonemic differences to constraint rankings: Research on second language phonology. *Studies in Second Language Acquisition* 26 (4), 513-549.

Eckman, F. R. (2008). Typological markedness and second language phonology. *Phonology and second language acquisition, 36*(6), 95-115.

Ehri, L. C., & Wilce, L. S. (1980). The influence of orthography on readers' conceptualization of the phonemic structure of words. *Applied Psycholinguistics, 1*(4), 371-385.

Elias, L. J. (2000). *Teaching the pronunciation of spelling patterns in an integrated ESL curriculum*. Doctoral dissertation. Minneapolis, USA: University of Minnesota.

Ellis, N. C., Natsume, M., Stavropoulou, K., Hoxhallari, L., Daal, V. H., Polyzoe, N., & Petalas, M. (2004). The effects of orthographic depth on learning to read alphabetic, syllabic, and logographic scripts. *Reading Research Quarterly*, 39(4), 438- 468.

Erdener, V. D., & Burnham, D. K. (2005). The role of audiovisual speech and orthographic information in nonnative speech production. *Language Learning*, 55(2), 191-228.

Escudero, P., Hayes-Harb, R., & Mitterer, H. (2008). Novel second-language words and asymmetric lexical access. *Journal of Phonetics*, 36(2), 345-360.

Escudero, P., & Wanrooij, K. (2010). Learning the phonological forms of new words: Effects of orthographic and auditory input. *Language and Speech*, 53, 361-381.

Escudero, P., Simon, E., & Mulak, K. E. (2014). Learning words in a new language: Orthography doesn't always help. *Bilingualism: Language and Cognition*, 17(2), 384-395.

Fender, M. (2008). Spelling knowledge and reading development: Insights from Arab ESL learners. *Reading in a foreign language*, *20*(1), 19-42.

Flege, J. E. (1995). Second language speech learning. Theory, findings, and problems. In Strange, W. (Ed.), *Speech Perception and Linguistic Experience. Issues in Cross-Language Research* (pp. 233-277). Baltimore: York Press.

Fraser, H., & Department of Education, Training and Youth Affairs (DETYA). (2001). *Teaching pronunciation: A handbook for teachers and trainers. Three frameworks for an integrated approach*. New South Wales.

Frost, R. (1998). Toward a strong phonological theory of visual word recognition: True issues and false trails. *Psychological Bulletin*, 123(1), 71-99.

Geylanioğlu, S., & Dikilitaş, K. (2012). Pronunciation errors of Turkish learners of English: Conceptualization theory as a teaching method. *The Journal of Language Learning and Teaching*, *2*(2), 38-50.

Ghazi-Saidi, L., & Ansaldo, A. I. (2017). Second language word learning through repetition and imitation: Functional networks as a function of learning phase and language distance. *Frontiers in Human Neuroscience*, 11:463, 1-13.

Gilakjani, A. P., & Sabouri, N. B. (2016). How can EFL teachers help EFL learners improve their English pronunciation?. *Journal of Language Teaching and Research*, *7*(5), 967-972.

Goswami, U. (2002b). Phonology, reading development and dyslexia: A cross-linguistic perspective. *Annals of Dyslexia* 52, 1-23.

Goswami, U., Ziegler, J. C., & Richardson, U. (2005). The effects of spelling consistency on phonological awareness: A comparison of English and German. *Journal of experimental child psychology*, *92*(4), 345-365.

Grainger, J., & Ferrand, L. (1996). Masked orthographic and phonological priming in visual word recognition and naming: Cross-task comparisons. *Journal of memory and language, 35*(5), 623-647.

Hall, N. (2011). Vowel epenthesis. *The Blackwell companion to phonology*, 1-21.

Hayes-Harb, R., Nicol, J., & Barker, J. (2010). Learning the phonological forms of new words: Effects of orthographic and auditory input. *Language and Speech*, 53, 367-381.

Hayes-Harb, R., Brown, K., & Smith, B. L. (2018). Orthographic input and the acquisition of German final devoicing by native speakers of English. *Language and Speech*, 61(4), 547-564.

Hayes-Harb, R., & Barrios, S. (2021). The influence of orthography in second language phonological acquisition. *Language Teaching*, *54*(3), 297-326.

Hişmanoğlu, M. (2006). Current perspectives on pronunciation learning and teaching. *Journal of language and linguistic studies, 2*(1), 101-110.

Hişmanoğlu, M. (2007). The [ɔ:] and [oʊ] contrast as a fossilized pronunciation error of Turkish learners of English and solutions to the problem. *Journal of Language and Linguistic Studies, 3*(1), 98-115.

Katz, L., & Frost, R. (1992). The reading process is different for different orthographies: The orthographic depth hypothesis. In R. Frost & L. Katz (Eds.), *Orthography, phonology, morphology, and meaning* (pp. 67-84). North-Holland.

Kelly, L. G. (1969). *25 Centuries of language teaching*. Rowley, MA: Newbury House.

Kenworthy, J. (1987). *Teaching English pronunciation*. Harlow, UK: Longman.

Khalilzadeh, A. (2014). Phonetic and non-phonetic languages. *International Journal of Languages' Education and Teaching*, 2(1), 1-16.

Kuhl, P. K. (1991). Human adults and human infants show a "perceptual magnet effect" for the prototypes of speech categories, monkeys do not. *Perception & psychophysics*, *50*(2), 93-107.

Kralova, Z., Skorvagova, E., Tirpakova, A., & Markechova, D. (2017). Reducing student teachers' foreign language pronunciation anxiety through psycho-social training. *System*, *65*, 49-60.

