REPUBLIC OF TURKEY
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF FOREIGN LANGUAGES EDUCATION
MA IN FOREIGN LANGUAGES EDUCATION (ENGLISH)

MASTER'S THESIS

INVESTIGATING THE EFFECTIVENESS OF FOUR INSTRUCTIONAL TECHNIQUES IN LEARNING TECHNICAL VOCABULARY

İLKNUR NURTEN BAĞCI
19708010

THESIS ADVISOR
Prof. Dr. HATİCE GÜLRU YÜKSEL

ISTANBUL
2023

REPUBLIC OF TURKEY
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF FOREIGN LANGUAGES EDUCATION
MA IN FOREIGN LANGUAGES EDUCATION (ENGLISH)

MASTER'S THESIS

INVESTIGATING THE EFFECTIVENESS OF FOUR INSTRUCTIONAL TECHNIQUES IN LEARNING TECHNICAL VOCABULARY

İLKNUR NURTEN BAĞCI
19708010
ORCID NO: 0000-0002-0907-0748

THESIS ADVISOR
Prof. Dr. HATİCE GÜLRU YÜKSEL

ISTANBUL
2023

REPUBLIC OF TURKEY
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF FOREIGN LANGUAGES EDUCATION
MA IN FOREIGN LANGUAGES EDUCATION (ENGLISH)

MASTER'S THESIS

INVESTIGATING THE EFFECTIVENESS OF FOUR INSTRUCTIONAL TECHNIQUES IN LEARNING TECHNICAL VOCABULARY IN ENGLISH

İLKNUR NURTEN BAĞCI
19708010

Date of Thesis Defense: 15.02.2023

This thesis has been approved unanimously.

	Title Full Name	Signature
Thesis Advisor	**: Prof. Dr. Hatice Gülru YÜKSEL**	
Jury Members	**: Prof. Dr. Türkay BULUT**	
	Asst. Prof. Dr. Semin KAZAZOĞLU	

ISTANBUL
FEBRUARY, 2023

ÖZ

DÖRT ÖĞRETİM TEKNİĞİNİN İNGİLİZCE TEKNİK KELİME ÖĞRENİMİ ÜZERİNE ETKİSİ
İlknur NURTEN BAĞCI
Şubat, 2023

Mimarlık, mühendislik ve tıp gibi birçok meslekte başarılı iletişim için teknik kelime kullanımı oldukça önemlidir. Yıllardır yapılan kelime edinimi çalışmalarına rağmen, öğretim stratejilerinin tekne kelime öğrenimi üzerine etkisi hakkında hala çok az şey bilinmektedir. Bu çalışmanın amacı İngilizce açıklama, Türkçe açıklama görsel resimler ve tesadüfi öğrenme olarak 4 farklı öğretim stratejisinin teknik kelime öğrenimi üzerindeki etkisini araştırmaktır: Bu sebeple 3 araştırma sorusu geliştirilmiştir. (1) Her bir öğretim tekniği üretimsel kelime bilgisinin genişletilmesini ne ölçüde etkiler? (2) Dört öğretim tekniği grubu arasında öğretimsel kelime bilgisi gelişiminde fark var mıdır? (3) Kelime dağarcığı, dört grupta üretimsel teknik kelime bilgisinin öğrenimini yordar mı?

Araştırma İstanbul'da bir vakıf üniversitesinde 58 mimarlık öğrencisi ile yapılmıştır. Katılımcılar dört gruba ayrılmıştır. Her grupta farklı bir strateji ile öğretim gerçekleşmiştir. Çalışmanın başında öğrencilere Kelime Dağarcığı Testi (Nation & Beglar, 2007) uygulanmıştır. Her öğretimin sonunda öğrencilere test uygulanmıştır. Yedi hafta sonunda da hatırlamalarını ölçmek için bir test daha uygulanmıştır. Gruplar içindeki ve arasındaki farkları görmek için test sonuçları kıyaslanmıştır.

Araştırma İngilizce açıklama ve Türkçe açıklama gruplarının 7 hafta sonunda daha fazla kelime hatırladığı sonucuna ulaşmıştır. Diğer gruplarda ise bir gelişme görülmemiştir. Kelime dağarcığı ve teknik kelime öğrenimi açısından istatistiksel olarak önemli bir ilişki bulunmamıştır. Araştırmaya göre, teknik kelime öğretiminde terimler resimlerle desteklenerek hem anadilde hem de hedef dilde açık bir şekilde öğretilirse daha iyi bir sonuca ulaşılacağı çıkarımı yapılmıştır.

Anahtar Kelimeler: Teknik kelime, Özel Amaçlı İngilizce Öğretimi, Mimarlık için teknik kelime

ABSTRACT

INVESTIGATING THE EFFECTIVENESS OF FOUR INSTRUCTIONAL TECHNIQUES IN LEARNING TECHNICAL VOCABULARY
İlknur NURTEN BAĞCI
February, 2023

In many professions, such as architecture, engineering, and medicine, technical terminology is essential for successful communication. Despite years of study on vocabulary acquisition, little is known about the influence of instructional strategies on technical vocabulary learning. The purpose of this research is to evaluate the efficacy of four instructional strategies in technical vocabulary learning: English explanation, Turkish explanation, visual pictures, and incidental learning. Three research topics were developed to this end: (1) To what extent does each instructional technique affect the expansion of productive technical vocabulary knowledge? (2) Is there a difference in productive technical vocabulary growth between the four instructional groups (namely, English-English explanation, English-Turkish explanation, picture description, and implicit instruction)? (3) Does vocabulary size predict productive technical vocabulary learning for four groups with different instructions?

The research involved 58 architecture students from a private institution in Istanbul. The participants were separated into four groups. In each group, the researcher used one of the four instructional strategies. The Vocabulary Size Test was administered to each group before to the experiment (Nation & Beglar, 2007). They were given an immediate and a delayed post-test during and at the end of the intervention. To discover differences between and within groups, the test results were compared.

The study revealed that the English explanation and Turkish explanation groups improved revealed a better result in the delayed exam, while the other two groups showed no improvement. In terms of the relationship between vocabulary size and technical vocabulary understanding, no statistically significant link was discovered. The study suggested that while acquiring technical vocabulary, terms should be clearly taught with illustrations and explanations in both the native and target languages.

Key Words: Technical vocabulary, English for Specific Purposes, technical vocabulary for Architecture

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my advisor, Prof. Dr. Hatice Gülru Yüksel, for her invaluable guidance and support throughout my thesis journey. Her expertise and insights have been instrumental in shaping my research and helping me to navigate the challenges along the way.

Additionally, I would like to thank the instructors in ELT MA program at Yıldız Technical University for their support and the knowledge they share during the course period.

Eğitim öğretim hayatım boyunca ve bütün kararlarımda yanımda olup beni destekleyen canım annem Şaziye Nurten'e ve babam Nevzat Nurten'e beni koşulsuz sevdikleri ve bana hep inandıkları için ne kadar teşekkür etsem az kalır. Onların yanımda oluşu ve beni daima destekleyişleri bu süreçteki gücümün ve motivasyonumun temelidir. Ayrıca bu zorlu süreçte bebeğimle ilgilenerek tezim için zaman ayırmamı sağlayan ve bizden desteğini esirgemeyen diğer annem Yasemin Bağcı'ya sonsuz teşekkürlerimi sunarım. İyi ki varsınız!

I would like to express my heartfelt gratitude to my spouse, R. Buğra Bağcı for his constant encouragement, understanding and support. His unwavering belief in me and my abilities has been a source of inspiration and motivation.

I would like to acknowledge my little baby, Deniz Bilge, for bringing joy and happiness to my life, and for being my constant reminder of why I am doing this.

Finally, the Scientific and Technological Research Council of Turkey (TÜBİTAK) financed this thesis under the 2210- A National Scholarship Program for Master's Students. I would like to extend my gratitude to TUBITAK for supporting my graduate thesis financially.

İstanbul; February, 2023 İlknur NURTEN BAĞCI

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

VST : Vocabulary Size Test

IMM : Immediate Test

DEL : Delayed Test

SPSS :Statistical Package for the Social Sciences

EAOP : English for Academic and Occupational Purposes

EAP: English for Academic Purposes

1. INTRODUCTION

1.1. Overview

Vocabulary teaching is a crucial aspect of language education. It is the process of introducing and reinforcing new words, phrases, and idioms to students in order to help them improve their language skills and communicate more effectively. It is becoming increasingly clear that lexical development in a second language (L2) is complex and multifaceted (Kim, Crossley, Kyle, 2018; Pellicer-Sánchez, 2016). Effective vocabulary instruction goes beyond just providing definitions of words; it also involves teaching word-learning strategies, such as how to infer meaning from context, and providing opportunities for students to use and practice new words in authentic contexts. Additionally, research shows that vocabulary instruction is most effective when it is well-integrated with other language skills, such as reading and writing, and when it is tailored to students' individual needs and learning styles. By providing students with a strong foundation of vocabulary, they will be well-equipped to understand, express and negotiate meaning with others.

Among these reasons, learning a language with the academic and professional motivation is becoming highly popular among tertiary level students. In the competitive working environment, one outstanding feature of an individual is to be equipped with an additional language and the knowledge of the jargon of their profession. Therefore, mastering the technical terms of the field that is studied is an essential part of the study. To achieve this goal, educators and curriculum developers need to pay close attention to technical vocabulary learning in either departmental courses or English language courses.

1.2. Theoretical Framework

Language teaching and learning has been an important issue for decades because people have always needed to communicate with the speakers of other languages for many reasons. The need for a common language and acquiring it has paved the way to find ways to learn languages. In today's world, people generally learn languages due to professional reasons as well as cultural reasons. It is now easier to find a job in an international company or a different country where people are supposed to understand each other through languages. Besides, the need to follow the developments in an interest area is also another factor for learning a language. Because the technical part of every language requires a certain effort to understand and use, the technical language of a foreign language may even demand more to be literate in the subject area. In the universities, the technical language of fields is given in ESP lessons. The ESP classes are shaped around the needs of the profession and the other departmental courses.

ESP (English for Specific Purposes) is a subbranch of language teaching which enables teaching the language for different fields of expertise rather than the language of English in general. It enables professional groups to focus on a specific subject to learn different uses of English for those subjects (Rahman, 2015). ESP has been divided into three subgroups which are English as a restricted language, English for Academic and Occupational Purposes (EAOP) and English with specific topics (Carver, 1983). While EAP mainly focuses on the academic needs of learners, EOP deals with the language that learners will use for the professional purposes (Kucherenko, 2013). Even though language teaching views content instruction as helping students grasp the context provided, the focus in ESP teaching is on the topic rather than the linguistic structures. Context is better understood when vocabulary is taught. The vocabulary is specific to the area studied.

It can be said that ESP practices may differ in terms of context and activities that are held during a lesson. (Strevens, 1992) describes ESP as having two kinds of characteristics that are absolute and variable, which determines its framework. The categories are described and extended as being constructed or intertwined to a peculiar discipline, having a different methodology, generally for adults and intermediate or advanced learners (Dudley-Evans & St John, 1998). Different work areas pave the way to different registers for language use, thus requiring the analysis of the grammar and lexis of those registers (Hutchinson & Waters, 1987). However, this focus on sentence level is not enough for an ESP learner (Allen & Widdowson, 1974), and there should be a close attention to the rhetoric and discourse analysis. The scope of the aim of ESP can be enhanced as to equip the learners with the necessary language components regarding the necessary vocabulary, function, manner, and pragmatics of the area. The activities for specific purposes can be different from the ones that are for EGP (English for General Purposes) in that they focus on specific context and functions. There is a wide variety of ways to involve learners in English for specific purposes.

One major distinction between ESP (English for Specific Purposes) and EGP (English for General Purposes) is the inclusion of technical vocabulary in ESP. Technical vocabulary refers to the specialized terms and language specific to a particular profession or subject area that learners encounter and use in their professional lives. The acquisition of technical vocabulary is essential for success in an academic setting, as it is a prominent part of comprehending and effectively communicating within a specific field or discipline. The importance of learning technical vocabulary should not be underestimated, as it plays a vital role in the development of expertise and understanding in a particular subject area.

Mastering the technical vocabulary work for learners from many aspects. First and foremost, learning technical vocabulary allows students to comprehend and engage with the material they are studying. Without a thorough understanding of the terminology used in a subject, it is difficult to grasp the concepts being presented. According to studies on the minimum amount of vocabulary needed for effective reading comprehension, 98 percent coverage is required for the best understanding (Hsueh-Chao & Nation, 2000; Schmitt, Jiang, Grabe, 2011). Technical vocabulary also serves as a common language for researchers and professionals in a given field, allowing them to communicate effectively with one another and share ideas and information.

In addition, technical vocabulary is an integral aspect of successful academic writing and research. It refers to the specific terms and language used within a particular field or discipline and is necessary for effectively communicating complex ideas and findings. A strong command of technical vocabulary allows researchers and writers to convey their thoughts and results accurately and clearly and is therefore essential for academic success. This is especially true when writing for peer-reviewed journals or presenting research at conferences, as these forums often have high standards for the use of technical vocabulary. In these cases, a lack of understanding or misuse of technical terms can lead to misunderstandings or even rejection of the work.

Therefore, it is important for researchers and writers to be familiar with and proficient in the technical vocabulary of their field, and to use it correctly and appropriately in their writing.

Furthermore, the acquisition and proficient utilization of technical vocabulary is frequently a prerequisite for professional advancement within various fields. This competence is highly esteemed by employers and may be a crucial factor in decisions regarding hiring and promotion. The ability to comprehend and effectively employ technical terminology is a valuable skill as it allows for effective communication with colleagues, clients, and customers, and facilitates a deeper understanding of specialized materials and concepts within one's field.

The importance of technical vocabulary was propounded by many studies. To set an example, Coxhead et al. (2016) studied Carpentry and found that with an additional list of 104 abbreviations and 28 proper nouns, the technical word list for carpentry included little over 1400 words. Likewise, over 1460 words, or more than 30% of the words in a corpus of Plumbing-related textual material were located in Coxhead and Demecheleer's (2018) technical word list for plumbing. Learning the technical vocabulary may take time because their usage in daily life is very limited. As Zahar, Cobb and Spada (2001) showed in their study, frequency affects the vocabulary acquisition in a positive way. To teach the vocabulary, the learners must face them many times. Joe's study (2010) proved that the words that are encountered most were easy to remember. Some technical vocabulary areas may also create a significant learning challenge (Brown, 2005).

The present study aims to investigate the effectiveness of four instructional methodologies for improving students' interaction with technical vocabulary. Specifically, the study will examine different techniques and approaches used to help learners gain a more comprehensive understanding and utilization of technical terms. By examining various instructional methodologies, the study seeks to identify those that are most effective in promoting learners' acquisition and retention of technical vocabulary. This research is important as a strong foundation of technical language which is often necessary for success in fields such as science, technology, engineering, and mathematics. Additionally, the ability to effectively communicate and understand technical language is increasingly important in the modern world, as the use of technical terminology is prevalent in many aspects of life.

1.3. Statement of the Problem

The purpose of learning a language differ across the learning groups. It is possible to learn a language for general purposes to a high level and probably in a much easier way compared to a specific field of language when thinking of the usage area and percentage of prevalence (Brown, 2005).

There are several factors that contribute to the difficulty of learning technical vocabulary. One such factor is the inherent complexity of the concepts or ideas that are often conveyed through technical terms. Technical vocabulary is often used to refer to specific and often complex concepts that may be unfamiliar to learners, which can make it difficult to understand the meaning of the terms being used (Brown, 2005). Another factor that can make learning technical vocabulary challenging is the high density of technical terms in specialized texts. In particular, technical terms may account for a relatively substantial proportion of the total number of words in such texts (Chung & Nation, 2003), which can make reading these texts more demanding for learners. Overall, these factors can make learning technical vocabulary a challenging task, particularly for learners who do not have a strong foundation in the subject matter or who are not familiar with the concepts being referred to by the technical terms. Another factor is the specialized nature of the fields or industries in which technical vocabulary is often used. These fields or industries may require a certain level of background knowledge or familiarity with the subject matter in order to fully understand the context in which the technical terms are being used. For learners who do not possess this background knowledge, understanding the technical vocabulary and its context can be challenging.

In addition, technical vocabulary often includes terms that are not commonly used in everyday language, which can make them more difficult to remember. This is particularly true if the technical vocabulary is not related to a person's everyday life or interests. When technical terms are not connected to a learner's existing knowledge or experiences, they may be more difficult to retain and use effectively. Overall, these factors can make learning technical vocabulary a challenging task, particularly for learners who are not familiar with the subject matter or who do not have a strong foundation in the use of technical terminology.

Technical vocabulary has a more limited usage because of the population that uses it. It is specific to one area and is known mostly by the professionals of it. Therefore, the learners of technical vocabulary are at a disadvantage not to recycle the vocabulary and put them in their daily language access enough, and their use is generally restricted to the classroom environment. Whereas the courses at the institutions are designed to complement this need, the practice done to learn the technical side of the language may happen to fall short. Chung and Nation (2003) state that there has been a lot of research on high frequency and academic terms, but there hasn't been much on technical vocabulary. Nonetheless, technical language is commonly employed by people working or studying in a specific subject, and it has been identified as a critical component of ESP learning.

While learning technical vocabulary can be challenging for students, it can also be challenging for teachers to find materials that are tailored to the needs of their students. This is because the professional or academic requirements for technical knowledge and vocabulary can vary greatly depending on the field or discipline. As a result, it can be difficult for teachers to locate materials that are relevant and useful for their students. In addition, the specialized nature of many disciplines can make it challenging to find materials that are appropriate for use in the classroom. Overall, the task of finding materials that are suitable for teaching technical vocabulary can be demanding for teachers, as they must navigate the specific requirements and needs of their students and subject matter.