Kuhl, P. K. (2000). A new view of language acquisition. *Proceedings of the National Academy of Sciences*, 97(22), 11850–11857.

Kuhl, P. K. (2007). Cracking the speech code: How infants learn language. *Acoustical science and technology*, *28*(2), 71-83.

Kuhl, P. K., & Iverson, P. (1995): Linguistic experience and the "perceptual magnet effect". In Strange, W. (Ed.), *Speech Perception and Linguistic Experience. Issues in Cross-Language Research* (pp. 121-154). Baltimore: York Press.

Kuhl, P. K., Conboy, B. T., Coffey-Corina, S., Padden, D., Rivera-Gaxiola, M., & Nelson, T. (2008). Phonetic learning as a pathway to language: new data and native language magnet theory expanded (NLM-e). *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1493), 979-1000.

Labov, W. (1996a). Some notes on the role of misperception in language learning. In R. Bayley & D. R. Preston (Eds.), *Second language acquisition and linguistic variation* (pp. 245-252). Amsterdam: Benjamins.

Lado, R. (1957). *Linguistics Across Cultures: Applied Linguistics for Language Teachers*. Ann Arbour: University of Michigan Press.

Lems, K. (2012). The effect of L1 orthography on the oral reading of adult English language learners, *Writing Systems Research*, 4(1), 61-71.

Levis, J. M. (2005). Changing contexts and shifting paradigms in pronunciation teaching. *TESOL Quarterly*, 39(3), 369-377.

Lombardi, L. (2003). Second language data and constraints on manner: Explaining substitutions for the English interdentals. *Second Language Research*, *19*(3), 225-250.

Lord, G. (2008). Podcasting communities and second language pronunciation. *Foreign Language Annals*, *41*(2), 364-379.

Lowie, W. (2013). Dynamic systems theory approaches to second language acquisition. *The encyclopedia of applied linguistics*, *3*, 1806-1813.

Marsden, E., & Torgerson, C. J. (2012). Single group, pre-and post-test research designs: Some methodological concerns. *Oxford Review of Education*, *38*(5), 583-616.

Marx, R. G., Menezes, A., Horovitz, L., Jones, E. C., & Warren, R. F. (2003). A comparison of two time intervals for test-retest reliability of health status instruments. *Journal of clinical epidemiology*, *56*(8), 730-735.

Matthews, J., & Brown, C. (2004). When intake exceeds input: Language specific perceptual illusions induced by L1 prosodic constraints. *International Journal of Bilingualism*, *8*(1), 5-27.

McGurk, H. & Macdonald, J. (1976). Hearing lips and seeing voices. *Nature*, 264, 746-748.

Metsala, J.L. (1997a). An examination of word frequency and neighborhood density in the development of spoken word recognition. *Memory and Cognition*, 25, 47-56.

Metsala, J.L. & Walley, A.C. (1998). Spoken vocabulary growth and the segmental restructuring of lexical representations: Precursors to phonemic awareness and early reading ability. In J.L. Metsala & L.C. Ehri (Eds.), *Word recognition in beginning literacy* (pp. 89-120). Mahwah, New Jersey: Erlbaum.

Morley, J. (1991). The pronunciation component in teaching English to speakers of other languages. *TESOL Quarterly*, 25(3), 481-520.

Muneaux, M., & Ziegler, J. (2004). Locus of orthographic effects in spoken word recognition: Novel insights from the neighbour generation task. *Language and cognitive processes*, *19*(5), 641-660.

Nimz, K. (2011). Vowel perception and production of late Turkish learners of L2 German. Paper presented in *the Proceedings of the 17th International Congress of Phonetic Sciences* (ICPHS XVII). Hong Kong.

Nimz, K. (2016). *Sound perception and production in a foreign language: Does orthography matter?*. Doctoral Dissertation. Potsdam, Germany: Universität Potsdam.

Nimz, K., & Khattab, G. (2020). On the role of orthography in L2 vowel production: The case of Polish learners of German. *Second Language Research*, 36(4), 623-652.

O'Connor, J. D., & Fletcher, C. (1989). *Sounds English: A pronunciation practice book*. Longman.

Ohala, D. K. (2008). Phonological acquisition in a first language. *Phonology and second language acquisition*, *36*, 19-40.

Öney, B., & Durgunoğlu, A. Y. (1997). Beginning to read in Turkish: A phonologically transparent orthography. *Applied Psycholinguistics*, *18*(1), 1-15.

Pattamadilok, C., Kolinsky, R., Ventura, P., Radeau, M., & Morais, J. (2007). Orthographic representations in spoken word priming: No early automatic activation. *Language and Speech*, *50*(4), 505-531.

Pennington, M. C. (1996). Cross-language effects in biliteracy. *Language and education*, *10*(4), 254-272.

Pennington, M. C., & Rogerson-Revell, P. (2019). English pronunciation teaching and research. *Londres: Palgrave Macmillan*, 10, 978-988.

Perre, L., & Ziegler, J. C. (2008). On-line activation of orthography in spoken word recognition. *Brain research*, *1188*, 132-138.

Pytlyk, C. (2011). Shared orthography: Do shared written symbols influence the perception of L2 sounds? *Modern Language Journal*, 54, 541-557.

Rafat, Y. (2011). *Orthography-induced transfer in the production of novice adult English-speaking learners of Spanish*. Doctoral Dissertation. Toronto, Canada: University of Toronto.

Rafat, Y. (2015). The interaction of acoustic and orthographic input in the acquisition of Spanish assibilated/fricative rhotics. *Applied Psycholinguistics*, 36(1), 43-66.

Rafat, Y. (2016). Orthography-induced transfer in the production of English-speaking learners of Spanish. *Language Learning Journal*, 44(2), 197-213.

Rafat, Y., & Perry, S. J. (2019). Navigating orthographic issues in the teaching of Spanish pronunciation. In R. Rao (Ed.), *Key issues in the teaching of Spanish pronunciation: From description to pedagogy* (pp. 237-253). New York/London: Routledge.

Rastle, K., McCormick, S. F., Bayliss, L., & Davis, C. J. (2011). Orthography influences the perception and production of speech. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 37*(6), 1588-1594.

Roach, P. (1998). *English phonetics and phonology*. Cambridge: CUP.

Roelofs, A. (2006). Brief reports: The influence of spelling on phonological encoding in word reading, object naming, and word generation. *Psychonomic bulletin & review*, *13(1)*, 33-37.

Sarıkaya, N. Y. (2013). *Non native English speaking teachers' self perceptions of their pronunciation and pronunciation teaching practices*. MA Thesis. Ankara: Bilkent University, Graduate School of Educational Sciences.

Seidenberg, M. S., & Tanenhaus, M. K. (1979). Orthographic effects on rhyme monitoring. *Journal of Experimental Psychology: Human Learning and Memory*, *5*(6), 546-554.

Seidenberg, M. S., & McClelland, J. L. (1989). A distributed, developmental model of word recognition and naming. *Psychological review*, 96(4), 523-568.

Selinker, L. (1972). Interlanguage. *International Review of Applied Linguistics*, 10, 209-231.

Silveira, R. (2009). Investigating the role of orthography in the acquisition of L2 pronunciation: A case study. *Recent research in second language phonetics/phonology*, 270-290.

Silveira, R. (2012). L2 production of English word-final consonants: The role of orthography and learner profile variables. *Trabalhos em Linguística Aplicada*, 51(1), 13-34.

Shea, C. E. (2017). L1 English / L2 Spanish: Orthography-phonology activation without contrasts. *Second Language Research*, 33(2), 207-232.

Showalter, C. E. (2020). Russian phono-lexical acquisition and orthographic input. *Studies in Second Language Acquisition*, 42(2), 255-277.

Simon, E., Chambless, D., & Kickhöfel Alves, U. (2010). Understanding the role of orthography in the acquisition of a nonnative vowel contrast. *Language Sciences*, 32(3), 380-394.

Simon, E., & Van Herreweghe, M. (2010). The relation between orthography and phonology from different angles: Insights from psycholinguistics and second language acquisition. *Language and Speech*, 53(3), 303-306.

Sparks, R. L., & Ganschow, L. (1991). Foreign language learning differences: Affective or native language aptitude differences?. *The modern language journal*, *75*(1), 3-16.

Sparks, R. L., Ganschow, L., & Patton, J. (1995). Prediction of performance in first-year foreign language courses: Connections between native and foreign language learning. *Journal of educational psychology*, *87*(4), 638-655.

Sparks, R. L., Ganschow, L., & Javorsky, J. (2000). Déjà vu all over again: A response to Saito, Horwitz, and Garza. *Modern Language Journal*, 251-255.

Steele, J. (2005). Assessing the role of orthographic versus uniquely auditory input in acquiring new L2 segments. Paper presented at the *7èmes Journées internationales du réseau français de phonologie*, 2-4.

Sutherland, S. (2015). What Happens in the Brain When We Read?. *Scientific American Mind*, *26*(4), 14-14.

Taft, M. (2001). Processing of orthographic structure by adults of different reading ability. *Language and Speech*, *44*(3), 351-376.

Taft, M. (2006). Orthographically influenced abstract phonological representation: Evidence from non-rhotic speakers. *Journal of psycholinguistic research*, *35*(1), 67-78.

Tyler, M. D., & Burnham, D. K. (2006). Orthographic influences on phoneme deletion response times. *Quarterly Journal of Experimental Psychology*, 59(11), 2010-2031.

Van den Bosch, A., Content, A., Daelemans, W., & de Gelder, B. (1994). Measuring the complexity of writing systems. *Journal of Quantitative Linguistics*, 1(3), 178-188.

Van Orden, G. C., & Goldinger, S. D. (1994). Interdependence of form and function in cognitive systems explains perception of printed words. *Journal of Experimental Psychology: Human Perception and Performance*, *20*(6), 1269-1291.

Van Orden, G. C., Pennington, B. E, & Stone, G. O. (1990). Word identification in reading and the promise of subsymbolic psycholinguistics. *Psychological Review*, 97(4), 488-522.

Varasarin, P. (2007). *An action research study of pronunciation training, language learning strategies and speaking confidence*. Doctoral Dissertation. Melbourne, Australia: Victoria University.

Venkatagiri, H.S. & Levis, J.M. (2009). Phonological awareness and speech comprehensibility: An exploratory study. *Language awareness*. 16(4), 263-277.

Veivo, O., & Järvikivi, J. (2013). Proficiency modulates early orthographic and phonological processing in L2 spoken word recognition. *Bilingualism: Language and Cognition*, *16*(4), 864-883.

Veivo, O., Järvikivi, J., Porretta, V. J., & Hyona, J. (2016). Orthographic activation in L2 spoken word recognition depends on proficiency: Evidence from eye-tracking. Frontiers in Psychology, 27(7), 1120-1135.