Over the years, research has widely demonstrated the effectiveness of explicit teaching in the context of strategy building for learners (Amit & Portnov-Neeman, 2017; O'Neill, Geoghegan, Petersen, 2013; Hollingsworth & Ybarra, 2008; Mellard & Scanlon, 2006; Soler, 2005). However, the specific methods employed in explicit vocabulary education have varied, and relatively few studies have directly compared these different methods in technical vocabulary teaching. Explicit teaching refers to a direct and overt method of instruction that is focused on the deliberate and conscious acquisition of knowledge or skills. In the context of vocabulary education, explicit teaching can involve a range of techniques, such as providing definitions, explanations, or examples of words or terms, as well as providing opportunities for learners to practice using these words in context. While explicit teaching has been shown to be effective in helping learners build strategies for acquiring and retaining vocabulary, more research is needed to identify the most effective methods for teaching technical vocabulary specifically, and to compare the relative effectiveness of different explicit teaching approaches.

Research on the teaching of vocabulary in a second or foreign language has significantly risen in recent years, yet few studies have really focused on productive vocabulary knowledge (Akbarian, Farajollahi, Catalán, 2020).

The primary focus of this research is to evaluate the influence of four vocabulary teaching techniques (teaching with English explanation, Turkish explanation, picture description, and incidental learning) on productive technical vocabulary growth.

1.4. Purpose of the Study

In an effort to find the solutions, the following research questions are dealt with in this research:

1) To what extent does each instructional technique affect the expansion of productive technical vocabulary knowledge?

2) Is there a difference in productive technical vocabulary growth between the four instructional groups (namely, English-English explanation, English-Turkish explanation, picture description, and implicit instruction)?

3) Does vocabulary size predict productive technical vocabulary learning for four groups with different instructions?

1.5. Significance of the Study

The importance of the study begins with the differentiation of the general and technical vocabulary learning. In nature, the general vocabulary has high frequency whereas technical vocabulary does not necessarily occur very often. Thus, this can lead to differences in the instruction of both types. As Nation and Kyongho (1995) stated, the pedagogical approaches employed for the acquisition of various types of vocabulary should be tailored to the specific characteristics of the vocabulary in question because the gain from different types of vocabulary may differ and the effort required for their teaching and learning may also vary. One way of teaching may not be helpful for both, or even if it is helpful research should be done to see if the tested methods apply for both general English and technical English. Therefore, this study is designed to see the possibility of applicability of certain teaching methods of general vocabulary teaching to technical vocabulary teaching end give a clue for teachers working in that area.

When the previous literature is reviewed, it is seen that there is research to test the vocabulary size, vocabulary teaching, and their relationship with each other. Different types of instructional methodologies have been also discussed; however little research is done to see how technical vocabulary is acquired through different instructional methodologies. This research aims at explaining the effectiveness of four instructional methodologies with a quasi-experimental design.

1.6. Limitations

The limitations of the study are listed as follows:

- The study was conducted with groups who meet for only 2 hours a week for their English lesson. The time of the lesson was not enough to recycle the target words in different activities. The students encounter the words in the application called Quizlet, in the reading and in the comprehension questions. Because of the time restrictions it was not possible to revise the vocabulary in the following lessons except teacher's reminding of the previous words if there were similarities with the new ones even the online vocabulary set was presented to students for outside of classroom use.

- Another significant weakness of this study was the inability to control the groups outside of the classroom. The researcher was unable to control the participants' access to other language learning tools different from the ones they are taught with. It was also impossible to determine how much time each group spent expanding their vocabulary knowledge outside of class.

- Due to the time restrictions, the students found it tiring to learn technical vocabulary and be tested on them every week. Their motivation could be kept high with more variety of classroom activities.

- The length of teaching for each group is a second limitation. Future research might extend the treatment period for each group to determine if better outcomes can be obtained. For example, the study may be carried over a whole year or a semester utilizing the vocabulary teaching methodologies for the class.

- The sample size of the study was limited to 57 participants in total and not equal among groups. If the participants were equally distributed, the results may come out differently.

- The study had a narrow scope, as it only examined a limited number of words, and did not take into consideration how many letters or syllables are in the phrase, or how long they are in total. longer words typically take more time to process and are more difficult to remember as compared to shorter words. Similarly, the number of syllables in a word can also affect its complexity level, and thus its processing difficulty. This could have a significant impact on the study's findings, as the length of a word can affect factors such as memory retention, processing time, and ease of understanding.

- The post-test was administered through an online platform, which presented certain challenges in terms of ensuring academic integrity. It was difficult to monitor and prevent cheating among the students due to the lack of in-person supervision. Additionally, the online format of the test made it harder to provide support and encouragement to the students when they encountered difficulties or decided to discontinue the test. This could potentially lead to a lower level of engagement and motivation among the students, which might affect their performance on the test.

- The study was only done with the students of Architecture and Interior Architecture Department. The results may be different with other professions' terminology.

- Since the study was conducted with first year students in the department, they were occupied with departmental projects most of the time and may have not had enough time to revise the words outside the classroom. The study may reveal different results if it is done with preparatory school students who have much time for English.

1.7. Definitions of Key Terms

Receptive Vocabulary

Words that learners can understand and recognize when they are employed in context are referred to as receptive vocabulary (Nation, 2022).

Productive Vocabulary Knowledge:

Knowledge of terms that one must be familiar with in order to use them effectively when speaking or writing. (Crow, 1986). Words that learners can pronounce correctly, comprehend, and apply effectively in speaking and writing are referred to as productive vocabulary. It includes the elements required for receptive vocabulary as well as the capacity to speak or write at the proper time. As a result, since students can use their own words to communicate with others, productive vocabulary can be considered as an active process (Webb, 2005).

Technical Vocabulary

Technical vocabulary is terminology that is specialized to a given discipline and that communicates the thoughts and ideas that are specific to that discipline (Schmitt & Schmitt, 2020).

2. LITERATURE REVIEW

The literature review in this section aims to provide a comprehensive overview of the topics of lexical availability, receptive vocabulary knowledge, and productive vocabulary knowledge as they pertain to language learning. In order to do so, the literature on these subjects will be thoroughly examined and various definitions will be explained in order to provide language teachers and researchers with a clear understanding of how to conceptualize these concepts. The review will also include findings from reputable sources and studies in the field, as well as discussion of different types of instruments used to measure the level of lexical availability and the size of both receptive and productive vocabulary knowledge. By examining and assessing the available data on these topics, the aim is to provide a deeper understanding of their importance and relevance in language learning.

2.1. Vocabulary

A key aspect of language proficiency is vocabulary, which forms a significant part of how effectively learners talk, listen, read, and write. Both first- and second-language scholars believe that vocabulary knowledge is exceptionally important in language competency (Grabe, 1991). In order to communicate in English, one needs a broad vocabulary: 8000–9000-word families for reading and around 5000–7000 word families for speaking (Nation, 2008). Without a large vocabulary and methods for expanding it, learners frequently fall short of their potential and may become deterred from taking use of the chances for language learning that are all around them(Richards et al., 2002).

One of the hardest and most important parts of learning a new language is developing individual's vocabulary. The fluctuation of vocabulary acquisition has prompted scholars and educators to examine and seek the best way for students to learn language. To have a complete understanding of terminology, there are two principles that are essential. To successfully accomplish communicative activities like listening, learners must first be able to distinguish between different facets of word knowledge. The ability to employ vocabulary with competence, which demonstrates that the learner has attained an advanced level in language, is the second way to demonstrate word knowledge (Yanagisawa & Webb, 2019). Furthermore, vocabulary knowledge is also defined as the breadth of vocabulary that L2 learners can comprehend (Milton, 2009). According to Nation (1990), vocabulary knowledge includes information of vocabulary items in writing and speaking, as well as linguistic features such as syntax, meaning, concept and frequency of usage, compatibility, and collocation. In order for learners to utilize words appropriately, they must learn the ways in which certain words are to be used rather than comprehending how and where to employ them.

2.2. Identifying Technical Vocabulary

Vocabulary has been divided and inspected under the categories of high-frequency or general service vocabulary, academic/sub-technical vocabulary, technical vocabulary and low-frequency vocabulary (Peacock, & Flowerdew, 2001). The differentiation between the types of vocabulary is made due to different usage purposes. As the name suggests, high frequency words are the ones that are used very often in every kind of oral or written products. Academic vocabulary with moderate recurrence is termed as semi-technical vocabulary (Farrell, 1990) or sub-technical vocabulary (J. R. Cowan, 1974), and they are generally the words that have both technical and non-technical meaning. According to Schmitt and Schmitt (2020) technical vocabulary is terminology that is specific to a given field (such as business, architecture, or engineering) and that expresses the concepts and ideas that are specific to that field (ledger, scalpel, catalyst). Some common terms with high frequency can also have a technical meaning (Coxhead, 2018). Line, beam, blind, steep, and point are a few examples from Architecture. Learners are likely to be familiar with the common meanings of these high frequency words, but they must also acquire their technical definitions so that can read texts in specific subject area, attend academic conferences or writing reports in their subject area (Nation, 2001). Technical words, contrary to sub-technical terminology, are those employed in a field of expertise and vary greatly from subject to subject. They are commonly recurring words in a certain field that are context-bound and topic-dependent. Low-frequency words are infrequently recycled lexemes (Hsu, 2013).

Technical vocabulary is an important issue for students studying a language for a specific purpose to make the most of the content they study. It is a kind of vocabulary that is subject-specific, appears in a special area, and is part of a subject-knowledge system. Each of these characteristics might serve as a foundation for the careful identification of words. However, little is known about such vocabulary, owing to the lack of well-established approaches for determining which words are technical terms and which are not, as well as the scarcity of research comparing the efficacy of various approaches. The main problem is that technicality is a functional element of a word, hence the specific use of a word must be considered when determining whether it is a technical term or not.

The literature discusses a variety of techniques for categorizing technical words in corpora, a process that is not always simple to complete (Chung & Nation, 2004; Pearson, 1998). Some of these methods include using term extraction procedures that depend on statistical formulas and quantitative data or comparing the frequency and range of words in a specialized corpus across a general corpus or another discipline (Cabré, 1999; Bowker & Pearson, 2002; Chung & Nation, 2003).

The analysis of technicality of words in a specific context has been investigated by many researchers so far. In order to find the most effective approach to identifying technical vocabulary, Chung and Nation (2004) compared four approaches: a) using a rating scale; b) using a technical dictionary; c) using clues provided in the text; and d) using a computer-based approach. They found that the average percentage of terms and non-terms correctly identified by rating scale is 100% which is followed by the computer-based approach with 82.7% rates of correct identification and using a technical dictionary with 81.5% with Dorland's Dictionary and 79.8% with Oxford Dictionary. The least effective approach was using clues provided in the text (75.5%). The rating scale method for term identification includes determining whether particular meanings of words fit into the field of specialized meaning. This method uses intuitive knowledge of researchers to decide if the word is technical in the specified area or not. The words are evaluated by the raters more than one to ensure the reliability of the scale. The inter-rater reliability should be achieved by coming to a decent level of consensus. One essential criterion for the raters is that they need to have deep knowledge of the target subject area. The second most reliable approach of determining the technical vocabulary is to benefit from technical dictionaries which comprise the subject-related words and their specific meaning in the area.

Similarly, Kwary (2011) reviewed four different methods for determining the technical vocabulary. The methods he studied were vocabulary classifications, keyword analysis, term extraction and systematic classifications. The first method that Kwary (2011) examines is, the vocabulary classification method provided by Nation (2001). The method allows the generation of word lists based on frequency and range using a program named Range_GSL_AWL. The words that are not present in those lists are recognized as low-frequency words or technical words. This way of deciding on the technicality of the words is not sufficient to tell if the word is technical or not; however, it is a shortcut to minimize the number of words that need to be investigated. The second method to analyze the keywords in a text is to use chi-square statistics. It examines and compares the target source to the reference corpus. The computer program generates a list of words that are significantly more common in the target corpus than in the reference corpus. However, this method implies certain drawbacks. First, it lacks word classes, making it impossible to determine whether a word is a noun, verb, or adjective, which may be problematic for users. The inability to analyze multi-word units is another drawback, as it may lead to the neglect of a significant portion of technical vocabulary. The problem can be solved using a menu called Clusters, however Kwary (2011) finds it impractical because the clusters need to be decided manually by the researcher which is against the idea of using a computing device or program because it requires considerable amount of time and effort.

Keyword analysis can be applied as a solution to the problem of uncertainty in determining the technicality of a word stemming from the high frequent technical words existing in the text which does not appeal to the rule of frequency. Keyword analysis works with the principle of ordering and showing the frequency of words in the target corpus and comparing them. However, a problem arises because of the lack of the capability of the word classes. It does not tell if a word is a noun or a verb. Additionally, it does not show the word units that are composed of more than one unless they are chosen manually by the researcher.

Another digital method of determining technical vocabulary is term extraction. It is superior to the aforementioned digital methods in terms of working on multi-word units and showing the keyness degree of the word. It reveals more lemma candidates or terms compared to vocabulary classification and keyword analysis. Along with that advantage, its working capacity is limited to maximum three-word unit.

The last method that Kwary (2011) reviewed is the systematic classification which enables the researchers to work with bigger units of words. The practice of this method has three steps which are subject-field classification, internal subject classification and terminological classification respectively. The classification procedure goes from general to specific terminology. The general term is extracted in the subject-field classification phase and further terminologies are drawn from the umbrella term. By this means, it decreases the number of technical words that can be overlooked by researchers. Similar to other methods, the main drawback is the length of time required to conduct and come to a conclusion.

After considering the pros and cons of each method, Kwary (2011) proposes a hybrid method. He suggests using keyword analysis to generate a list of possible terminology and using systematic classification to increase the number of terms by scrutinizing them further and including abbreviations and other words borrowed from Latin or other languages.

The application of two methods that were mentioned in Kwary's review was investigated by Tongpoon-Patanasorn (2018). By using a combination of methods, she created a list of frequently used technical terms in the subject of finance (Keyword Analysis and a modified rating scale). The resulting list included 979 terms that are essential to finance and is grouped into 569 word families. Both the General Service List (GSL) and the Academic Word List (AWL) provide a list of these 979 terms (413 and 291 words, respectively). The study showed that, compared to using each of these methods alone, a combination of Keyword Analysis and Rating Scale method may more accurately detect high-frequency technical words.

A corpus analysis can be used to monitor the selection of technical words for a specialized field and can show various language usage and preference patterns in the target field. Gilmore and Millar (2018) conducted a thorough analysis of the eight million-word Specialized Corpus of Civil Engineering Research Articles (SCCERA) developed in Tokyo. First, a keyword analysis of research articles was performed to identify civil engineering terms with potential educational value. The keywords were then compared to the New General Service List (NGSL) and the New Academic Word List (NAWL) and classified into three groups: words that frequently occur in general English, words that frequently occur in academic English, and words that do not appear in either the NGSL or the NAWL. To find fixed expressions typical to the field, 3-, 4-, 5-, and 6-word combinations were removed and subjected to a separate "cluster analysis." These were discovered to typically fall under one of five groups: Cause-and-effect language, comparison-and-contrast language, language used to quantify, deictic language, and language used to convey the writer's position.

Muñoz (2015) studied 700 research articles and a lexical description of the corpus and an analysis of high-frequency terms were conducted as two steps of the study that integrated quantitative and qualitative approach. The lexical analysis showed that the corpus had a small word range and considerable lexical variance. Academic terms had a coverage of 6%, which was lower than the 10%–12% indicated for research publications but higher than the 4% reported for newspapers.

Justeson and Katz (1995) argued that determining if a candidate term can be classified as a technical term is generally a straightforward task, even in the absence of context. However, determining if a noun phrase is a technical term is a more subjective endeavor. Many phrases that are not included in a specialized dictionary may appear to be technical terms within the context of a particular document. The distinction between non-technical noun phrases and specialized terms can be challenging to discern. They worked on identifying technical noun phrases rather than nouns only.

2.3. Teaching Technical Vocabulary

Technical vocabulary teaching refers to the practice of teaching specialized or domain-specific vocabulary to learners in a particular field or subject area. Technical vocabulary is a crucial facet of learning in many fields, including science, technology, engineering, and mathematics (STEM), as well as other disciplines such as medicine and law (Yager, 1983). Effective technical vocabulary teaching can help learners develop a deep understanding of the concepts and terminology in their field, which can improve their ability to communicate and apply their knowledge.

There are several approaches to technical vocabulary teaching, including direct instruction, inductive learning, and contextualized learning. Direct instruction involves explicit teaching of technical vocabulary words and their definitions, often through the use of flashcards, worksheets, or other visual aids (Alamri & Rogers, 2018). Inductive learning involves providing learners with examples or contexts in which the technical vocabulary is used, and then having them infer the meaning of the words on their own (Maxom, 2012). Contextualized learning involves teaching technical vocabulary in the context of authentic materials or real-world situations, which can help learners see the relevance and importance of the words in their field (Gu & Jhonson, 1996).

Effective technical vocabulary teaching also involves selecting and sequencing the vocabulary words in a way that maximizes learning. This may involve starting with the most important or fundamental words, and then gradually introducing more specialized or complex words as learners progress. It may also involve using a variety of teaching methods and activities, such as games, role-plays, and discussion, to engage learners and help them retain the vocabulary (Littlewood & William, 1984).

Teaching technical vocabulary can be a challenge for educators, as it requires not only understanding the concepts and terms being taught, but also effectively conveying that understanding to students. One of the key challenges of technical vocabulary teaching is that technical words can often be abstract and difficult to understand, especially for learners who are not familiar with the field or subject area (Johnson, & Hwang, 1983). This can make it difficult for learners to remember and use the vocabulary accurately and fluently. To address this challenge, effective technical vocabulary teaching should incorporate multiple exposures to the words, as well as opportunities for learners to practice and apply the vocabulary in authentic contexts (Al-Jarf, 2022; La'biran, 2021; Masita, 2020; Viola, Yanto, Mobit, 2020).