Vigil, N. A., & Oller, J. W. (1976). Rule fossilization: A tentative model 1. *Language learning*, *26*(2), 281-295.

Vokic, G. (2011). When alphabets collide: Alphabetic first-language speakers' approach to speech production in an alphabetic second language. *Second Language Research*, 27(3), 391-417.

Yilmaz, M. (2014). The awareness of phonetics in ELT. *Procedia-Social and Behavioral Sciences*, *116*, 2765-2769.

Young-Scholten, M. (2002). Orthographic input in L2 phonological development. In P. Burmeister, T. Piske, & A. Rohde (Eds.), *An integrated view of language development: Papers in honor of Henning Wode* (pp. 263-279). Trier, Germany: Wissenschaftlicher Verlag Trier.

Young-Scholten, M., Akita, M., & Cross, N. (1999). Focus on form in phonology: Orthographic exposure as a promoter of epenthesis. In P. Robinson & N. O. Jungheim (Eds.), *Pragmatics and pedagogy: Proceedings of the third PacSLRF* (Vol. 2, pp. 227-233). Tokyo: Aoyama Gakuin University.

Young-Scholten, M., & Langer, M. (2015). The role of orthographic input in second language German: Evidence from naturalistic adult learners' production. *Applied Psycholinguistics*, 36(1), 93-114.

Zampini, M. L., & Hansen Edwards, J. G. (2008). *Phonology and second language acquisition.* John Benjamins.

Ziegler, J. C., & Ferrand, L. (1998). Orthography shapes the perception of speech: The consistency effect in auditory word recognition. *Psychonomic Bulletin & Review*, *5*(4), 683-689.

Ziegler, J. C., Ferrand, L., & Montant, M. (2004). Visual phonology: The effects of orthographic consistency on different auditory word recognition tasks. *Memory and Cognition*, 32(5), 732-741.

Ziegler, J. C., Petrova, A., & Ferrand, L. (2008). Feedback consistency effects in visual and auditory word recognition: Where do we stand after more than a decade?. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *34*(3), 643-661.

Zjakic, H. (2017). *Effects of orthography on monolingual and bilingual perception of non-native consonant clusters*. MRes. Thesis. Sydney, Australia: Western Sydney University.

APPENDICES

APPENDIX-1. Demographic Information Questionnaire

STUDENT INFORMATION FORM

Name- Surname: Age: Department:

1. At what stage did you start learning English?
…… Kindergarten
…… Primary School 1-3
…… Primary School 3-5
…… Middle school

2. Please tick your educational background?
Private school …… Primary school …… Middle school …… High school
Public school …… Primary school …… Middle school …… High school

3. Please tick the resources you used in your schools in learning English?
…… School resources
…… Foreign sources
…… Both of them

4. Which of the following skills were used the most during your English learning period? (You can mark more than one.)
…… Reading …… Writing
…… Listening …… Speaking
…… Grammar …… Pronunciation

5. Have you been given additional information about word pronunciation in your English lessons?
…… Yes (…… always …… sometimes ……rarely)
…… No

6. Have you ever been abroad for a long time? (more than 1 month)
…… Yes ……. No

6. Do you think English words are difficult to pronounce?
…… Yes ……..No

(If yes, explain why it is difficult for you: ……..

……..……..)

7. Have you ever been interested in English outside of school?
…… Yes ……..No

(If yes, please indicate what you are interested in (e.g., TV series/movie, game etc.) …….
……. …)

7. How many hours a day are you exposed to English outside of class?
…… 0 …… 0-2 …… 3-5 …… 6-7 ……. 8+

8. If your answer to the above question is not 0, please indicate what you were exposed to?
…… series/movie …… game …… book …… other (specify: ……)

ÖĞRENCİ BİLGİ FORMU (Turkish)

Ad- Soyad: Yaş: Bölüm:

1. İngilizce öğrenmeye hangi aşamada başladınız?
…… Anasınıfı
…… İlkokul 1-3
…… İlkokul 3-5
…… Ortaokul

2. Eğitim geçmişinizi işaretleyiniz?
Özel okul …… İlkokul …… Ortaokul …… Lise
Devlet okulu …… İlkokul …… Ortaokul …… Lise

3. İngilizce öğreniminde okullarınızda kullandığınız kaynakları işaretleyiniz?
…… Okulun kaynakları
…… Yabancı kaynaklar
…… Her ikisi de

4. İngilizce öğrenim döneminizde aşağıdaki becerilerden hangileri daha çok kullanıldı? (Birden fazla işaretleyebilirsiniz.)
…… Okuma …… Yazma
…… Dinleme …… Konuşma
…… Gramer …… Telaffuz

5. İngilizce derslerinizde kelime telaffuzları için ayrıca bilgiler verildi mi?
…… Evet (…… her zaman …… bazen ……nadiren)
…… Hayır

6. Hiç uzun süreli yurtdışında bulundunuz mu? (1 aydan fazla)
…… Evet …… Hayır

6. Sizce İngilizce kelimelerin telaffuzu zor mu?
…… Evet …… Hayır

(Evet ise size neden zor geldiğini açıklayınız:
……..

……..……..)

7. Şimdiye kadar okul dışında İngilizce ile ilgilendiniz mi?
…… Evet …… Hayır

(Evet ise ne ile ilgilendiğinizi belirtiniz (örn: dizi/film, oyun vb.) …….
……
……)

7. Ders dışında İngilizce'ye günde kaç saat maruz kalıyorsunuz?
…… 0 …… 0-2 …… 3-5 …… 6-7 ……. 8+

8. Yukarıdaki soruya cevabınız 0 değil ise ne ile maruz kaldığınızı belirtiniz?
…… dizi/film …… oyun …… kitap …… diğer (belirtiniz: ……)

APPENDIX-2. Consent Form

VOLUNTARY PARTICIPATION FORM

This study is a research study titled "Orthography Effect on the Pronunciation of Turkish EFL Learners" and it aims to see the effect of written language on students' pronunciation and to make applications to reduce this effect. The study is carried out by Canan Deveci and its results will shed light on the development of pronunciation studies.

• Your participation in this study is on a voluntary basis.

• In line with the purpose of the study, you will be asked to pronounce specially selected words to find the effects on the study by pre-test, application, and post-test and your voice recordings will be taken.

• You do not have to write your name or give any information that will reveal your identity / the names of the participants in the research will be kept confidential.

• The data collected within the scope of the research will only be used for scientific purposes, they will not be used outside the purpose of the research or in any other research, and if necessary, they will not be shared with others without your (written) consent.

• You have the right to examine the data collected from you if you wish.

• The data collected from you will be protected and will be archived or destroyed at the end of the research.

• There will be no questions/requests that may disturb you during the data collection process. However, if you feel uncomfortable for any reason during your participation, you will be able to leave the study at any time. If you leave the study, the data collected from you will be removed from the study and destroyed.

Thank you for taking the time to read and evaluate the volunteer participation form. You can direct your questions about the study to Canan Deveci from Atatürk University School of Foreign Languages.

Researcher Name: Canan Deveci
Address : Atatürk University
School of Foreign Languages

I consent to the use of the information I have provided for scientific purposes, knowing that I can withdraw from the study at my own free will, if I wish.

Participant Name and Surname:
Signature:
Date:

GÖNÜLLÜ KATILIM FORMU (Turkish)

Bu çalışma, "Türk Öğrencilerin İngilizce Sesletiminde Yazımın Etkisi" başlıklı bir araştırma çalışması olup öğrencilerin telaffuzunda yazı dilinin etkisini görmek ve bu etkiyi azaltmaya yönelik uygulamalar yapmak amacını taşımaktadır. Çalışma, Canan Deveci tarafından yürütülmekte ve sonuçları ile telaffuz çalışmalarının gelişimine ışık tutulacaktır.

- Bu çalışmaya katılımınız gönüllülük esasına dayanmaktadır.
- Çalışmanın amacı doğrultusunda, ön test, uygulama, ve son test yapılarak çalışmaya söz konusu olan etkileri bulmak için özel olarak seçilmiş kelimeleri telaffuz etmeniz istenecek ve ses kaydınız alınacaktır.
- İsminizi yazmak ya da kimliğinizi açığa çıkaracak bir bilgi vermek zorunda değilsiniz/araştırmada katılımcıların isimleri gizli tutulacaktır.
- Araştırma kapsamında toplanan veriler, sadece bilimsel amaçlar doğrultusunda kullanılacak, araştırmanın amacı dışında ya da bir başka araştırmada kullanılmayacak ve gerekmesi halinde, sizin (yazılı) izniniz olmadan başkalarıyla paylaşılmayacaktır.
- İstemeniz halinde sizden toplanan verileri inceleme hakkınız bulunmaktadır.
- Sizden toplanan veriler korunacak ve araştırma bitiminde arşivlenecek veya imha edilecektir.
- Veri toplama sürecinde/süreçlerinde size rahatsızlık verebilecek herhangi bir soru/talep olmayacaktır. Yine de katılımınız sırasında herhangi bir sebepten rahatsızlık hissederseniz çalışmadan istediğiniz zamanda ayrılabileceksiniz. Çalışmadan ayrılmanız durumunda sizden toplanan veriler çalışmadan çıkarılacak ve imha edilecektir.

Gönüllü katılım formunu okumak ve değerlendirmek üzere ayırdığınız zaman için teşekkür ederim. Çalışma hakkındaki sorularınızı Atatürk Üniversitesi Yabancı Diller Yüksekokulu'ndan Canan Deveci'ye yöneltebilirsiniz.

Araştırmacı Adı :Canan Deveci
Adres :Atatürk Üniversitesi Yabancı Diller Yüksekokulu

Bu çalışmaya tamamen kendi rızamla, istediğim takdirde çalışmadan ayrılabileceğimi bilerek verdiğim bilgilerin bilimsel amaçlarla kullanılmasını kabul ediyorum.

Katılımcı Ad ve Soyadı:
İmza:
Tarih:

APPENDIX-3. Sample Lesson Plan used in the Intervention

SAMPLE LESSON PLAN

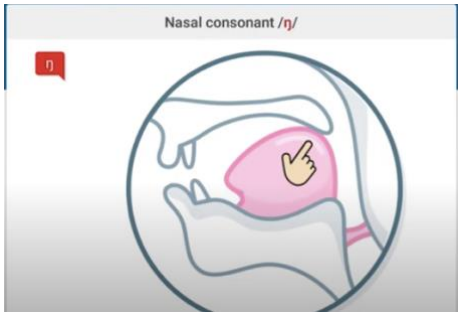
Date: December 17, 2021
Subject: Consonant Digraphs (word-final <ng>) (from the category *two graphemes-one sound*)

1) The instructor gives the full explanation of the topic for that day.