To start with, as in the general vocabulary teaching, the introduction time of the technical vocabulary teaching has been scrutinized. Memory (1990) compared three groups based on their scores as a result of the presentation time instructions. He taught vocabulary in the "before" group "after" group and the "during" group. In the assessment and evaluation part he asked students to write the definitions of the technical terms. He concluded that if acquiring definitions is the goal, a topic area teacher's delivery of vocabulary instruction is more crucial than the time at which it is given.

The same topic was studied by Alamri and Rogers (2018), with an additional focus on the visualization and written context type of instructions. They worked with Arabic learners of English and found a positive impact of pretty teaching vocabulary with visuals. They proposed that this proactive multimodal method improves learners' capacity to recognize vocabulary items, making it a potential tool for increasing vocabulary intake.

Lessard-Clouston (2008) looked at the differences between the native and non-native speakers of English students' technical vocabulary learning in theology lessons. He found that the learners make use of different kinds of strategies however not a dominant strategy was adopted by both of the learner groups. The result was surprising in because of the higher scores by unstructured learning. but the researchers are of the opinion that structured manner vocabulary learning could be more useful for non-native speakers of English in terms of growing in depth of vocabulary knowledge.

One effective strategy for teaching technical vocabulary is the use of real-world examples and demonstrations (Sinulingga, 2012). By providing students with concrete, relatable examples of the terms being taught, educators can help students better understand and remember the meanings of the terms. This can also help to contextualize the vocabulary, making it more meaningful and applicable to students.

Another strategy is the use of graphic organizers, such as concept maps or diagrams. These visual aids can help students make connections between different technical terms and concepts, aiding in their understanding and retention of the material. Saragih (2019) studied the effect of concept mapping technique with midwifery students end compared it to conventional vocabulary teaching. He led one experimental and one control group, applied pretest and post tests and looked at the difference in success of both groups in both tests. He concluded that semantic mapping technique had a significant effect in technical vocabulary gain.

Educators can also use mnemonic devices, such as acronym or rhymes, to help students remember complex or difficult-to-pronounce terms (Atkinson, 1975; Rodriguez & Sadoski, 2000). Atkinson and his colleagues devised the keyword technique, which consists of two stages: First, it builds a link between a new word and a known term, specifically keyword, based on acoustic similarities; second, via the linkage of the target term with the keyword, it creates a fictitious connection (Baleghizadeh & Ashoori, 2010).

Semantic mapping, rote memorization, and the keyword approach were the three vocabulary acquisition techniques that Sagarra and Alba (2006) tested experimentally. The respondents were 778 third-semester undergraduates at a US institution taking Spanish as a second language. 24 experimental Spanish words were used in the study, and they were picked because they were very concrete and easy to visualize. The students were given the same target words utilizing various vocabulary learning techniques, instructions, and examples after taking a pre-test to determine their prior vocabulary knowledge. The only difference was the presentation order of the learning methods. The study found that the keyword method was the most effective in providing long-term retention of the vocabulary, showing that methods that require deeper processing through form and meaning associations are better for vocabulary retention.

Another effective technique for teaching technical vocabulary is to have students create their own definitions for the terms being taught (Gu & Johnson, 1996). This can help students to actively engage with the material, as well as encouraging them to think critically about the meanings of the terms. Educators can also have students create their own examples or illustrations of the concepts being taught, which can aid in their understanding and retention of the material. Pollard (1999) conducted a study in which he examined the effects of preparing a dictionary. Students in the first class who volunteered to assist establish the Dictionary began an open-ended mini-project to create and build a Dictionary "framework" of unfamiliar terminology found in the IT course. The goal of that framework was to include a "Glossary," "Dictionary," and an interactive "Quiz" part. The first students to participate were instructed to choose six distinct concepts and submit single-sentence definitions for the Dictionary framework's Glossary section. They examined the library for further material and illustrations and presented their work in writing. An instructor graded the project based on proper content, clear and succinct descriptions, inventive drawings, spelling and grammatical correctness. Following this activity, students were divided into eight teams of six students each, with responsibility for around 36 Glossary and

Dictionary entries. Each team was now tasked with presenting its definitions in a way suited for the World Wide Web. Definitions for the Expanded Dictionary were created using the HTh4L programming language, animated images, and Java applets. As part of their contribution to the Dictionary, many teams offered their own versions of a multiple-choice Quiz written in Common Gateway Interface script. The results showed that this student-centered responsibility for learning by teaching peers motivated students while also being a cost-effective approach of obtaining knowledge.

A combination of different strategies was studied and found to be useful for technical vocabulary teaching. Al-Jarf (2022) employed the multiple-associations educational strategy with groups of students acquiring ESP and general English vocabulary at King Saud University's College of Languages and Translation, and it was helpful in improving their general and specialized vocabulary. T-test findings revealed significant differences in posttest mean scores between the experimental and control groups. The use of the multiple associations strategy in general and specialized vocabulary training resulted in greater achievement (vocabulary development) in the experimental group.

Incorporating hands-on activities and lab experiments can also be a helpful strategy for teaching technical vocabulary. By allowing students to interact with the concepts and terms being taught, educators can provide students with a more concrete understanding of the material. This can also be an effective way to engage students who may have different learning styles or preferences.

2.4. Intentional Vocabulary Teaching

Any particular term can be learned over time. Acquiring a vocabulary is a gradual process; as new word knowledge components are produced over time, each one is gradually mastered to a higher degree (Schmitt & Schmitt, 2020; Hinkel, 2005). Numerous studies have been done to determine how well various vocabulary acquisition techniques work. However, it is still unclear how speakers of second languages pick up new words. Intentional vocabulary instruction is a key component of effective reading and language development for students of all ages. By intentionally selecting and teaching specific words, teachers can help students build a rich and varied vocabulary that will support their reading comprehension and communication skills. This review will explore the current research on intentional vocabulary instruction and its effectiveness in improving reading and language outcomes for students.

One study found that explicit vocabulary instruction was effective in improving vocabulary knowledge and reading comprehension for second and third grade students (Stahl & Nagy, 2006). The study used a variety of techniques, including word sorts, word maps, and semantic feature analysis, to help students learn and retain new words.

A meta-analysis of vocabulary instruction studies found that explicit vocabulary instruction was effective in improving vocabulary knowledge and reading comprehension for students in grades K-12 (Graves, 2006). The study found that the most effective vocabulary instruction included a combination of direct teaching, contextual reading and writing, and student-centered learning activities.

Vocabulary instruction is one of the topics that is most commonly mentioned while teaching English as a foreign language. The process of teaching and learning would provide challenges for teachers. They have trouble figuring out how to teach students in a way that yields the most satisfactory results (Alqahtani, 2015). Memory (1990) states that some of the students won't learn the terms if the teacher doesn't make an attempt to teach them. The textbook will likely become more challenging for such learners to comprehend and learn from as a result. It is still unclear what the ideal strategy is for achieving effective vocabulary learning, partly because it varies depending on so many different variables (de Groot, 2006). One of the ways of instruction is teaching vocabulary intentionally. The word “intentionally” is interchangeably used as “instructed, deliberately, or explicitly” in the literature (Webb, Yanagisawa, Uchihara, 2020). The learners are explicitly taught the meaning of the words and exercises are prepared to recycle the words many times.

Vocabulary knowledge is frequently described as the accumulation of interconnected "subknowledges" that include word meaning, morphological knowledge, collocational and syntactical knowledge, figurative and associational knowledge, and knowledge of social or other restrictions and limitations that must be adhered to when using a word (Nation, 2001; Richards, 1976; Ringbom,1987). In addition to having a big number of lexical items, a student needs to know a significant deal about each item in order to use it properly. “Knowing a significant deal” has been largely discussed in the literature. It is also known as the "depth" or "quality" of one's vocabulary knowledge and is just as significant as vocabulary size (Schmitt, 2008). One of the best descriptions of that must be understood can be found in Nation (2000, p. 41). Nation (2000, p. 41). provides one of the best explanations for the variety of "word knowledge" aspects" that must be comprehended.

Table 1. What is involved in Knowing a Word

Form	spoken	R	What does the word sound like?
		P	How is the word pronounced?
	written	R	What does the word look like?
		P	How is the word written and spelled?
	word parts	R	What parts are recognizable in this word?
		P	What word parts are needed to express the meaning?
Meaning	form and meaning	R	What meaning does this word form signal?
		P	What word form can be used to express this meaning?
	concept and referents	R	What is included in the concept?
		P	What items can the concept refer to?
	associations	R	What other words does this make us think of?
		P	What other words could we use instead of this one?
Use	grammatical functions	R	In what patterns does the word occur?
		P	In what patterns must we use this word?

	collocations	R	What words or types of words occur with this one?
		P	What words or types of words must we use with this one?
	constraints on use (register, frequency ...)	R	Where, when, and how often would we expect to meet this word?
		P	Where, when, and how often can we use this word?

Source: Nation, I. *Learning Vocabulary in Another Language (Cambridge Applied Linguistics).* 1st ed. Cambridge University Press, 2001.

Note. In column 3, R stands for receptive knowledge and P stands for productive knowledge.

There are various methods to be applied explicitly while teaching technical vocabulary to cover the areas mentioned in the Table 1. The adoption of lexical methods varies depending on several elements, such as the educational setting or the students' degree of competence. It seems hard to use the exact same tactics with learners who are in various age groups or with various degrees of language proficiency. At the tertiary level, language teachers seek that their students have a certain degree of proficiency before enrolling in their classes. Examples include the ability to search for specific information in a text or to group words using the concepts of synonymy and antonymy. In their study, Alam and Uzzaman (2016) discovered that techniques such as "contextual reading, using a dictionary, using online social platforms, watching movies, taking notes, listening to lectures, memorization, listening to audio-visual materials, and reading billboards" significantly improved learners' vocabulary knowledge (p. 109). By accepting the differences among peers in the process of language learning, the utilization of various lexis learning approaches also corresponds to varied learner types.

Gu and Johnson (1996) sought to identify the vocabulary learning methods used by Chinese university students studying English, as well as to investigate the relationship between these methods and learners' progress. Using a vocabulary acquisition questionnaire, they collected data from 850 sophomore non-English majors at Beijing Normal University. They compared survey responses to outcomes from a vocabulary size test and the College English Test (CETBANDB) and listed the learning strategies of the students. Participants yielded adopting a wide range of vocabulary acquisition approaches including contextual guessing, effective dictionary usage, taking notes, paying great attention to word formation, contextual encoding, and activating newly acquired terms except for rote learning. The results indicated that the combination of these five different learning strategies they listed in the study rather than individual techniques helped them improve their vocabulary size.

Similarly, (Karami & Bowles, 2019) scrutinized the best ways to help students for learning and remembering vocabulary in English as a Foreign Language (EFL) classrooms, applying intentional vocabulary teaching, incidental vocabulary teaching, and a mix of the two. They had three experimental and three control groups who took a pre-test in the beginning and an immediate post-test after the instruction. After the immediate post-test, the experimental groups took a delayed post-test. The three control groups did not get any vocabulary acquisition training, whereas the three experimental groups got the intervention (intentional, incidental, or a combination of both). The outcomes demonstrate that the mixed-instruction group scored better than the other two groups and remembered the vocabulary longer. Interestingly, the study showed that incidental vocabulary teaching was superior to the intentional vocabulary teaching.

On the other hand, there are some studies that focused on the comparison of the influence of the first language and second language on vocabulary learning. In her research, Ajabshir (2022) examined the effects of paper-based glosses in Farsi (L1) and English (L2) with two alternative presentation styles (at the bottom of the page and in the margin) on intermediate-level English language learners' (EFL) vocabulary retention and recall. Over the course of a two-month intervention, the participants read the passages under one of four conditions that were L1 gloss in the margin and at the bottom and L2 gloss in the margin and at the bottom of the page. A post-treatment vocabulary exam and a delayed post-test one month later were used to assess any vocabulary improvements. The post-test statistics of repeated measures

ANOVAs demonstrated that L1 glosses revealed a better result than L2 glosses (L1-margin> L1-bottom>L2-margin>L2-bottom).

2.4.1. The function of L1 and L2 in the learning of vocabulary

The role of first language (L1) in second language (L2) vocabulary learning has long been a subject of debate in the field of second language acquisition. Some researchers argue that the use of L1 in L2 vocabulary instruction can be beneficial, as it can provide learners with a familiar frame of reference and facilitate understanding. Other researchers, however, argue that the use of L1 may hinder L2 vocabulary learning, as it may lead to over-reliance on L1 and hinder the development of L2 vocabulary knowledge.

Studies have shown that L1 can be useful in L2 vocabulary learning, particularly for beginners and lower-level learners (van Zeeland & Schmitt, 2013). For example, research has shown that the use of L1 glosses (L1 translations of L2 words) can be effective in facilitating L2 vocabulary learning, especially when paired with context and imagery (Carrell, 1988). In addition, the use of L1 in vocabulary instruction has been found to be effective in promoting the retention and transfer of L2 vocabulary knowledge (Mohan & Lo, 1989).

However, the use of L1 in L2 vocabulary learning is not without its challenges. Some research suggests that the use of L1 may lead to over-reliance on translation and hinder the development of L2 vocabulary knowledge (Schmitt, 2000). In addition, the use of L1 may not be appropriate for all learners, as some learners may have a weaker foundation in their L1 or may not be proficient in the L1 of the vocabulary instruction (Coxhead, 2000).

Overall, the research suggests that the use of L1 in L2 vocabulary learning can be beneficial, but it is important for teachers to carefully consider the needs and proficiency levels of their learners and to use L1 judiciously in vocabulary instruction. Further research is needed to fully understand the complex relationship between L1 and L2 vocabulary learning and to determine the most effective ways to incorporate L1 in L2 vocabulary instruction.

2.5. Implicit Vocabulary Teaching

Incidental vocabulary learning is the process of picking up new words as a result of meaning-focused communication activities including reading, listening, and social contact (Huckin & Coady, 1999), and viewing television and films (Webb, Yanagisawa, Uchihara, 2020). Incidental learning, according to Loewen (2005), is learning that occurs even when there is no deliberate effort to learn anything new. The characteristics of incidental vocabulary acquisition, according to Laufer and Hulstijn (2001), include the fact that learners are not told they will be evaluated later when they are given a task that requires them to learn new lexical items.

2.6. Vocabulary Tests

Vocabulary measures of productive and receptive vocabulary are divided into two categories (Read, 2000): use and comprehension (knowing the meaning of a target word in a reading or audio text), or recall (a target word encountered in writing or speech) and recognition (getting the meaning of a target word in isolation). The trend in vocabulary assessment is performed via test recognition and recall tests, e.g., through the translations from L2-to-L1 and L1-to-L2 that genuinely measure the form-meaning relationship of an L2 word (Schmitt, 2010). This is because use and comprehension tests may be impacted by contextual factors (Read, 2000). Using form-meaning relationships as their foundation, Laufer and Goldstein (2004) identified four levels of form-meaning knowledge: active recall (providing L2 word forms), passive recall (providing L1 equivalents), active recognition (choosing L2 word forms), and passive recognition (choosing L1 equivalents). These four levels are also known as form recall, form recognition, meaning recognition, and meaning recall (Schmitt, 2010).

Productive vocabulary tests are a type of assessment that are used to measure an individual's ability to produce words or word forms in a given language. These tests are designed to assess an individual's vocabulary size and knowledge of words in the target language, and they may be used for a variety of purposes.

One of the main uses of these tests is to assess language development in children. For example, researchers may use productive vocabulary tests to track the vocabulary development of children as they acquire their first language, or to assess the vocabulary development of second language learners.

Another use of productive vocabulary tests is to identify areas of weakness in language learning. For example, an educator may administer a productive vocabulary test to a language learner who is having difficulty in a particular area, such as vocabulary acquisition, in order to identify specific areas of weakness. Additionally, productive vocabulary tests are used for assessing language proficiency for academic or professional purposes. For instance, academic institutions and employers often use such tests to evaluate the language proficiency of candidates, particularly in the case of second language learners.

2.6.1. Types of Productive Tests

Productive knowledge entails understanding a lexical item well enough to generate it when it is required to convey communicative meaning in speech or writing (Schmitt, 2019). The productive knowledge can be assessed through many different kinds of productive vocabulary tests, and the specific tasks included in a given test may change depending on the test objectives, the age, and the language proficiency of the test takers. Some examples for productive vocabulary tests may include the following:

The Lex-30: The Lex-30 is a test for assessing the vocabulary size of a learner of a second language. The test was developed by researchers Paul Meara and Tony Fitzpatrick in 2000. The test is designed to be quick and easy to administer and can be used with learners at different proficiency levels. It consists of a word association task in which participants are presented with 30 stimulus words and are asked to provide three or four replies for each of the words. The participants are not required to generate a predetermined set of response target words.

The Lex-30 test measures vocabulary size by counting the number of different words that the participants produce in their responses to the stimulus words. Since the test is not limited to a predetermined set of response target words, it allows for a more comprehensive assessment of the learner's vocabulary. Additionally, the test's ability to measure the vocabulary size of learner with different proficiency level because it's not restricted with a specific target set of words. The test is useful for researchers and educators because it provides a measure of vocabulary size that is directly related to the target language. Additionally, it can be used for comparisons between different groups of learners, such as those at different proficiency levels or those who are studying the language in different contexts. The Lex-30 has been found to be a reliable measure of vocabulary size and it also correlates well with other measures of vocabulary size and overall proficiency of the second language. One of the main advantages of Lex-30 is that it is quick to administer, so it is useful for large-scale assessments. (Meara & Fitzpatrick, 2000).

The Lexical Frequency Profile (LFP): It is a method for assessing the vocabulary usage of a learner of a second language. This method was first proposed by researchers Laufer and Nation in 1995.