What is a consonant digraph?
Consonant digraphs are pairs of consonant letters representing a single consonant sound in spoken language. In certain cases, one of the letters becomes silent, but more often than not, the combination creates a new sound that neither letter would make on its own.
Examples: ch – chair, chat, cherry
ch – arch, march, rich
gh – cough, enough, trough
ng – king, bang, hang
ph – phase, phrase, photocopy
ph – graph, telegraph, autograph
sh – sheep, show, shoulder
sh – ash, dish, crash

2) The instructor says that among these consonant digraphs, word final <ng> (the articulation of /ŋ/ phoneme) will be dealt getting the attention of the students to the differences in the sounds of /n/ and /ŋ/. Turkish learners pronounce the word *king* /kıŋ/ as /kıng/ or /kınk/. Pronunciation of the grapheme <g> is an orthography-induced phone addition. Learners map <n> and <g> as two different phoneme categories instead of nasal /ŋ/.

3) The instructor presents visuals illustrating the articulation of the sound /ŋ/.



4) The instructor presents a list of words containing /n/ and /ŋ/ phonemes in word-final positions and students repeat these words after a native speaker pronunciation from the website Natural Reader. Some of the words are given below:

pan	pang	ping
/pæn/	/pæŋ/	/pıŋ/
kin	king	kong
/kın/	/kıŋ/	/kɒŋ/
son	song	sung

/sʌn/ /sɒŋ/ /sʌŋ/
ban bang slang
/bæn/ /bæŋ/ /slæŋ/
win ring skiing
/wɪn/ /rɪŋ /ˈskiːɪŋ/
sin wing spring
/sɪn/ /wɪŋ/ /sprɪŋ/
ton belong paying
/tʌn/ /bɪˈlɒŋ/ /ˈpeɪɪŋ/
been fling mourning
/biːn/ /flɪŋ/ /ˈmɔːnɪŋ/
nun strong dong
/nʌn/ /strɒŋ/ /dɒŋ/
dun dung sting
/dʌn/ /dʌŋ/ /stɪŋ/
hen hang seeing
/hɛn/ /hæŋ/ /ˈsiːɪŋ/
bin bring swing
/bɪn/ /brɪŋ/ /swɪŋ/

5) The students listen to some of the words and circle the words that are pronounced in the list above.
6) The students practice the words in sentences made up with the target words. They also write the phonetic transcription of the target words to sense the differences in the spelling and pronunciation.

- The tasting of the *tan / tang* was disgusting.
- The bee *stun / stung* caused *pain / paying*.
- A *pin / ping* is necessary in boxing.
- The lady's *bun / bung* had *wins / wings.*
- The young *king / kin* is an outstanding *sinner / singer*
- This old *clan / clang* is part of the *hun / hung*.

- Dog's *fangs* are *cutting.*
- This *lasting thing* is *thin.*
- The word *seeing* is not the word *seen.*
- I had *nothing* to do I that *mourning morning*.
- The angels show their *wings* in the *evening.*
- The lungs of the *smoking young* are not *strong.*
- I hate *chatting, babbling, gossiping*.
- No kin or *darling* for the *killing king*.

7) The students produce the following tongue twisters in single and choir activities.

Do not hang the ring thing next to the wrong thong
The ringing swinging singing singers sang winning songs
A crying, mourning song in the evening
A stinging dancing on a swing in spring
Everything for belonging to the young darling

APPENDIX-4. Post-Reflection Questionnaire

POST-REFLECTION QUESTIONNAIRE

This questionnaire has been prepared to find out if the 6-week intervention you received on raising awareness on the effects of written language on pronunciation and reducing these effects has influenced your pronunciation skills, and if so, what kind of influence it has. Please read the following statements carefully and indicate your answer by ticking the most appropriate option. The results will show the usefulness of the intervention given to you and will contribute to the study.

Statement	**Strongly agree 5**	**Agree 4**	**Neutral 3**	**Disagree 2**	**Strongly disagree 1**
The 6-week intervention on raising awareness on the effects of written language on pronunciation and reducing these effects,					
1. improved my pronunciation.	**5**	**4**	**3**	**2**	**1**
2. increased my awareness of the effect of spelling on pronunciation.	**5**	**4**	**3**	**2**	**1**
3. allowed me to see the effect of spelling on my own pronunciation.	**5**	**4**	**3**	**2**	**1**
4. helped me understand the words I listen to better.	**5**	**4**	**3**	**2**	**1**
5. was helpful.	**5**	**4**	**3**	**2**	**1**
6. the resources used were useful.	**5**	**4**	**3**	**2**	**1**
7. increased my motivation towards pronunciation learning.	**5**	**4**	**3**	**2**	**1**
8. made me pay more attention to the pronunciation of the new words I learned.	**5**	**4**	**3**	**2**	**1**

9. How did the training you received contribute to you in general? Explain.

……
……

10. Did you find what you needed about pronunciation in intervention? Explain.

……
……

11. Could you make suggestions for improving the intervention? Explain.

……
……

12. What aspects of intervention did you like? Explain.

……
……

13. What aspects of intervention did you dislike? Explain.

……
……

DEĞERLENDİRME ANKETİ (Turkish)

Bu anket, yazı dilinin sesletime etkileri üzerine farkındalık oluşturulması ve bu etkilerin azaltılması üzerine aldığınız 6 haftalık eğitimin telaffuz becerilerinizde etkisi olup olmadığını, olduysa ne tür bir etki olduğunu öğrenmek için hazırlanmıştır. Aşağıdaki maddeleri dikkatle okuyup size en uygun olan seçeneği işaretleyerek cevabınızı belirtiniz. Sonuçlar, verilen eğitimin sizin tarafınızdan yararlılığını gösterecek ve yapılan çalışmaya katkı sağlayacaktır.

Durum	**Kesinlikle katılıyorum 5**	**Katılıyorum 4**	**Kararsızım 3**	**Katılmıyorum 2**	**Kesinlikle katılmıyorum 1**
Yazı dilinin telaffuza etkileri üzerine farkındalık oluşturulması ve bu etkilerin azaltılması üzerine aldığım 6 haftalık eğitim,					
1. telaffuzumu geliştirdi.	**5**	**4**	**3**	**2**	**1**
2. yazı dilinin telaffuza etkisi ile ilgili farkındalığımı arttırdı.	**5**	**4**	**3**	**2**	**1**
3. yazı dilinin kendi telaffuzumdaki etkisini görmemi sağladı.	**5**	**4**	**3**	**2**	**1**
4. dinlediğim kelimeleri daha iyi anlamama katkı sağladı.	**5**	**4**	**3**	**2**	**1**
5. telaffuz için yararlıydı.	**5**	**4**	**3**	**2**	**1**
6. kullanılan kaynaklar telaffuzum için faydalıydı.	**5**	**4**	**3**	**2**	**1**
7. telaffuz öğrenimine karşı motivasyonumu artırdı.	**5**	**4**	**3**	**2**	**1**
8. öğrendiğim yeni kelimelerin telaffuzuna daha çok dikkat etmemi sağladı.	**5**	**4**	**3**	**2**	**1**

9. Aldığınız eğitimin size katkı sağladığını düşünüyor musunuz? Açıklayınız.

……
……

10. Eğitimde telaffuz konusunda ihtiyaç duyduklarınızı bulabildiniz mi? Açıklayınız.

……
……

11. Eğitimin geliştirilmesi için önerileriniz nelerdir?

……
……

12. Eğitimin hangi yanlarını sevdiniz? Açıklayınız.

……
……

13. Eğitimin hangi yanlarını sevmediniz? Açıklayınız.

……
……

APPENDIX-5. Key to Transcription

IPA

Vowels

/i/	seat	/sit/
/ɪ/	sit	/sɪt/
/e/	mate	/met/
/ɛ/	met	/mɛt/
/æ/	mat	/mæt/
/ə/	about	/əbaʊt/
/ʌ/	hut	/hʌt/
/a/	hot	/hat/
/o/	low	/lo/
/ɔ/	law	/lɔ/
/u/	pool	/pul/
/ʊ/	pull	/pʊl/
/ɚ/-/ɝ/	girl, flirt	/gɚl/, /flɚt/ in American English
/ɜ/	girl	/gɜ:l/ in British English
/ɑ/	bath	

/ei/	hate	/heit/
/əʊ/	boat	/bəʊt/
/ai/- /aɪ/	eye	/ai/
/au/- /aʊ/	how	/haʊ/
/oi/- /oɪ/	boy	/boi/
/ɪə/	fierce	/fɪəs/
/eə/	tear	/teə/
/uə/	tour	/tuə/

Consonants:

/p/	pea	/pi/
/t/	tea	/ti/
/k/	key	/ki/
/b/	bee	/bi/
/d/	deed	/did/
/g/	gay	/gei/
/ʧ/	cheese	/ʧiz/
/ʤ/	judge	/ʤʌdʒ/
/f/	five	/faɪv/
/θ/	thigh	/θaɪ/
/s/	sigh	/saɪ/
/ʃ/	shy	/ʃaɪ/
/h/	high	/haɪ/
/v/	vine	/vaɪn/
/ð/	these	/ðiz/
/z/	zeal	/zil/
/ʒ/	measure	/mɛʒə/
/r/	read	/rid/
/m/	meal	/mil/
/n/	kneel	/nil/
/ŋ/	king	/kɪŋ/
/l/	lean	/lin/
/j/	year	/jɪə/
/w/	west	/wɛst/

APPENDIX-6: Sample Words for Categories

One grapheme-zero sound

<b>
Bomb
Tomb
Jamb
Lamb
Womb
Dumb
Comb
Limb
Numb
Climb
Thumb
Rhomb
Plumb
Crumb
Aplomb
Corymb
Entomb
Firebomb
Choriamb
Outclimb
Debt
Doubt
Subtle
Subtly
Redoubt
Subtler
Doubtful
Indebt
Unsubtle
Misdoubt
Debtless

<c>
Science
Scissors
Sciatic
Scilicet
Scientist
Scientific
Scintillate
Scintillant
Scene
Scent
Scenic

Scenery
Scenario
Scentless
Ascent
Descent
Nascent
Discern
Obscene
Crescent
Transcend

<k>
Know
Knew
Knee
Knit
Knop
Knot
Knob
Knap
Knife
Kneel
Knave
Knock
Knish
Knell
Knight
Knubby
Knoll
Knuckle
Knurled
Knawel
Knaves

<p>
Psalm
Psoas
Pseudo
Psycho
Psychic
Psalter
Psaltery
Psalmody
Psilosis
Psychosis
Psychology
Psaltery
Psephology
Pneuma

Pneumonia
Pneumatic
Pneumography

<l>
Talk
Walk
Chalk
Stalk
Folk
Catwalk
Outwalk
Fisherfolk
Should
Would
Could
Balm
Palm
Calm
Half
Calf
Behalf

<t>
Castle
Rustle
Bustle
Pestle
Hustle
Whistle
Epistle
Apostle
Thistle
Bristle
Gristle
Often
Soften
Listen
Hasten
Fasten
Moisten
Glisten
Christen