The LFP involves analyzing the written output of a learner, such as an essay answer to a discussion topic, and categorizing the words used in the output based on their frequency of occurrence in the language being learned. The words are typically grouped into three categories: high-frequency words, which are the most commonly used words in the language; mid-frequency words, which are less commonly used than high-frequency words but still occur frequently in the language; and low-frequency words, which are the least commonly used words in the language. The main advantage of the LFP is that it provides a measure of the learner's vocabulary usage that is directly related to the target language. By analyzing the frequency of words used, the LFP allows researchers to identify patterns in the learner's vocabulary use and determine which words the learner is most likely to know and use in the target language. It can be used in a number of different ways. For example, researchers may use it to compare the vocabulary usage of different groups of learners, such as learners at different proficiency levels or learners who are studying the language in different contexts. Additionally, the LFP can be used to evaluate the effectiveness of vocabulary instruction, by comparing the vocabulary usage of learners before and after they have received instruction in a particular set of words. (Laufer & Nation, 1995).

Category generation task: Students are asked to include as many keywords as they can from a specified category, including animals or bodily parts, when creating a list of words that meet a particular category (Izura, Hernández-MuÑoz, Ellis, 2005). For example, the test may ask the individual to produce a list of animals that live in the ocean. The task appears to be quite trustworthy and capable of distinguishing between learners of varying levels of proficiency (Roghani & Milton, 2017).

Filling in the blank with the most appropriate word: Test takers are expected to provide the best word fitting in the blank (Schmitt, 2010). Fill in the blank type of question to test the productive knowledge of vocabulary is a useful way since it allows to measure many aspects of vocabulary rather than just meaning. As Schmitt (1995, p.89) suggests:

> This type of item requires a learner to be able to read the contextual clues, use the context to recall the correct word and write it down in its correct form. So as in the multiple-choice item above, it mainly deals with conceptual word meaning and written form, only this time productively.

The productive vocabulary levels test, created by Laufer and Nation (1999), is a frequently utilized test format. Test takers are provided with a definition, a sentence context, and/or the start of the target word, and expected to write specific target terms for those definitions. This format has a statement that utilizes the target term but leaves the place blank in each test item. The sentence gap must be filled in by test-takers. The beginning letter(s) are given as hints to encourage test-takers to generate the correct target term as in "Farmers are introducing innova______ that increases the productivity per worker." (Schmitt, 2010: p. 203). But he questions the reliability of this test design because the test item's difficulty may be influenced by the given initial letter(s) and the sentential context. Additionally, he contends that a test of this kind cannot assess students' thorough understanding of productive words because it is not communicative enough. However, this type of test requires word recall which is a part of productive vocabulary learning. Although this test was created to assess the size of a student's productive vocabulary, Niu (2015) believes that it is also appropriate for assessing students' gains in productive vocabulary as a result of task performance.

Productive vocabulary tests, which can be designed to elicit either oral or written responses, can be administered individually or in groups, by a trained professional, or as a self-assessment test. Because of their nature, students' responses may not be fully elucidated, and that arouses the questions of how to score the correct answers. While the receptive vocabulary scoring can be done with giving certain scores to each correct answer and adding them up for a total amount, the productive vocabulary scoring is controversial given that the answers might be partially correct, and this partial correctness is questioned in terms of its rate within the word. It is difficult to determine the real quantity or breadth of a learner's productive vocabulary from any short sample since a learner's vocabulary, whether created in written or spoken form, is likely to be so context-specific (Meara & Fitzpatrick, 2000).

Translation tests: These tests are assessment tools that measure an individual's ability to translate between two languages. In these tests, participants are presented with definitions or descriptions in their primary language (L1) and are asked to write the equivalent term or phrase in the target language (L2) (Webb, 2008).

Dialogue Systems: Tellols, Tokunaga and Yamamoto (2019) present a novel approach for assessing language learners' productive vocabulary using dialogue systems that requires learners to utilize the target term to be assessed during a conversation without explicit guidance.

Hidden-task-oriented Dialogue Systems: Due to the fact that even native speakers struggle to recall a single word given its meaning and the dialogue contexts in the Dialogue Systems collected from a human-human corpus are insufficient for predicting the following utterances containing the target word, Tellols, Tokunaga and Yamamoto (2020) suggested using a novel type of dialogue system to lead learners to use particular terms during a natural conversation in order to determine if they are included in their free productive vocabulary. In this type, a hidden task is utilized to make people utter the target word. However, they found that the presented task is more challenging than a simple question answer dialogue task designed to elicit the target word, yet it is doable by humans.

2.6.2. Scoring Productive Tests

Many approaches to scoring productive vocabulary have been experimented and tested. A lexical production scoring protocol (LPSP) was developed by Barcroft (2000a) and tests partial word-form knowledge based on the number and location of appropriately produced letters. This scoring method makes enhanced distinctions between letters that are produced and letters that are created in the right position. Any fully formed word is given a score of 1 using this methodology. Other scores are given as follows: .25 if roughly one-quarter of the word (or one right letter) was created; .50 if roughly half of the word was formed; and .75 if roughly three-quarters of the word was produced; and 0 in every other situation. In two research that examined the nature of learning partial word forms for L2 Spanish.

In the studies in 2000b and 2008, Barcroft provided evidence of the value of scoring using the LPSP. Both studies used a word-picture pair learning paradigm and asked English-speaking L2 Spanish learners to learn 24 new words by repeating each pair twice. In each experiment, after the learning phase, participants were asked to produce each target word as best they could, either orally or in writing, when only pictures were provided. Barcroft examined every item that students produced to determine the percentages of partially created target words in contrast to the fully created ones, the approximate amount of each word learners produced, the lengths of fragments that they tended to make, and the place where they produced the fragments. Both investigations found that partial words were more likely to be produced than complete words, in addition to the fact that two syllabus-words were produced fully more than three-syllabus words, and this was supported with the findings by another study (Barcroft & Rott, 2010). Furthermore, Barcroft (2008) discovered a tendency to produce one-letter word fragments at a significant percentage with a heavy preference for word-initial position. These findings imply that, when compared to learning entire words, partial word form acquisition is the norm rather than the exception. The research also revealed a word-internal primacy effect for learning early word forms, but it did not support the bathtub effect's recency (word-final) component.

In a different study, Barcroft (2002) examined "the impact of semantic learning, structural learning, and no extrapolation upon picture-cued word-form memory" by L1 English learners of Spanish. He used letter-based rating, word-based rating, and syllable-based rating. Partial word learning was taken into account in both letter-based and syllable-based grading, but not in word-based scoring. However, the study found no evidence of a moderating influence of different scoring methods on various learning environments. Similarly, in the study he conducted in 2004, Barcroft evaluated the effects of sentences’ structure and repetition of word-meaning on English-native Spanish learners' word recall using whole word scoring and syllable scoring. This study also found no significant moderating influence, either.

Niu (2015), studied the scoring of receptive and productive vocabulary learning and compared their effectiveness on the results of vocabulary gain. She adopted three different ways to score the productive vocabulary which are letter-based scoring, syllable-based scoring, and word-based scoring. The first one assesses the precision with which letters of a target word produced by students and thus takes into account even partially correct spellings. When a word is formed correctly, all of its letters are created appropriately. Niu developed the scoring guidelines by modifying Barcroft's LPSP (2002). When LPSP was applied to that investigation, it became clear that the sensitivity of LPSP was not sufficient for the variance of erroneous forms. Therefore, rather than utilizing a 5-point scale (i.e. 0, 0.25, 0.5, 0.75, and 1), the right letters were assessed using a letter-based scoring approach, and the percentage of correct letters was then translated into points.. In the adapted version of letter-based scoring, Niu (2015) utilized three levels: 1) When nothing was entered or if none of the letters were provided correctly, no points were awarded; 2) If all the letters were provided properly, 1 point was awarded; 3) When some of the given letters were right, they received a score between 1 and 0. To determine this, divide the entire number of accurate letters by the overall number of target letters, or by the total number of given letters if more accurate letters were written than target letters. In contrast, syllable-based scoring only considers the scores for syllables that are correctly produced. This method is less precise than letter-based scoring because incorrect syllables are scored as 0, including partially correct ones. Because there are some differences between phonetic and orthographic syllable divisions (Wells, 1990), in her investigation, the target words were syllabified using phonetic syllabification rules on their orthographic forms. Only correctly constructed words are recognized in the third scoring technique, word-based scoring. It is the least fine-grained approach of the three because eliminating incorrect word forms also means eliminating correct letters or syllables. The results demonstrate that letter-based scoring provided higher scores than syllable-based scoring, which in turn produced higher scores than word-based scoring, across all tasks and on all productive posttests. However, on posttests 1 or 3, the three scoring techniques did not result in significantly different cross-task lexical learning, but on some of the test form, the type of scoring led to differences in the results. She concluded that even when the difference scoring did not have any effects on the learners' lexical gain, they prevailed a significantly different intra-learner word gain and cross-task effects.

3. METHODOLOGY

3.1. Introduction

This section includes information about the participants, tools, processes, and materials used to gather the data as well as the techniques used to analyze the data.

The purpose of this study is to evaluate teaching technical vocabulary of Architecture through English to English, English to Turkish, and English with picture descriptions explicitly versus vocabulary teaching implicitly through reading with no specific focus on the words and to see the degree of vocabulary retention varying depending on the type of the method. Hence, a quasi-experimental design was created and conducted in an English course of a private university's school of foreign languages in the 2021-2022 academic year.

3.2. Participants of the Study

The study was conducted for the first grade students of the Architecture Program of a foundation (private) university in İstanbul. The study started with 128 Architecture students at first, and the number declined to 72 participants given their attendance in the post-test. To be able to have a proper set of data, the students who did not take the Vocabulary Size Test and the Post-test were excluded, and finally the number of the students decreased to 58. Convenience sampling was employed while choosing the study group. Convenience sampling, according to Fraenkel, Wallen, and Hyun (2012), is a sample strategy that allows researchers to deal with a great number of participants available for the study. The students were at the first year of their department. Four groups as three experimental groups and one control group were formed based on the grouping of their preferences determined by their weekly schedule. Hence the grouping was done randomly rather than choosing for a specific purpose.

Table 2. The Distribution of the Students across Groups

Study Groups	Previous Number of Participants	Current Number of Participants
English-English (Group 1)	41	20
English-Picture (Group 2)	27	12
Incidental (Group 3)	25	12
English-Turkish (Group 4)	34	14
Total	127	58

Note: The previous number refers to the number of the students when they were first registered in the courses while the current number refers to the number of the students after disregarding the students who did not take the Vocabulary Size Test and Delayed Test.

As can be seen in the Table 2, at the beginning of the study, there were 41 students in the English-English group (Group 1), 27 students in the English-Picture group (Group 2), 25 students in Incidental learning group (Group 3), and 34 students in English-Turkish group (Group 4). However, some of the students were absent in most of the classes, and some of them did not take the post-test. Therefore, the final number of the students were 20 students in group 1 (12 female, 8 male), 12 in group 2 (11 female, 1 male), 12 in group 3 (9 female, 3 male), and 14 (10 female, 4 male) in group 4. Almost all the students studied at the Preparatory Program of the university except few of them who took the proficiency exam at the university and passed it on the first try. The students need to be at least at the upper-intermediate level to be able to pass the exam. They take ESP courses (English for Specific Purposes) in the first year named Advanced English I and II in which they learn certain technical vocabulary in the Architecture context and cover field-related reading and listening texts. They make use of a teacher-prepared course pack for two semesters. The program they study in is composed of 30% English mediated courses.

The materials and the exams are given in English in those courses. All the four groups were taught by the same instructor who is the researcher of this study.

Table 3. Socio-Demographic Information of the Students

Variable		**Frequency**	**Percent**
Gender	Male	16	27,58
	Female	42	72.41
Background	Turkish	47	81.03
	Other	11	18.96
Total		58	100

The descriptive analysis of socio-demographic characteristics was reported in this section. First, the descriptive findings of the sociodemographic factors using frequencies and percentages were evaluated. Table 3 reports that the cohort consists of 42 (72.41%) female participants and 16 (27,58%) male participants. The background of the students is different in terms of nationality. While 47 (81.03%) were from a Turkish background who lived in Turkey and speak Turkish as the mother tongue, the 11 (18.96%) of them are from different backgrounds, mainly Arabic.

3.3. Data Collection Instruments

The data were compiled with the help of three instruments. These are Vocabulary Size Test which was designed by Nation and Beglar (2007), Immediate Tests given after each session, and Delayed Test given after 7 week-period. The immediate and Delayed Tests were prepared by consulting experts' opinion. The students were provided with the vocabulary set prepared on a website called Quizlet. Quizlet was found to be both useful and simple to use for learning technical vocabulary (Yüksel, Mercanoğlu & Yılmaz, 2020). The students were divided into four groups, and they were given the words with Turkish translation, with English translation, with pictures, and one of the groups was not given any materials except the reading texts. The lessons were designed to cover the technical words included in a reading text written in bold. The list of the words was given before the reading texts and students practiced the vocabulary. They read the text and answer the questions that get students’ attention to the target vocabulary.

3.3.1. Vocabulary Size Test

The Vocabulary Size Test (VST) (Nation & Beglar, 2007) is an assessment tool that aims to accurately and comprehensively measure the vocabulary size of a learner of English, including the first 1000 to the 14th 1000 word families. The goal of measuring vocabulary size for non-native speakers is to understand how well equipped they are to perform various tasks such as reading novels, newspapers, watching movies, and engaging in casual conversations. According to Nation (2006), research has shown the vocabulary sizes required for comprehension tasks. The findings indicate that learners should have a vocabulary of around 8,000 word families to achieve such comprehension. The study's assumption is that proper names do not need to be known. Figure 1 from Nation (2006) shows the vocabulary sizes necessary to reach 98% comprehension of various types of text. Once a learner reaches 98% coverage of a text, it is possible for them to understand it adequately without assistance (Hu & Nation, 2000). Another reason to measure vocabulary size is to track the development of learners' vocabularies. There is a lack of information available on the rate of growth for non-native speakers' vocabularies. To measure this, a test that can measure a wide range of vocabulary sizes for individual learners over time and across a group of learners is needed. The other reason to measure vocabulary size is to compare non-native speakers with native speakers, which could be useful for various comparisons such as determining the rate of growth in second language learning environments, whether it is faster, slower, or similar to native speakers. This can also help to identify if there is a specific threshold, as it has been suggested by the 98% coverage threshold.

Texts	98% coverage	Proper nouns
Novels	9,000 word families	1-2%
Newspapers	8,000 word families	5-6%
Children's movies	6,000 word families	1.5%
Spoken English	7,000 word families	1.3%

Figure 1. Vocabulary sizes needed to get 98% coverage (including proper nouns) of various kinds of texts (Nation, Beglar, 2007, p. 9)

To compare the groups' vocabulary knowledge in general English, the fifth 1000 words of Vocabulary Size Test was administered at the beginning of the study. It is a test that students can take online and see their scores after submitting their answers. The test is composed of 14 parts in which 10 out of 1000 words for each part were asked. It includes the words for general English; thus, the result gives an idea about the students' level of general vocabulary even though they are presumably B2 level as a result of their proficiency score of the preparatory program of the university. The questions are multiple choice type of questions in which test-taker are given the target word in a sentence written in bold and asked to choose its synonym or meaning. The scores for each part are given separately. The researcher applied it up to the 5th 1000-word test, 50 questions in total and got results for each part and added them up to have a total score.

3.3.2. Immediate Tests

These tests refer to the tests that were given to the students on the lesson days. The tests were designed to address a specific research question, which is how well students recall the technical vocabulary just after they learn. They were in the form of "fill in the blank" questions, which required students to recall the words they had covered during the lesson. Only the first letters were provided. The goal of the test is to measure the student's ability to recall the vocabulary with little help.

The tests were prepared and administered through Google forms, and the answers were retrieved from the forms as an excel document and scored considering the letter-based scoring.

3.3.3. Delayed Test

The test was designed to assess students' recall of the technical words that they studied during the seven weeks. The test included all the 70 words that were covered in the process. It was prepared in accordance with the questions and words that were tested in the immediate tests. This test was different from the immediate tests in terms of the questions in which students were provided with the words in the lesson and asked to write them in the blanks. However, in the delayed test, the first two or three letters of the target words were provided to the students to give a clue about the word and no other kinds of help was provided. The first letters restrict test-takers from writing another term that is semantically acceptable in the current context but belongs to a different category (Laufer & Nation, 1999). Because this test was designed to assess productive vocabulary skills, the fewest letters possible were utilized to disambiguate the cue. If two letters in the supplied phrase could start two probable words, an extra letter was inserted to discard this possibility. The size of the highlighted gap at the end of the incomplete word does not indicate how many letters are required to complete it. An example can be seen below:

1. To have a more effective ventilation system and let air move in and out, slo_____ o________ were installed throughout the house.

2. Sl______ is a durable rock that is suitable for many uses. We can see it as pathway flooring in most of the specifically designed gardens.

The answer of the first sentence is "slot outlets", and of the second sentence is "slate". Because the words start with the same letters, the first three letters were provided to guide the students to pick the write intended word. The second answer was too short to provide extra letters, so only the first two letters were provided considering that the differentiation clue was already provided in the long word.

This test was also retrieved from the Google Forms as an excel document and the scores were calculated through letter-based scoring.

3.4. Data Collection Procedure and Research Context

The participants have 2 hours of English lessons each week in 14 weeks. In one of the weeks, they have exams and a jury week on which they are expected to present their project to a group of teachers. They speak Turkish in the jury in the first year, however they are expected to present their projects in English in the fourth year. The data was collected in the last seven weeks following the exam and jury week.