<w>
Wry
Wrap
Writ
Wren

Wring
Write
Wrong
Wreak
Wrist
Wroth
Wrens
Wretch
Wraith
Wrench
Wreath
Answer
Sewn
Pawn
Grown
Hawk
Sword
Town
Dwarf
Crawl
Jewel
Awful
Crown
Brown
Tower
Bowel
Sewing
Thrown
Steward
New
Law
Sew
Bow
View
Chew
Show
Blow
Allow
Arrow
Flaw
Crew
Nephew
Preview

Two graphemes-one sound

<au>
Auto
Autumn

Audience
Authentic
Author
Authority
Automobile
Auction
Audition
Audio
Augment
Auditorium
August
Auspicious
Authenticity
Autonomy
Aura
Austerity
Pauper
Haughty
Laurel
Faulty
Cauliflower
Vaulting
Saucer
Assault
Sausage
Laundry
Caulk
Astronaut
Authorize
Slaughter
Cauldron
Tautology
Audacity

<ui>
Build
Guilt
Guild
Circuit
Biscuit
Druid
Guitar
Guinea
Cuisine
Pursuit
Suit
Juicy
Fluid
Bruise

Fruit
Cruise
Suitcase
Guitarist
Circuitry
Building
Cuisine
Juicer
Squirt
Guiltless
Fruitful
Tuition

<ie>
Believe
Brief
Chief
Relief
Achieve
Field
Yield
Niece
Piece
Priest
Siege
Thieve
Fierce
Shield
Grief
Reprieve
Diesel
Briefing
Achieve
Priestess
Sieve
Thieves
Shriek

<ng>
Sing
Bring
Long
Wrong
Song
King
Ring
Young
Strong
Swing

Tong
Lung
Bing
Gang
Hang
Fang
Ping
Tang
Thing
Gong
Clang
Ding
Wing
Thong
Along
Among
Hong
Singalong
Gong
Fang
Pong
Thrilling
Charming
Sting
Wrangling
Spring
Bong
Bling
Hiking
Jogging
Rang
Fling
Stung
Plunging
Yang
Slang
Ming
Dangling
Humming
Shooting
Prong
Wring
Wrung

Two graphemes-zero sound

<ue>
Unique
League

Tongue
Plaque
Opaque
Mosque
Fatigue
Antique
Oblique
Colleague
Dialogue
Antique
Picturesque
Grotesque
Boutique
Technique
Burlesque
Critique
Mystique
Basque
Catalogue
Plaque
Applique
Cheque
Monologue
Dialogue

<gh>
Light
Might
Slight
Night
Sight
Fight
Flight
Sleigh
Highness
Weighed
Righteous
Thigh
Weight
Neighbor
Straight
Thought
Daughter
Bought
Neigh
Height
Though
Inveigh
Frighten

Three graphemes-one sound (or two sounds)

<iou>
Courageous
Gracious
Spacious
Anxious
Precious
Delicious
Malicious
Fictitious
Infectious
Ambitious
Conscious
Mysterious
Ferocious
Curious
Luscious
Tenacious
Ambiguous
Pious
Vicious
Hilarious
Glorious
Victorious
Harmonious
Notorious
Envious
Studious
Spurious
Curious
Industrious
Ingenious
Devious
Furious
Contagious
Repetitious
Religious
Judicious

No graphemes-one sound

Huge
Human
Humid
Humor
Humiliate
Cute
Cube

Cue
Popular
Humiliate
Union
Ambulance
Accuse
Accumulate
Cucumber
Costume
Confuse
Continue
Value
Fabulous
Tune
Music
Museum
Monument
Usual
Pursue
Residue
Assume
Amusement
Uniform
Immune
Fuse
Fuel
Pure
Beauty
Durable
Tutor
Manipulation
Pupil
Puberty
Stupid
Manual
Stimulate
Community
Formula
Tumor
Speculate
Student
Mutual
Mule
Constitute
During
Uvular
Distribute
Refute
Capsule

Evaluate

Different graphemes-same sound

Pear / Pair
Write / Right
Flour / Flower
Sun / Son
Sea / See
Read / Red
Meat / Meet
To / Too
Buy / Bye
Hear / Here
Allowed / Aloud
Brake / Break
Eye / I
One / Won
Hair / Hare
Threw / Through
Morning / Mourning
Weather / Whether
Principle / Principal
Mail / Male
Night / Knight
Piece / Peace
Right / Rite
Bare / Bear
Role / Roll
Pail / Pale
Tail / Tale
Cite / Site
Board / Bored
Forth / Fourth

APPENDIX-7. Ethics Committee Decision Document

Eğitim Bil. Ens.

Evrak Kayıt Tarihi: 13.10.2021 | Protokol No: 193347 | Tarih: 26.10.2021

ANADOLU ÜNİVERSİTESİ
SOSYAL VE BEŞERÎ BİLİMLER BİLİMSEL ARAŞTIRMA VE YAYIN ETİĞİ KURULU
KARAR BELGESİ

ÇALIŞMANIN TÜRÜ:	Doktora Tez Çalışması
KONU:	Eğitim Bilimleri
BAŞLIK:	Türk Öğrencilerin İngilizce Telaffuz Problemlerinde İmlanın Etkisi Orthograpy Effect on Pronunciation Problems of Turkish EFL Learners
PROJE/TEZ YÜRÜTÜCÜSÜ:	Prof. Dr. Handan YAVUZ
TEZ YAZARI:	Canan DEVECİ
ALT KOMİSYON GÖRÜŞÜ:	-
KARAR:	Olumlu