The students were presented with the new vocabulary with the help of a reading text. As supported by studies, reading has the greatest potential of all the different inputs for vocabulary learning (Jonathans et al., 2021). In order to improve target vocabulary and retention, reading combined with vocabulary practice is more preferable than a pure reading strategy (Min, 2008). Laufer found that more vocabulary was learned when words were completed in sentences, used in compositions, and written than when the words were encountered in reading (2003). To provide understanding of the reading the students first presented with the unknown vocabulary, in other words technical vocabulary. The students were given Quizlet links with which they could practice the new terms with pre-prepared explanations either in English, Turkish or pictures. The students were given the reading texts and the exercises rather than other productive activities because of the time restrictions. Having only reading and "fill in the blanks" exercises can be presumed as a drawback for vocabulary gain because of the nature of the activity as semi-controlled. Nonetheless, it was found that longer sentence-writing exercises produced more word learning than shorter sentence-reading exercises. On condition that the amount of time spent on each activity was the same, the outcomes were different, with the reading activity producing greater improvements (Webb, 2005).

The words that were chosen to be taught were selected based on their existence in the reading text and in the dictionaries for technical vocabulary of Architecture. The technicality of the words was proven to be valid considering their involvement in the dictionaries. The dictionaries are the well-known and used materials in the lessons of the students.

The procedure started with the application of the Vocabulary Size Test (Nation & Beglar, 2007) to the four groups of study which were divided randomly. The students chose their sections considering their schedule for the upcoming term. The method of teaching was determined after they chose their sections, therefore none of them knew which method they would be taught with. Their voluntary participation was asked for in the beginning and all of them agreed on it. They continued their regular lesson and intervention lessons in the last seven weeks of the semester.

The students first were sent the links of the Quizlet set for each week before the lesson starts. They were given time to practice the vocabulary in the beginning of the lesson. Then the words were revised together with the teacher. The students were put into groups and played a game to have some idea about the meaning of the game before the reading. The game is automatically created with the help of Quizlet website. It assigns students into random groups of three or four, and the questions appear on each of their screens and the options for the answer are distributed on their phones. The students come together to answer the questions as a group. This part was the same in three experimental groups, and nothing special was done for the control group where learning vocabulary was incidental. Some examples can be found below.

Perforated metal  Hewn stone 

After the game, the students were given the reading texts in which the target words were written in bold. The readings were about one page long. They were followed by comprehension questions and vocabulary questions in three experimental groups. In the incidental group, just the comprehension questions were asked. The answers to the comprehension questions were found in the sentences with the target words, so that the students would encounter the words one more time. At the end of the lesson, the tests were given. Their function was similar to exit ticket (Cornelius, 2013) which is a brief assessment tool that is used to quickly gauge student understanding at the end of a lesson or class period. It is a way to check in on student comprehension before they leave the classroom and move on to the next topic or subject (Wylie, Lyon, Goe, 2009). Figure 2 summarizes the process.

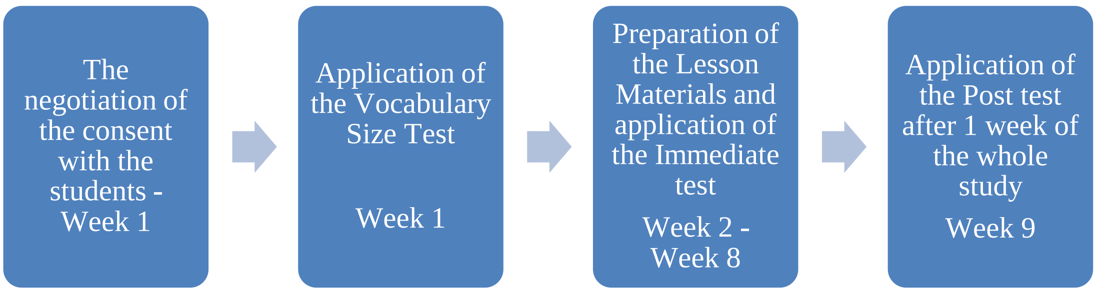


Figure 2. Experimental Process

3.4.1. Ethical Approval and Consent to Participation

Before the process started, the researchers informed the students about what they were going to do during this semester, ensuring them that their performance in the study would not negatively affect their real grades in the Advanced English I lesson, and the data would only be used for the research purposes. They were also informed that they would be given additional mark for the classroom evaluation grade if they participated willingly in the study.

3.4.2. Choosing Technical Vocabulary

The words to be tested in the study were chosen from the books that contain technical vocabulary and content (Coles & House, 2007; Farrelly, 2012; Mertens, 2010; Waterman, 2012). The subject related books provided a list for technical vocabulary that appeared in the text before. The content was parallel to what students were supposed to cover that week. The topics were specifically materiality, a project of an Embassy building, elements of construction, fundamentals of Interior Architecture materials and texture, the Architects of Renaissance, how shapes affect Architecture and lastly Pyramids. The technicality of the chosen words was checked through using various dictionaries (Cowan & Smith, 2004; Harris, 2006). The words were introduced with either in English explanation, Turkish explanation or related pictures. The English and Turkish explanations were provided with the help of technical terms dictionaries. Before deciding on the last version of the explanations, they were asked to an interpreter for clarity. The pictures were selected based on the explanation in English and Turkish. There can be more than one meaning in technical vocabulary similar to general vocabulary. Expectedly, it was not easy to determine which meaning should actually be taken. To understand the contextual meaning of the words, the words were evaluated in the context that they appeared in and discussed with field experts. The pictures which were taught to reflect the related meaning most were used. The pictures were first chosen from the database of Quizlet, but in the case of inconsistency, pictures from outer sources were used. The words were presented to students as the word one side, and the explanation or picture on the other side.

3.4.3. Application of Tests

The students were given two types of tests to check their technical vocabulary retention. One of the tests is the immediate test which students took just before they left the lesson. The tests were given to students at the end of each session after they covered a reading and related vocabulary exercises. After doing the reading, the students were asked to close their notes and sent the link for the immediate tests. They were supposed to fill in the blanks with the appropriate word. When they finished, they were allowed to leave the class. This procedure continued for seven weeks. The tests encompass each of the ten words that students learn during the session. The immediate test is composed of 70 questions, every 10 of which were given in different sessions.

The other one is the delayed test. Delayed test was given after the seven sessions were over in the final week. The test was given online. The students were asked to answer fill in the blank questions that include all the 70 words in 40 minutes. They were invited to a Zoom session and given the link. They were given limited time to prevent looking up the words in the dictionary. They were encouraged to take the exam in return for 10 more points to their presentation grades which affected their overall grade by 25% for their English lesson. They were also informed that one of the reading texts that they had studied in one of the seven sessions previously would be used in the final exam.

According to research, using different exam formats has an impact on test takers' ability to demonstrate vocabulary learning attainment (Laufer & Goldstein, 2004). The difference between knowing a word and utilizing a word provides one way to look at the broader job of vocabulary development. To put it another way, the goal of acquiring a vocabulary should be to be able to recall words as well as immediately utilize them in a variety of linguistic settings as needed (McCarthy, 1984 as cited in Gu, 2003). They need to have active vocabulary and be tested on it due to the fact that they need the technical vocabulary either in their academic or professional lives. They are supposed to present their projects in English before they graduate from their departments which indicates that they need to be able to use the words in an active way. Speaking and writing are two forms of active knowledge, and they both imply that we are able to recall the right verbal or written form for the idea we wish to convey (Laufer & Goldstein, 2004). However, standard Levels Test only promises to assess basic recognition knowledge (Cobb, 2000). To this end, the questions in the tests were prepared as fill in the blank form. Yet the words were not provided for them in order to avoid the chance factor. However, because the cognitive load of seventy words can be too much demanding, some of the first letters of the target words were given in the blanks as in Cobb's (2000) Controlled Productive Levels Test. The number of the given letters were decided regarding the similarity of the present words in the target list.

3.4.4. The scoring of the tests

The fact that the tests used to assess the immediate and delayed retention were designed to measure the productive learning of the words made it necessary to find alternative ways to score. The operational definition of productive lexical learning is described as the ability of learners to construct the orthographical form of a target word when given the meaning (Niu, 2015). The productive testing and scoring are confined to be more effective with low levels, and it generally detects what students do not know rather than what they know (Meara & Fitzpatrick, 2000). In this study, the students were given a limited set of technical vocabulary, thus this limitation of the controlled productive test could be ignored.

The choice of a more or less fine-grained scoring approach to assess lexical learning depends on how word learning is characterized because various fine-grained scoring techniques focus on various aspects of what learners recall (Niu, 2015). To be more specific, there are several different aspects word knowledge that can be assessed (Duff, Biber & Conrad, 2001). Anderson and Freeboy (1981) referred to these aspects as "depth" of word knowledge. The concept of depth of word knowledge has been expressed in a variety of ways, but they all imply that it is made up of a variety of sub-knowledges. For instance, Nation (1990) suggested four dimensions of word knowledge: form, position, function, and meaning. According to Henriksen (1999), "lexical competence" entails knowledge with precision, depth, and both receptive and productive applications while it is defined in terms of in terms of levels that advance from a surface level familiarity to the capability of using new words correctly in speech and writing by others (Dale, 1965; Laufer, Elder, Hill, Congdon, 2004). Furthermore, Beck and McKeown (1991) defined levels of word knowledge along a continuum, from no knowledge to full knowledge. The word knowledge categories that native speakers normally possess are listed by Nation (1990). To mention them shortly, vocabulary size refers to the number of words an individual knows (Schmitt & Meara, 1997). Word meanings are an individual's understanding of the meanings of words and their ability to use them correctly in different contexts (Moonan, 1976). Word forms include an individual's knowledge of the different forms of a word (e.g., singular vs. plural, past tense vs. present tense) and their ability to use those forms correctly (Cabré, 1999). Word structure includes an individual's knowledge of the structure of words (e.g., prefixes, suffixes, roots) and their ability to use that knowledge to decode unfamiliar words (Jensen, 1990). Word associations are an individual's ability to relate words to one another based on their meanings, forms, or other characteristics (Schmitt & Meara, 1997). The aim of the tests was to test learning of the technical vocabulary from different aspects. It may not test all these aspects with this type of test; however, it will minimize the number of the areas that other types of scoring ignore.

3.5. Data Analysis

Following the collection of data, particular methods were implemented for the analysis of quantitative data. Details of these methods will be thoroughly described in this section.

3.5.1. Quantitative Data Analysis

The quantitative data in the study were analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.0. It is a statistical analysis, data management, and data documentation software (Pallant, 2020). The tests that were employed to obtain the data is shown in the Table 4 below.

Table 4. Analysis of the Data Obtained from the Tests

The Analysis of The Data Obtained from The Tests	Tests of Analysis
To what extent does each instructional technique affect the expansion of productive technical vocabulary knowledge?	Wilcoxon Test
Is there a difference in productive technical vocabulary growth between the four instructional groups (namely,	Kruskal Wallis-H Test

English-English explanation, English-Turkish explanation, picture description, and implicit instruction)?	
Does vocabulary size predict productive technical vocabulary learning for four groups with different instructions?	Spearman's Rank Correlation Coefficient

The Kruskal-Wallis H test is a nonparametric statistical test used to compare the median of two or more groups (Taylor, 2005). It is similar to the one-way ANOVA (analysis of variance) test, but it can be used when the data does not meet the assumptions of normality required for the ANOVA test.

The Kruskal-Wallis H test is used to determine whether there is a significant difference in the median of a continuous dependent variable between two or more independent groups. It is a nonparametric alternative to the one-way ANOVA, which is used to test for a significant difference in the means of two or more groups.

To perform the Kruskal-Wallis test, the data is ranked and the sum of the ranks is calculated for each group. The test statistic H is then calculated using these sums of ranks. The null hypothesis for the test is that there is no difference in the medians of the groups, and the alternative hypothesis is that there is at least one pair of groups with a significantly different median. The p-value is calculated from the test statistic and is used to determine the significance of the result. If the p-value is less than the predetermined alpha level (usually 0.05), the null hypothesis is rejected, and it can be concluded that there is a significant difference in the medians of the groups.

Spearman's rho is a statistical measure that is used to assess the strength and direction of the linear relationship between two variables when the data is ranked rather than interval or ratio level (Cooksey, 2020). It is a type of Pearson correlation coefficient that is specifically designed for this type of data. The value of Spearman's rho ranges from -1 to 1, with -1 indicating a strong negative relationship, 0 indicating no relationship, and 1 indicating a strong positive relationship. This measure is commonly used in research to examine the association between two variables, such as the relationship between years of education and income or the relationship between exercise frequency and weight loss. In order to calculate Spearman's rho, the ranks of the values for each variable are first determined and then the Pearson correlation coefficient is applied to the ranked data. The resulting coefficient is then interpreted in the same way as the Pearson correlation coefficient, with values close to -1 or 1 indicating a strong relationship and values close to 0 indicating a weaker or nonexistent relationship.

4. RESULTS

This chapter discusses the findings about the impact of four different instructions on technical vocabulary learning and whether there are any significant differences among them. Regarding this study, the data were collected through Vocabulary Size Test, immediate and delayed tests. The students were registered in four separate groups as their department requires. In the beginning, all the groups were given Vocabulary Size Test to have idea about their General English levels. Then, they were introduced the new vocabulary through Quizlet sets, a reading text, and comprehension questions that get their attention to the target vocabulary. They were presented with 10 technical words each week for seven weeks, and they were asked to complete an immediate test every week just after the lessons. The tests were taken during the lesson hour. At the end of the seven weeks, the students were asked to take a delayed test in which all the 70 words were tested. The immediate and delayed tests assessed the same words in different questions.

4.1. Test Results for the Research Question 1

Table 5. Wilcoxon Test Results

Test Statistics[a]

	English-English Delayed – Immediate	Eglish-Picture Delayed – Immediate	Incidental Learning Delayed – Immediate	English-Turkish Delayed – Immediate
Z	-2.875[b]	-.392[c]	-2.589[c]	-2.731[b]
Asymp. Sig. (2-tailed)	.004	.695	.010	.006

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. Based on positive ranks.

To understand the improvement in all four groups, Wilcoxon Test is applied to compare the group's first and the last grades. Wilcoxon test, also known as Wilcoxon signed-rank test, is a non-parametric statistical test used to compare two related samples. It is used to determine whether the mean ranks of two sets of data are significantly different from each other. This test is often used when the data do not follow a normal distribution or when the sample size is small. The Wilcoxon test involves ranking the differences between the paired observations and comparing the sum of the ranks of the positive differences to the sum of the ranks of the negative differences. The test produces a p-value, which indicates the probability of obtaining the observed difference by chance. If the p-value is below a predetermined significance level (usually 0.05), the null hypothesis of no difference between the two sets of data is rejected (Cooksey, 2020).

The results in Table 5 show that while there is statistically significant difference in the English-English (0.004, $p<0,05$), English-Turkish (0.006, $p<0,05$) and incidental learning group (0.010, $p<0,05$), the English-picture group (.695, $p>0,05$) did not reveal a significant change in vocabulary learning.

4.2. Test Results for the Research Question 2

The number of students in the study is less than 30 in each group, thus Kruskal-Wallis which is a non-parametric test was implemented to evaluate the data. The significance (alpha) value for each of the statistical analysis was set at .05. The key findings were delineated using the review of studies that have been written about how to report statistical data. .

The focus of the study is the difference in technical vocabulary learning through four different instructional methodologies across groups. The number of the students in each group is no more than 24, thus Kruskal Wallis Test was applied to identify the differences for each test. The nonparametric equivalent of the one-way ANOVA is the Kruskal-Wallis Rank test. Instead of using mean scores in some other unit of measurement, it examines the statistical difference across three or more independent groups using mean ranks (Cooksey, 2020).

Table 6. Test Statistics[a,b]

	Immediate Test	Delayed Test
Chi-Square	2.812	18.960
df	3	3
Asymp. Sig.	.422	.000

a. Kruskal Wallis Test

b. Grouping Variable: Group

As for the purpose of the second research question, the Kruskal-Wallis H Test was applied to see if there is a difference among the groups. As shown in Table 6, the statistics revealed that there is a significant difference in delayed test (0.00, $p < 0.05$) whereas there is not a statistically difference among groups in the immediate test results (0.422, $p > 0.05$). To see the

Table 7. Ranks and Test Statistics

	Group	N	Mean Rank
Vocabulary Size Test	Eng-Eng	20	38.65
	Eng-Pic	12	20.29
	Inc	12	26.33
	Eng-Tr	14	27.04
	Total	58	
Immediate Tests	Eng-Eng	20	26.63
	Eng-Pic	12	32.54
	Inc	12	35.08
	Eng-Tr	14	26.21
	Total	58	
Delayed Test	Eng-Eng	20	37.38
	Eng-Pic	12	22.83
	Inc	12	14.17
	Eng-Tr	14	37.11
	Total	58	

As shown in the Table 7, 58 students (*N*=58) took the three types of tests. 20 of them belong to the English-to-English explanation group, 12 of them belong to English to picture group, 14 of them belong to English to Turkish explanation group, and 12 of them belong to the incidental learning group. Eng-Eng group ranked the highest mean (*Mean rank* = 38.65) in the vocabulary size test. It can be said that their vocabulary size was better than the others as a group. It is followed by Eng-Tr group (*Mean rank* = 27.04). Incidental learning group is almost similar to Eng-Tr group (*Mean rank* = 26.33). There is almost no difference between those two groups while Eng-pic group scored the lowest mean (*Mean rank* = 20.29).

The Kruskal Wallis H Test showed no significant difference between the four groups in technical vocabulary learning in the first place. All the four instructional methodologies are found to be equally effective for the short-term period according to the results of immediate test.

The delayed test results showed differences between groups in terms of success. The English-to-English group ranked the highest with its mean (*Mean rank* = 37.38) in the delayed test. The effect of the intervention is the best with the English-to-English group where students were provided with technical English explanations of the words or phrases. The second-best result is seen in the English to Turkish group (*Mean rank* = 37.11). They are followed by English with pictures group (*Mean rank* = 22.83) and incidental group (*Mean rank* = 14.17). The results show that providing the learners with English and Turkish explanations of technical vocabulary was more effective in the long run.

The results are processed and evaluated through independent samples median test. The median test is intended to examine the null hypothesis that samples are drawn from populations with median values that are equal (Tufféry, 2011). Six hypotheses are tested and dealt as discussed below.

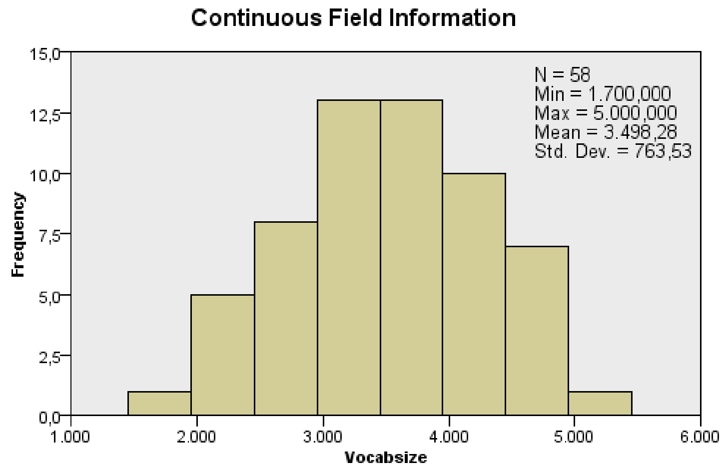
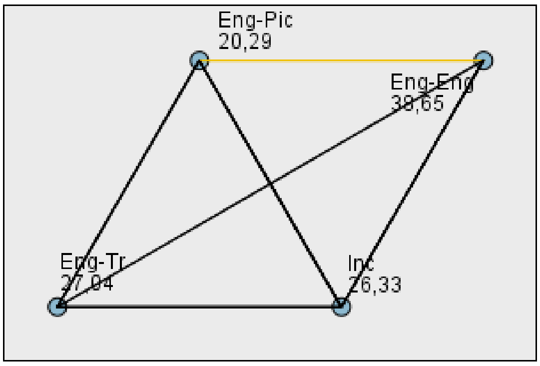


Figure 3. Independent Samples Median Test for Vocabulary Size Test

In the Figure 3, within all the groups, the highest grade is 5.000 whereas the lowest grade is 1.700. The mean of the whole community is 3.498. The median among all the participants is 3.500 which shows that the mean and median are approximately close, thus the distribution data set is symmetrical. Independent sample median test shows that the median of Vocabulary Size Test does not differ across groups maintaining the null hypothesis. It indicates that there is no significant difference in terms of academic characteristics of the participants (p = 0.170, p>0.05).

Pairwise Comparisons of Group



Each node shows the sample average rank of Group.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
Eng-Pic-Inc	-6,042	6,886	-,877	,380	1,000
Eng-Pic-Eng-Tr	-6,744	6,635	-1,016	,309	1,000
Eng-Pic-Eng-Eng	18,358	6,159	2,981	,003	,017
Inc-Eng-Tr	-,702	6,635	-,106	,916	1,000
Inc-Eng-Eng	12,317	6,159	2,000	,046	,273
Eng-Tr-Eng-Eng	11,614	5,878	1,976	,048	,289

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is ,05.

Figure 4. Pairwise Comparisons for the Distribution of Vocabulary Size Test

As shown in Figure 4, the second hypothesis in Kruskal Wallis H Test is concerned with the distribution of Vocabulary Size Test across groups. The average rank of the English-Turkish group is 27.04, the English-English group is 38.65, the incidental group is 26.33, and the English-picture group is 20.29. The adjusted significance value for the comparison of English-picture group and incidental group; English-picture and English-Turkish group; and English-Turkish and incidental group are 1.00 ($p>0.05$). Similarly, the significance value for the comparison of English-English and incidental group is 0.273 ($p>0.05$), and the one for English-Turkish and English-English is 0.289 ($p>0.05$) whereas a significant difference is found between the groups of English-picture and English-English (0.017, $p<0.05$). The results suggest that English-English group did significantly better than the picture group in the Vocabulary Size Test.

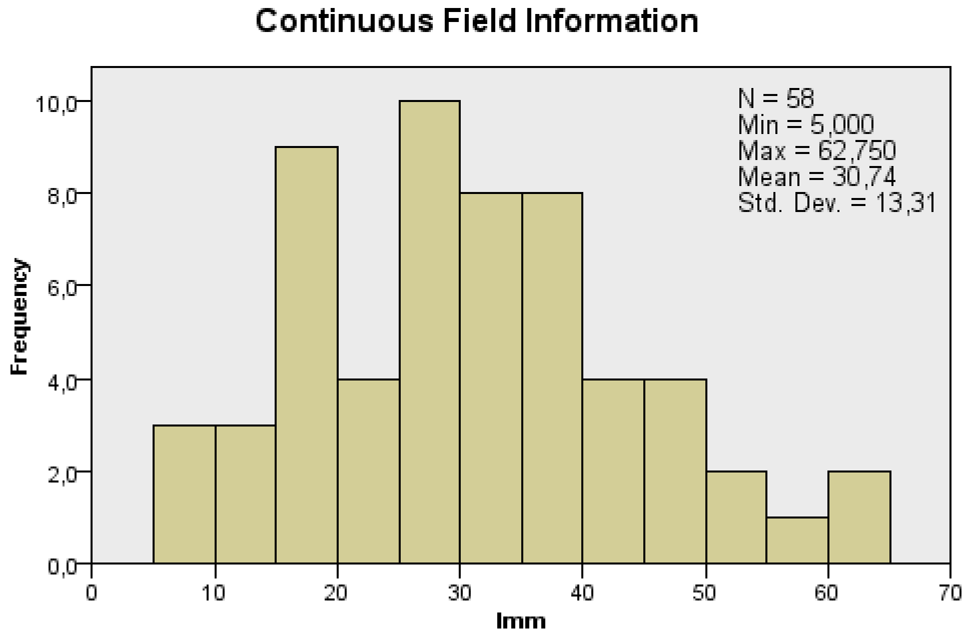
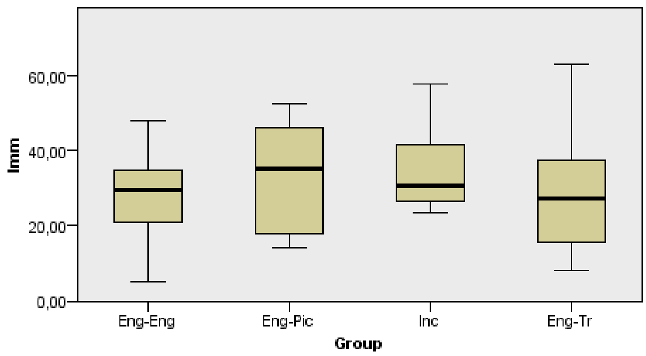


Figure 5. Independent Samples Median Test for the Immediate Test

In the Figure 5, within all the groups, the highest grade is 62.75 whereas the lowest grade is 5.00. The mean of the whole community is 30.74, The median among all the participants is 29.875 which shows that the mean and median are approximately close, thus the distribution data set is symmetrical. Independent sample median test shows that the median of Immediate Test does not differ across groups maintaining the null hypothesis. It indicates that there is no significant difference in terms of short-term effect of different instructional methodologies on the participants' vocabulary gain ($p = 0.892$, $p>0.05$).

Independent-Samples Kruskal-Wallis Test



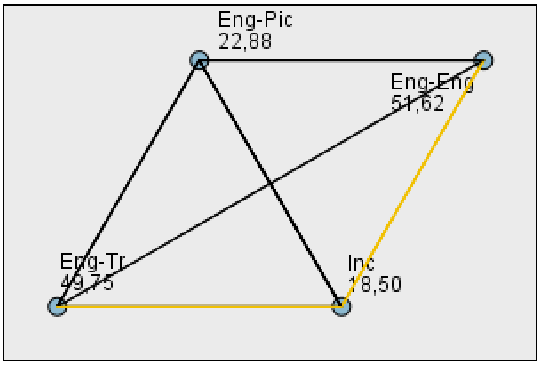
Total N	58
Test Statistic	2,812
Degrees of Freedom	3
Asymptotic Sig. (2-sided test)	,422

1. The test statistic is adjusted for ties.
2. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

Figure 6. Independent Samples Kruskal Wallis Test for the Immediate Test

When the Independent Samples Kruskal Wallis Test was applied for the Immediate Test, it was found that the significance value is 0.422 (p>0.05) as shown in Figure 6. It means that the groups performed almost equally in the Immediate test indicating no statistical difference.

Pairwise Comparisons of Group



Each node shows the sample median of Group.

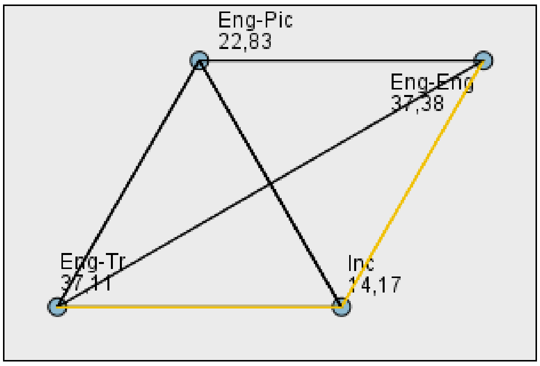
Sample1-Sample2	Test Statistic	Sig.	Adj.Sig.
Inc-Eng-Pic	,000	1,000	1,000
Inc-Eng-Tr	15,476	,000	,001
Inc-Eng-Eng	13,333	,000	,002
Eng-Pic-Eng-Tr	2,476	,116	,693
Eng-Pic-Eng-Eng	2,133	,144	,865
Eng-Tr-Eng-Eng	,486	,486	1,000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is ,05.

Figure 7. Pairwise Comparisons of Independent Samples Median Test for the Delayed Test

The Figure 7 summarizes the application of median test between the groups in terms of the Delayed Test. It can be seen that the adjusted value is not statistically different between Incidental group and English-Picture group ($p=1.00$, $p>0.05$) whereas the Incidental group differs significantly from English-Turkish ($p=0.001$, $p<0.05$) and English-English groups ($p=0.002$, $p<0.05$). When English-Picture is compared with other groups, its significance value is 0.693 ($p>0.05$) for the English-Turkish group and 0.865 ($p>0.05$) with the English-Turkish group.

Pairwise Comparisons of Group



Each node shows the sample average rank of Group.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
Inc-Eng-Pic	8,667	6,893	1,257	,209	1,000
Inc-Eng-Tr	-22,940	6,642	-3,454	,001	,003
Inc-Eng-Eng	23,208	6,165	3,764	,000	,001
Eng-Pic-Eng-Tr	-14,274	6,642	-2,149	,032	,190
Eng-Pic-Eng-Eng	14,542	6,165	2,359	,018	,110
Eng-Tr-Eng-Eng	,268	5,884	,046	,964	1,000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is ,05.

Figure 8. Pairwise Comparisons for the Distribution of Delayed Test

Figure 8 shows that the pairwise comparison of groups for the Delayed test reveal a similar result to median test results. While Incidental group and English-Turkish group ($p=0.003$, $p<0.005$) and English-English group ($p=0.001$, $p<0.005$) are found to be significantly different the other pairs of groups did not show any significant differences. This result suggests that students who were taught the technical vocabulary with either Turkish or English explanations remembered better after a certain period.

4.3. Test Results for the Research Question 3

To see the predictability of technical vocabulary learning in the short and long periods Spearman's rank correlation coefficient test were applied. It is a statistical test used to determine the strength and direction of the relationship between two variables that are measured on an ordinal or continuous scale. It is often used when the data is not normally distributed or when the variables are not interval/ratio data. The test calculates the correlation between the ranks of the two variables, rather than the raw data, and produces a coefficient (r) that ranges from -1 to 1, where -1 indicates a perfect negative correlation, 0 indicates no correlation, and 1 indicates a perfect positive correlation (Cooksey, 2020).

4.3.1. Vocabulary Size and the Immediate Tests

Correlations

			Vocabulary Size Test	Immediate Test
Spearman's rho	VocabularySize Test	Correlation Coefficient	1.000	-.155
		Sig. (2-tailed)	.	.246
		N	58	58
	ImmediateTest	Correlation Coefficient	-.155	1.000
		Sig. (2-tailed)	.246	.
		N	58	58

Figure 9. The correlation between the Vocabulary Size Test and Immediate Test

The correlation between the Vocabulary Size Test and the Immediate Test was evaluated using Spearman's rank correlation. The Figure 9 shows that the correlation coefficient between those two variables is -0.155, and the significance value is 0.2468 (p>0.05) which means there is a no correlation between vocabulary size and vocabulary retention of the participants in the short term. The result suggests that the vocabulary size does not help to predict good technical vocabulary learning at B1 level.

4.3.2. Vocabulary Size and the Delayed Test

Correlations

			Vocabulary Size Test	Delayed Test
Spearman's rho	VocabularySizeTest	Correlation Coefficient	1.000	.022
		Sig. (2-tailed)	.	.868
		N	58	58
	DelayedTest	Correlation Coefficient	.022	1.000
		Sig. (2-tailed)	.868	.
		N	58	58

Figure 10. The correlation between the Vocabulary Size Test and Delayed Test

The correlation between the Vocabulary Size Test and the Delayed Test was evaluated using Spearman's rank correlation. The Figure 10 shows that the correlation coefficient between those two variables is 0.22, and the significance value is 0.868 ($p>0.05$) which means there is a no correlation between vocabulary size and vocabulary retention of the participants in the long run. The result suggests that the vocabulary size does not help to predict good technical vocabulary learning at B1 level for the long period.

5. DISCUSSION AND CONCLUSION

This quantitative study investigates the effects of methodological instructions on technical vocabulary teaching with the help of target word-picture, target word - English explanation, target word - Turkish explanation sets and no specific emphasis on the target vocabulary. B1 level first grade university students' vocabulary size and technical vocabulary gain were tested through Vocabulary Size Test, Immediate Tests, and a Post-Test. The main findings and implications in this thesis investigation were discussed referencing the related work in the literature. Answers to the research questions were addressed and tried to be clarified in this section in distinct subheadings by integrating other study results and the specific findings of this study. A general conclusion was also written for each research question. Finally, the potential implications of this study are presented. Following this part, suggestions for researchers, teachers, material developers, and future research are presented.

5.1. Discussion on the Findings for RQ1

The first research question in this study aims to investigate whether the implementation of an intervention results in improved learning of technical vocabulary. The findings of the study indicate that the intervention is effective in enhancing the retention of technical vocabulary among students over a seven-week period. The results show a significant improvement in mean ranks of immediate and delayed tests for students in the English-English, English-Turkish, and incidental groups, but not in the English-picture group. This suggests that the intervention has a positive impact on the long-term retention and usage of technical vocabulary among students in general.

Previous research is consistent with the findings of the English-Turkish group in this study. For instance, Darginaviciene (2018) discovered that Generation Z learners favored traditional methods for learning ESP vocabulary, such as translating the target vocabulary into their L1. Avand (2009) also investigated the impact of L1 on ESP learning in the context of reading comprehension and found that L1 had a facilitating effect on ESP learning. Akbari and Tahririan (2009) explored the vocabulary learning strategies of students and found that 65% of them preferred memorizing technical vocabulary with the L1 meaning equivalent, with some creating bilingual word lists during the initial stages of technical vocabulary learning. Additionally, Čarapić (2022) examined the effectiveness of various activities for teaching ESP vocabulary, including reading comprehension, listening, speaking, grammar exercises, and translation. The results indicated that translation activities were among the most effective methods for learning ESP vocabulary, suggesting that learners prefer using L1 equivalents.

English-English group has made progress in technical vocabulary learning supporting the studies with similar results. According to Akbari and Tahririan's study (2009), 35% of students prefer to learn vocabulary by using English synonyms as they help with retention and association of meaning. Xhaferi (2009) found that learners use monolingual dictionaries as a last resort when they are unable to guess the meaning of a word from context. In a study conducted with intermediate English learners in Iran, Ahangari and Dogolsara (2015) observed significant improvement in vocabulary learning after a five-session treatment involving the use of monolingual dictionaries. This could be attributed to the fact that using a monolingual dictionary requires more effort from learners but can lead to improved retention of both concrete and abstract vocabulary. Wijesuriya and Dissanayake (2020) examined the impact of monolingual and bilingual online dictionaries and found that the former was more effective in helping learners retain vocabulary. Monolingual dictionaries offer extensive contextualization and examples of word usage, which can facilitate learners' comprehension and production of new words in similar contexts.

The result regarding the incidental learning group who got only the reading and comprehension questions and showed a better retention in the delayed posttest was in line with the result of the study of Min (2008). In her study, she worked with two groups which were reading-vocabulary teaching and narrow reading for teaching ESP vocabulary and found that the narrow reading approach which was done with only a reading text with the target words in bold was not as effective as reading plus vocabulary development activities.

As a part of this study, the target word-picture group did not show a noteworthy retention in the long run. This can be explained because of the nature of the technical vocabulary, which is abstract, complex and difficult to understand (Johnson & Hwang, 1983). Therefore, the pictures may not be helpful to fully comprehend and internalize the vocabulary for longer periods. One possible explanation for these findings is the insufficiency of details in the pictures themselves (Boers, Warren, He & Deconinck, 2017; Solman & Wu, 1995; Peeck, 1993). Pictures may not be able to capture all aspects of the target vocabulary, particularly abstract or complex parts. In fact, a study by Boers et al. (2017) comparing vocabulary instruction with and without pictures, in addition to glosses, found no significant difference in learning outcomes between the two methods. Interestingly, the group that received pictures in addition to glosses actually performed worse in post-tests than the other groups. Another issue related to pictures is the potential presence of extraneous details that can distract students' attention from the target vocabulary. Similarly, Boers, Piquer Piriz, Stengers, and Eyckmans (2009) found that picture explanations had little effect on retention of the linguistic forms of vocabulary and may have an unfavorable impact on learning difficult or unfamiliar vocabulary. In a study by Tavakoli and Gerami (2013), comparing the effectiveness of the keyword method and the pictorial method, the researchers concluded that the pictorial method is not as effective as the keyword method. Therefore, it may be concluded that the use of pictures alone, without accompanying words, is not a helpful method for vocabulary instruction.

5.2. Discussion on the Findings for RQ2

The second research question investigates if there is any difference in technical vocabulary learning across four groups with different instructions. When looked closely, the result shows that the groups that were taught the technical vocabulary with either English or Turkish explanations did better in the delayed test while the incidental learning group and picture provided group were not affected much by the intervention.

The results found by Gu and Johnson (1996) is parallel to the findings of this research. Surprisingly enough, in their study, the group with the weakest scores highly depended on word lists that were visually repeated and firmly believed in memorizing. Moreover, it can be said that the instructions may benefit more the learners if they are used together rather than individually presented. As Johnson and Hwang (1983) suggest, it is possible to increase the learnability of unfamiliar technical terminology by introducing them to students before formal training, defining them in easily understood language, and employing concrete phrases with strong sensory, pictorial, or visual associations. One conclusion drawn from this study may correspond with the results of the that study in terms of combining different strategies. Even though each instructional methods were helpful in terms of vocabulary gain, they were not enough to master the words thoroughly. It can be suggested that the use of different methods such as studying vocabulary with English and Turkish explanations in addition to pictorial descriptions may help learners benefit more. The implication of the current study has similarity with the one by Karami and Bowles (2019) whose results revealed that mixed method group outperformed the one instructional method.

The other results obtained from the research is that there is no significant difference among the groups in the short term as immediate test results suggest whereas there is a significant difference in the delayed test results. The short-term effect could be explained with the Task-Induced Involvement Load Hypothesis which suggests that the tasks prepared by a teacher that requires “need, search and evaluation" increases the involvement of the learners in the process (Laufer & Hulstijn, 2001). The students in this study were engaged in the vocabulary learning process with vocabulary exercises and reading comprehension exercises even in incidental group, which led to an increase in the involvement in all the groups. For the long-term effect, Hulstijn and Laufer’s (2001) study, conforming to this study, found that the reading comprehension with fill-in task led to a better retention than only reading task.

Four different instructions can be said to be equally effective in technical vocabulary learning when tested immediately after the intervention, however the retention after a period varies across groups. It was found that the groups with the treatment either with English, Turkish or picture explanation of the technical words outperformed the incidental group. This result of the study is congruent with what Schmitt (2008) suggested. In comparison to incidental vocabulary learning, intentional vocabulary learning nearly always yields bigger and faster increases, with a higher likelihood of retention and of attaining levels of competence that are useful (Schmitt, 2008). Working with explanation means understanding the semantics of the words rather than memorization. The result is in line with the study by Dreyer and Bits (1994) in which they had three treatment and one control group and investigated the keyword-semantics, semantics, and keyword methods. The result was that the semantics group outperformed the keyword strategy group and the control group. On the other hand, Karami and Bowles' finding related to the success of incidental learning is contradictory. In this research study, incidental vocabulary learning was the least effective instructional methodology considering the long-term effect whereas Karami and Bowles (2019) found incidental vocabulary learning led to a better result than intentional learning.

5.3. Discussion on the Findings for RQ3

The third research questions investigates if general vocabulary size predicts technical vocabulary learning for four groups with different instructions. The result shows that there is not a correlation between the general vocabulary size and the technical vocabulary learning of ESP learners either for a short or a long period.

The research findings can imply that the size of a student's general vocabulary does not have a strong correlation with their ability to acquire technical vocabulary. The study suggests that the level of the students may play an important role in determining the success of technical vocabulary acquisition, and that the size of the student's general vocabulary is not the main factor that predicts the gain of technical vocabulary. One possible way to interpret this situation can be that the learners may not have developed an effective vocabulary learning strategy. Vocabulary learning strategy (henceforth VLS) such as guessing from the context, analyzing the part of speech, using monolingual dictionary, is important because of the transferability of the skill. As found in the study of Ahmad, Yunus and Hasan (2016), the students who did better in 8,000 word families and above in the Vocabulary Level Test are the ones who use VLS. If the participants had a well-established VLS, they would probably make use of this skill to learn the technical vocabulary. Previous studies on Indonesian (Munandar, Nurweni, Mahpul, 2015), Korean (Lee, 2007), Thai (Nirattisai & Chiramanee, 2014; Komol & Sripetpun, 2011), Algerian (Nacera, 2010), Chinese (Gu, 1994), Taiwanese (Chang, 2014) Iranian (Hamzah, Kafipour, Abdullah, 2009), and Turkish (Şener, 2015; Bozgeyik, 2011; Tanyer & Öztürk, 2014, Alemdari, 2010) revealed a similar result. English learners have indicated that more successful vocabulary learners employ vocabulary learning strategies more efficiently, and that there is a strong positive correlation between vocabulary gain and strategy use. Similarly, in the study that was done with the learners of Turkish as a Second/Foreign Language, Memiş (2018) found a significant positive relationship between the use of strategy and vocabulary. Specifically, the study by Nacera (2010) supports the idea related to the vocabulary size and strategy. She found that the strategies frequently utilized by students with larger vocabulary sizes varied from those used by students with smaller vocabulary sizes. She explains this with the point of view that the formers differentiated by the use of particular strategies that demand more work and time but result in more effective learning, including employing English in various ways, producing summaries, and guessing. The latter are distinguished by exerting less effort in learning and use surface methods such as rote memory and gesture tactics, which result in surface learning. Similarly, in their study that investigated the connection between the students' vocabulary learning practices and vocabulary size, Nirattisai and Chiramanee (2014) concluded that, seventeen of the 39 vocabulary learning strategies were linked to vocabulary size at an average level.

On the other hand, the result for this research question would be different if it were tested with participants with a higher proficiency level. Waldvogel's (2013) study supports this opinion with the result which shows a strong association between the usage of certain learning techniques and vocabulary size among advanced and more experienced learners, but not among beginning or intermediate-level learners. According to the findings, less experienced Spanish FL students may be less competent at regulating their own vocabulary learning.

Other reasons for this result might be other factors such as, students' interest and motivation, their prior knowledge and experience, or the nature of the technical vocabulary itself might be more important in determining students' proficiency in technical vocabulary.

5.4. Implications

The study suggests that the learning of technical vocabulary may be more effective when it is presented with explanations in either English or Turkish. The study implies that providing explanations in the students' primary language (L1) or the target language (L2) can help learners to better understand and remember the technical vocabulary.

The statement suggests that one way to provide these explanations is for teachers to create vocabulary sets or encourage students to create their own materials. This can help students to have a better understanding of the technical vocabulary and to be more engaged in the learning process.

Another way to provide explanations is to guide and facilitate students in using monolingual dictionaries to engage learners more in the target language. By using monolingual dictionaries, students will be exposed to the target language, and it will help them to acquire the target language more efficiently. This approach can help students to become more autonomous learners and to develop their language skills more effectively.

The study also looked at the effectiveness of using pictures to aid in the acquisition of technical vocabulary and found that the use of pictures alone did not lead to an improvement in the learners' ability to acquire technical vocabulary when presented in a reading text.

This could be because technical vocabulary is often abstract and refers to specific items or concepts that require additional information or background knowledge to understand. Pictures alone may not be able to provide enough information to fully grasp the meaning of these technical terms.

It can be suggested that pictures be used as supplementary materials to improve retention time, but not as a main way of teaching technical vocabulary. It implies that pictures can be used as an additional tool to support the learning of technical vocabulary, but it is not enough by itself. Therefore, the study suggests that technical vocabulary can be learned better when explicitly taught and other methods such as providing definition, explanation, or demonstration should be used along with pictures to help learners acquire technical vocabulary more effectively.

Other vocabulary learning strategies can be taught to learners. Learners can benefit more if they use vocabulary learning strategies (Nirattisai & Chiramanee, 2014). To improve learning strategies teachers should adapt materials, teaching methods, exercises, and evaluation techniques that encourage developing learning strategies suitable for skill learning (Gu & Johnson, 1996).

It's also important to note that the study's findings might be specific to the sample of the study, and therefore it is recommended to conduct further research with different samples and materials to generalize the results.

5.5. Recommendations for Future Research

The length of teaching for each group is not long enough, and future research may extend the treatment period for each group to determine if better outcomes can be obtained. For example, the study may be conducted over a whole year or a semester, utilizing different vocabulary teaching methodologies for the class. This would allow for a more comprehensive assessment of the effectiveness of the teaching methods and would provide a more accurate picture of the students' ability to acquire and retain technical vocabulary.

The students may have found the process of learning and being tested on technical vocabulary every week to be tedious and tiring. This could have led to a decrease in motivation and engagement among the students, which in turn could have affected their performance. To keep the students' motivation high, more variety of classroom activities should be incorporated. This would help to keep the students engaged and motivated and would make the learning process more interesting and enjoyable for them. This could include activities such as hands-on demonstrations, interactive exercises, or real-life applications of the technical vocabulary.

It is also important to note that the study's findings might be specific to the sample of the study, and therefore it is recommended to conduct further research with different samples and materials to generalize the results. Additionally, the findings of the study should be analyzed in the context of the specific teaching methodologies that were used, and the specific technical vocabulary that was taught.

The sample size of the study was limited, and not evenly distributed among the groups. This could have an impact on the study's results and conclusions. This could lead to a lack of generalizability of the results. If the sample size were larger and the participants were distributed equally among the groups, the results of the study might have been different. A larger sample size would increase the statistical power of the study and make the results more reliable and generalizable to a larger population.

This study was conducted with B1 level students, so the results may turn out to be like this at this level. Another study can be conducted with different level and different age group of students to see the effectiveness of the instructional methodologies.

REFERENCES

Ahangari, S., & Dogolsara, S. A. (2015). Comparing the effect of using monolingual versus bilingual dictionary on Iranian intermediate EFL learners' vocabulary learning. *English Language Teaching*, *8*(6), 141-149.

Ahmad, H., Yunus, M. M., & Hasan, N. H. (2016). English vocabulary size and vocabulary learning strategies of UiTM pre-diploma students. In *International Conference on Language, Education, Humanities and Innovation* (pp. 150-170).

Akbari, Z., & Tahririan, M. H. (2009). Vocabulary learning strategies in an ESP context: The case of Para/medical English in Iran. *The Asian EFL Journal Quarterly*, *11*(1), 39-61.

Akbarian, I., Farajollahi, F., & Jiménez Catalán, R. M. (2020). EFL learners' lexical availability: exploring frequency, exposure, and vocabulary level. *System*, *91*, 102261. https://doi.org/10.1016/j.system.2020.102261

Alam, M. A., & Ashrafuzzaman, M. (2018). Learning vocabulary at tertiary level: strategies, techniques and materials. *the Online Journal of New Horizons In Education*, *8*(3), 109-117. https://www.researchgate.net/profile/Md-Uzzaman-4/publication/326346675_LEARNING_VOCABULARY_AT_TERTIARY_LEVEL_STRATEGIES_TECHNIQUES_AND_MATERIALS/links/5b4724dc0f7e9b4637ce6dcf/LEARNING-VOCABULARY-AT-TERTIARY-LEVEL-STRATEGIES-TECHNIQUES-AND-MATERIALS.pdf

Alamri, K., & Rogers, V. (2018). The effectiveness of different explicit vocabulary-teaching strategies on learners' retention of technical and academic words. *The Language Learning Journal*, *46*(5), 622-633.

https://doi.org/10.1080/09571736.2018.1503139

Al-Jarf, R. (2022). A multiple-associations approach to teaching technical terms in English for specific purposes courses. *Online Submission*, *4*(3), 1-9. https://doi.org/10.32996/ijels.2022.4.3.1

Allen, J. P., & Widdowson, H. G. (1974). T*eaching the communicative use of English*.

Alqahtani, M. (2015). The importance of vocabulary in language learning and how to be taught. *International Journal of Teaching and Education*, *3*(3), 21-34. https://ideas.repec.org/a/sek/jijote/v3y2015i3p21-34.html

Amit, M., & Portnov-Neeman, Y. (2017, February). 'Explicit teaching' as an effective method of acquiring problem solving strategies-the case of'working backwards'. In *Cerme 10*.

Anderson, R. C., & Freebody, P. (1981). Vocabulary knowledge. *Comprehension and Teaching: Research Reviews*, 77-117. https://files.eric.ed.gov/fulltext/ED203299.pdf

Aritonang, M. M. I., & Sinulingga, J. (2012). Improving students' vocabulary achievement by using realia. *register: Journal of English Language Teaching of FBS-Unimed*, *1*(1). https://doi.org/10.24114/reg.v1i1.339

Atkinson, R. C. (1975). Mnemotechnics in second-language learning. *American Psychologist*, *30*(8), 821-828. doi:10.1037/H0077029

Avand, A. Q. (2009). Using translation and reading comprehension of ESP learners. *The Asian ESP Journal*, *5*(1), 44-60.

Baleghizadeh, S. & Ashoori, A. (2010). The effect of keyword and word-list methods on immediate vocabulary retention of EFL learners. *Pakistan Journal of Social Sciences (Pjss)*, *30*(2), 251-261. https://www.bzu.edu.pk/PJSS/Vol30No22010/Final_PJSS-30-2-06.pdf

Barcroft, J. (2002). Semantic and structural elaboration in L2 lexical acquisition. *Language Learning*, *52*(2), 323-363. https://doi.org/10.1111/0023-8333.00186

Barcroft, J. (2000a). *The effects of sentence writing as semantic elaboration on the allocation of processing resources and second language lexical acquisition*. University of Illinois At Urbana-Champaign.

Barcroft, J. (2000b). ‘The nature of partial word form learning,’ Paper Presented At the 4th Hispanic Linguistics Symposium. Bloomington, In.

Barcroft, J., & Rott, S. (2010). Partial word form learning in the written mode in L2 German and Spanish. *Applied Linguistics*, *31*(5), 623–650. https://doi.org/10.1093/Applin/Amq017

Beck, I., & Mckeown, M. (1991). *Conditions of vocabulary acquisition*.

Boers, F., Piquer Píriz, A. M., Stengers, H., & Eyckmans, J. (2009). Does pictorial elucidation foster recollection of idioms?. *Language Teaching Research*, *13*(4), 367-382.

Brown, K. (2005). *Encyclopedia of language and linguistics* (Vol. 1). Elsevier.

Cabré, M. T. (1999). *Terminology: theory, methods, and applications* (Vol. 1). John Benjamins Publishing.

Carver, D. (1983). Some propositions about ESP. *The ESP Journal*, *2*(2), 131-137.

Chung, T. M., & Nation, P. (2003). Technical vocabulary in specialised texts. *reading in a foreign language*, *15*(2), 103-116. https://Infallibleinroad.Co.Uk/Scholarspace.Manoa.Hawaii.Edu/Handle/10125/66770

Chung, T. M., & Nation, P. (2004). Identifying technical vocabulary. *System*, *32*(2), 251–263. https://doi.org/10.1016/J.System.2003.11.008

Cobb, T. (2000). One size fits all? francophone learners and English vocabulary tests. *Canadian Modern Language Review*, *57*(2), 295-324. https://doi.org/10.3138/cmlr.57.2.295

Cooksey, R. W. (2020). *Illustrating statistical procedures: finding meaning in quantitative data*. Springer Nature.

Coles, J., & House, N. (2007). T*he fundamentals of interior architecture*. Ava Publishing.

Cornelius, K. E. (2013). Formative assessment made easy: templates for collecting daily data in inclusive classrooms. *Teaching Exceptional Children*, *45*(5), 14-21. https://doi.org/10.1177/004005991304500502

Cowan, H. J., & Smith, P. R. (2004). Dictionary of architectural and building technology. In D*ictionary of architectural and building technology*. Routledge. https://doi.org/10.4324/9780203786383/Dictionary-Architectural-Building-Technology-Henry-Cowan-Peter-Smith

Cowan, J. R. (1974). Lexical and syntactic research for the design of EFL reading materials. *Tesol Quarterly*, *8*(4), 389. https://doi.org/10.2307/3585470

Coxhead, A. (2018). *Vocabulary and English for specific purposes research: quantitative and qualitative perspectives*. https://Www.Routledge.Com/Vocabulary-And-English-for-Specific-Purposes-Research-Quantitative-And/Coxhead/P/Book/9780367594473

Coxhead, A., Demecheleer, M., & McLaughlin, E. (2016). The technical vocabulary of carpentry: loads, lists and bearings. *Tesolanz Journal*, *24*, 38-71. https://www.tesolanz.org.nz/wp-content/uploads/2021/06/TESOLANZ_Journal_Vol24_2016.pdf

Coxhead, A., & Demecheleer, M. (2018). Investigating the technical vocabulary of plumbing. *English for Specific Purposes*, *51*, 84-97. https://doi.org/10.1016/j.esp.2018.03.006

Čarapić, D. (2022). Importance of translation in teaching and learning English for electrical and mechanical engineering-case study. *Journal of Teaching English for Specific and Academic Purposes*, 261-276.

Dale, E. (1965). Vocabulary measurement: techniques and major findings. *Elementary English*, *42*(8), 895-948. https://www.jstor.org/stable/41385916

Darginaviciene, I. (2018). Preferred techniques for learning ESP lexis by generation Z. *Kultura I Edukacja*, *120*(2), 37–50. https://doi.org/10.15804/kie.201818.02.02

De Groot, A. M. (2006). Effects of stimulus characteristics and background music on foreign language vocabulary learning and forgetting. *Language Learning*, *56*(3), 463-506. https://doi.org/10.1111/j.1467-9922.2006.00374.x

De Vos, J. F., Schriefers, H., Nivard, M. G., & Lemhöfer, K. (2018). A meta analysis and meta regression of incidental second language word learning from spoken input. *Language Learning, 68*(4), 906-941. https://doi.org/10.1111/lang.12296

Dreyer, C., & Brits, J. (2013). Memory strategies and ESL vocabulary acquisition. *Per Linguam, 10*(1). https://doi.org/10.5785/10-1-245

Dudley-Evans, T., St John, M. J., & Saint John, M. J. (1998). *Developments in English for specific purposes: a multi-disciplinary approach*. Cambridge University Press.

Duff, P. A., Biber, D., & Conrad, S. (2001). Corpus based research in tesol: quantitative corpus based research: much more than bean counting. *Tesol Quarterly*, *35*(2), 331-336. https://doi.org/10.2307/3587653

Fakher Ajabshir, Z. (2022). Investigating the effects of L1 and L2 paper-based glosses and their presentation formats on EFL learners' incidental vocabulary acquisition. *Language Related Research*, *12*(6), 155-186. http://lrr.modares.ac.ir/article-14-39075-en.html

Farrell, P. (1990). *Vocabulary in esp: a lexical analysis of the English of electronics and a study of semi-technical vocabulary*.

Farrelly, L. (2012). *The fundamentals of architecture*. Bloomsbury Publishing.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (Vol. 7, P. 429). Mcgraw-Hill.

Gilmore, A., & Millar, N. (2018). The language of civil engineering research articles: a corpus-based approach. *English for Specific Purposes*, *51*, 1–17. https://doi.org/10.1016/J.Esp.2018.02.002

Grabe, W. (1991). Current developments in second language reading research. *Tesol Quarterly*, *25*(3), 375-406. https://doi.org/10.2307/3586977

Gu, P. Y. (2003). Vocabulary learning in a second language: person, task, context and strategies. *Tesl-Ej*, *7*(2), 1-25. https://tesl-ej.org/wordpress/issues/volume7/ej26/ej26a4/

Gu, Y., & Johnson, R. K. (1996). Vocabulary learning strategies and language learning outcomes. *Language Learning*, *46*(4), 643-679. https://doi.org/10.1111/j.1467-1770.1996.tb01355.x

Harris, C. (2006). *Dictionary of architecture & construction 4th edition*. http://117.3.71.125:8080/Dspace/Handle/Dhktdn/4257

Henriksen, B. (1999). Three dimensions of vocabulary development. *Studies in Second Language Acquisition*, *21*(2), 303-317. https://doi.org/10.1017/S0272263199002089

Hinkel, E. (Ed.). (2005). *Handbook of research in second language teaching and learning*. Routledge. https://api.taylorfrancis.com/content/books/mono/download?identifierName=doi&identifierValue=10.4324/9780203836507&type=googlepdf

Hsu, W. (2013). Bridging the vocabulary gap for EFL medical undergraduates: the establishment of a medical word list. *Language Teaching Research*, *17*(4), 454–484. https://doi.org/10.1177/1362168813494121

Hsueh-Chao, M. H., & Nation, P. (2000). *Unknown vocabulary density and reading comprehension.*

Hulstijn, J. H., & Laufer, B. (2001). Some empirical evidence for the ınvolvement load hypothesis in vocabulary acquisition. *Language Learning*, *51*(3), 539–558. https://doi.org/10.1111/0023-8333.00164

Hutchinson, T., & Waters, A. (1987). *English for specific purposes*. Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511733031

Huckin, T., & Coady, J. (1999). Incidental vocabulary acquisition in a second language: a review. *Studies in Second Language Acquisition*, *21*(2), 181-193. https://doi.org/10.1017/S0272263199002028

Jenson, J. (1990). *Morphology: word structure in generative grammar*.

Izura, C., Hernández-MuÑoz, N., & Ellis, A. W. (2005). Category norms for 500 Spanish words in five semantic categories. *Behavior Research Methods*, *37*(3), 385-397.

Joe, A. (2010). The quality and frequency of encounters with vocabulary in an English for academic purposes programme. *Reading in a Foreign Language*, *22*(1), 117-138.

https://eric.ed.gov/?redir=http%3a%2f%2fnflrc.hawaii.edu%2frfl%2fApril2010%2farticles%2fjoe.pdf

Johnson, C. W., & Hwang, R. I. (1983). Learnability of technical vocabulary depends upon familiarity, comprehensibility and imagery. *Psychological Reports*, *53*(3), 767-770. https://doi.org/10.2466/pr0.1983.53.3.767

Jonathans, P. M., Widiati, U., Astutik, I., & Ratri, D. P. (2021). The practices of intentional vocabulary acquisition for Asian EFL learners: a systematic review. *English Review: Journal of English Education*, *9*(2), 253-262. https://journal.uniku.ac.id/index.php/ERJEE/article/download/4350/2560

Karami, A., & Bowles, F. A. (2019). Which strategy promotes retention? intentional vocabulary learning, incidental vocabulary learning, or a mixture of both? *Australian Journal of Teacher Education*, *44*(9).

https://doi.org/10.14221/Ajte.2019v44.N9.2

Kim, M., Crossley, S. A., & Kyle, K. (2018). Lexical sophistication as a multidimensional phenomenon: relations to second language lexical proficiency, development, and writing quality. T*he Modern Language Journal*, *102*(1), 120–141. https://doi.org/10.1111/modl.12447

Kucherenko, S. (2013). An integrated view of EOP and EAP. *Journal of Teaching English for Specific and Academic Purposes*, *1*(1), 3-9.

Kwary, D. A. (2011). A hybrid method for determining technical vocabulary. *System*, *39*(2), 175–185. https://doi.org/10.1016/J.System.2011.04.003

Laufer, B., & Nation, P. (1999). A Vocabulary-size test of controlled productive ability. *Language Testing*, *16*(1), 33–51.

https://doi.org/10.1177/026553229901600103

Laufer, B., & Goldstein, Z. (2004). Testing vocabulary knowledge: size, strength, and computer adaptiveness. In *Language Learning* (Vol. 54).

Laufer, B., Elder, C., Hill, K., & Congdon, P. (2004). Size and strength: do we need both to measure vocabulary knowledge? *Language Testing*, *21*(2), 202-226. https://doi.org/10.1191/0265532204lt277oa

Laufer, B., & Goldstein, Z. (2004). Testing vocabulary knowledge: size, strength, and computer adaptiveness. *Language Learning*, *54*(3), 399-436. https://doi.org/10.1111/j.0023-8333.2004.00260.x

Laufer, B. (2003). Vocabulary acquisition in a second language: do learners really acquire most vocabulary by reading? some empirical evidence. *Canadian Modern Language Review*, *59*(4), 567-587.

https://doi.org/10.3138/cmlr.59.4.567

Laufer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: the construct of task-induced involvement. *Applied Linguistics*, *22*(1), 1-26. https://doi.org/10.1093/applin/22.1.1

Laufer, B., & Nation, P. (1995). Vocabulary size and use: lexical richness in L2 written production. *Applied Linguistics*, *16*(3), 307-322. https://doi.org/10.1093/applin/16.3.307

Lessard-Clouston, M. (2008). Strategies and success in technical vocabulary learning: students' approaches in one academic context. *Indian Journal of Applied Linguistics*, *34*(1/2), 31. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=7f356821a9b52192f8e6451bf4d1f1e3ba743cf4

Littlewood, W., & William, L. (1984). *Foreign and second language learning: language acquisition research and its implications for the classroom*. Cambridge University Press.

Loewen, S. (2005). Incidental focus on form and second language learning. *Studies in Second Language Acquisition*, *27*(3), 361-386.

https://doi.org/10.1017/S0272263105050163

Masita, M. (2020). Teaching vocabulary using blended learning method. *Ethical Lingua: Journal of Language Teaching and Literature*, *7*(1), 128-135. https://doi.org/10.30605/25409190.143

Maxom, M. (2012). *Teaching English as a foreign language for dummies*. John Wiley & Sons.

Meara, P. (1989). Matrix models of vocabulary acquisition. *Aila Review*, *6*, 66-74. https://www.academia.edu/download/41508376/Processes_in_the_developing_lexicon_of_a20160124-13957-1tjk1ry.pdf#page=66

Meara, P., & Fitzpatrick, T. (2000). Lex30: An improved method of assessing productive vocabulary in an L2. *System*, *28*(1), 19-30.

Mellard, D. F., & Scanlon, D. (2006). Feasibility of explicit instruction in adult basic education: instructor-learner interaction patterns. *Adult Basic Education*, *16*(1), 21-37. http://hdl.handle.net/1808/3969

Memory, D. M. (1990). Teaching technical vocabulary: before, during, or after the reading assignment? *Journal of Reading Behavior*, *22*(1), 39-53. https://doi.org/10.1080/10862969009547693

Mertens, E. (2010). Visualizing landscape architecture. In *Visualizing Landscape Architecture*. Birkhauser Verlag Ag. https://doi.org/10.1007/978-3-0346-0459-8

Milton, J. (2009). *Measuring second language vocabulary acquisition* (Vol. 45). Multilingual Matters.

Min, H. T. (2008). EFL vocabulary acquisition and retention: reading plus vocabulary enhancement activities and narrow reading. *Language Learning*, *58*(1), 73–115. https://doi.org/10.1111/j.1467-9922.2007.00435.x

Moonan, L. (1976). Word meaning. *Philosophy*, *51*(196), 195-207.

https://doi.org/10.1017/S0031819100020611

Muñoz, V. L. (2015). The vocabulary of agriculture semi-popularization articles in English: a corpus-based study. *English for Specific Purposes*, *39*, 26–44. https://doi.org/10.1016/J.Esp.2015.04.001

Nacera, A. (2010). Languages learning strategies and the vocabulary size. *Procedia-Social and Behavioral Sciences*, *2*(2), 4021-4025.

Nation, I. S. P. (1990). *Teaching and learning vocabulary***.** Heinle & Heinle Publishers.

Nation, I. S. P. (2000). *Learning vocabulary in another language*. Cambridge University Press.

Nation, I. (2001). *Learning vocabulary in another language*. Cambridge University Press.

Nation, I. S. P. (2006). How large a vocabulary is needed for reading and listening? *Canadian Modern Language Review*, *63*(1), 59-82.

Nation, I. S. P., & Beglar, D. (2007). A vocabulary size test. *The Language Teacher*, *31*(7), 9–13.

Nation, I. S. P., & Beglar, D. (2007). *A vocabulary size test.* https://www.lextutor.ca/tests/vst/

Nation, P., & Kyongho, H. (1995). Where would general service vocabulary stop and special purposes vocabulary begin? *System*, *23*(1), 35-41. https://doi.org/10.1016/0346-251X(94)00050-G

Nirattisai, S., & Chiramanee, T. (2014). Vocabulary learning strategies of thai university students and its relationship to vocabulary size. *International Journal of English Language Education,* *2*(1), 273. doi:10.5296/ijele.v2i1.5366

Niu, R. (2015). Effect of fine-grained lexical rating on L2 learners' lexical learning gain. *Open Journal of Modern Linguistics*, *05*(05), 425–442. https://doi.org/10.4236/Ojml.2015.55038

O'neill, S., Geoghegan, D., & Petersen, S. (2013). Raising the pedagogical bar: teachers' co-construction of explicit teaching. *Improving Schools*, *16*(2), 148-158. https://doi.org/10.1177/1365480213493709

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Routledge.

Peacock, M., & Flowerdew, J. (Eds.). (2001). *Research perspectives on English for academic purposes*.

Pearson, J. (1998). *Terms in context*. J. Benjamins, 242.

Pellicer-Sánchez, A. (2016). Incidental L2 vocabulary acquisition from and while reading: an eyetracking study. *Studies in Second Language Acquisition, 38*(1), 97–130. https://doi.org/10.1017/S0272263115000224

Pollard, J. K. (1999, November). Learning-by-teaching: student generated web-based glossary, dictionary and quiz of information technology terms. In *Fie'99 Frontiers in Education. 29th Annual Frontiers in Education Conference. Designing the Future of Science and Engineering Education. Conference Proceedings (Ieee Cat. No. 99ch37011* (Vol. 2, Pp. 13a4-1). Ieee.

Rahman, M. (2015). English for specific purposes (Esp): a holistic review. *Universal Journal of Educational Research*, *3*(1), 24–31.

https://doi.org/10.13189/Ujer.2015.030104

Richards, J. C., Renandya, W. A., & Farajnezhad, Z. (2002). *Methodology in language teaching: an anthology of current practice*. https://doi.org/10.13140/Rg.2.2.36344.72962

Ringbom, H. (1987). *The role of the first language in foreign language learning* (Vol. 34). Multilingual Matters Limited.

Rodriguez, M. & Sadoski, M. (2000). Effects of rote, context, keyword, and context/keyword methods on retention of vocabulary in EFL classrooms. *Language Learning*, *50*(2), 385-412. https://doi.org/10.1111/0023-8333.00121

Roghani, S., & Milton, J. (2017). Using category generation tasks to estimate productive vocabulary size in a foreign language. *TESOL International Journal*, *12*(1), 143-159.

Sagarra, N. & Alba, M. (2006). The key is the keyword: L2 vocabulary learning methods with beginning learners of Spanish. *The Modern Language Journal*, *90*(2), 228-243. https://doi.org/10.1111/j.1540-4781.2006.00394.x

Saragih, E. (2019). The effect of semantic mapping technique on technical vocabulary mastery for midwifery students. *Studies in English Language And Education*, *6*(2), 333-342. https://doi.org/10.24815/siele.v6i2.14786

Schmitt, N. (1995). A fresh approach to vocabulary: using a word knowledge framework. *Relc Journal*, *26*(1), 86-94.

https://doi.org/10.1177/003368829502600105

Schmitt, N. (2008). Instructed second language vocabulary learning. *Language Teaching Research*, *12*(3), 329-363.

https://doi.org/10.1177/1362168808089921

Schmitt, N. (2010). *Researching vocabulary: a vocabulary research manual*. Springer.

Schmitt, N. (2019). Understanding vocabulary acquisition, instruction, and assessment: a research agenda. *Language Teaching*, *52*(02), 261–274. https://doi.org/10.1017/s0261444819000053

Schmitt, N., & Schmitt, D. (2020). *Vocabulary in language teaching*. Cambridge University Press.

Schmitt, N., Jiang, X., & Grabe, W. (2011). The percentage of words known in a text and reading comprehension. *The Modern Language Journal*, *95*(1), 26-43. https://doi.org/10.1111/j.1540-4781.2011.01146.x

Schmitt, N., & Meara, P. (1997). Researching vocabulary through a word knowledge framework: word associations and verbal suffixes. *Studies in Second Language Acquisition*, *19*(1), 17-36. https://doi.org/10.1017/S0272263197001022

Schmidt, R. R. (1990). The role of consciousness in second language learning. *Applied Linguistics*, *11*(2), 129–158.

https://doi.org/10.1093/applin/11.2.129

Soler, E. A. (2005). Does instruction work for learning pragmatics in the EFL Context? *System*, *33*(3), 417-435. https://doi.org/10.1016/j.system.2005.06.005

Stahl, S. A., & Nagy, W. E. (2007). *Teaching word meanings*. Routledge.

Strevens, P. (1992). English As an ınternational language: directions in the 1990s. In B. B. Kachru (Ed.), *The Other Tongue: English Across Cultures* (2nd ed., pp. 7–47). University of Illonois Press.

Tavakoli, M., & Gerami, E. (2013). The effect of keyword and pictorial methods on EFL learners' vocabulary learning and retention. *Porta Linguarum: revista internacional de didáctica de las lenguas extranjeras*, (19), 299-316.

Taylor, G. R. (Ed.). (2005). *Integrating quantitative and qualitative methods in research*. University Press of America.

Tellols, D., Nishikawa, H., & Tokunaga, T. (2019). Dialogue systems for the assessment of language learners' productive vocabulary. In *Proceedings of the 7th International Conference on Human-Agent Interaction* (pp. 223-225).

Tellols, D., Tokunaga, T., & Yamamoto, H. (2020). Assessing language learners' free productive vocabulary with hidden-task-oriented dialogue systems. In *HAI-GEN+ user2agent@ IUI*.

Tongpoon-Patanasorn, A. (2018). Developing a frequent technical words list for finance: a hybrid approach. *English for Specific Purposes*, *51*, 45-54. https://doi.org/10.1016/j.esp.2018.03.002

Tufféry, S. (2011). *Data mining and statistics for decision making*. John Wiley & Sons.

Van Zeeland, H., & Schmitt, N. (2013). Lexical coverage in L1 and L2 listening comprehension: the same or different from reading comprehension? *Applied Linguistics*, *34*(4), 457-479. https://doi.org/10.1093/applin/ams074

Vidal, K. (2011). A comparison of the effects of reading and listening on incidental vocabulary acquisition. *Language Learning*, *61*(1), 219-258.

Viola, D., Yanto, E. S., & Mobit, M. (2020). students' perception on learning technical vocabularies through vocabulary self-collection strategy. *Journal of Languages and Language Teaching*, *8*(4), 391-401.

https://doi.org/10.33394/jollt.v8i4.2802

Vu, D. V., & Peters, E. (2023). A longitudinal study on the effect of mode of reading on incidental collocation learning and predictors of learning gains. *Tesol Quarterly*, *57*(1), 5-32.

Waldvogel, D. A. (2013). The relationships between vocabulary learning strategies and vocabulary size among adult Spanish foreign language learners. *Journal of Language Teaching & Research*, *4*(2).

Waterman, T. (2012). T*he fundamentals of landscape architecture*. Ava Publishing. www.thamesandhudson.com

Webb, S., & Chang, A. C. S. (2015). How does prior word knowledge affect vocabulary learning progress in an extensive reading program? *Studies in Second Language Acquisition*, *37*(4), 651-675.

https://doi.org/10.1017/S0272263114000606

Webb, S. (2008). Receptive and productive vocabulary sizes of L2 learners. *Studies in Second Language Acquisition*, *30*(1), 79-95.

https://doi.org/10.1017/S0272263108080042

Webb, S. (2005). Receptive and productive vocabulary learning: the effects of reading and writing on word knowledge. *Studies in Second Language Acquisition*, *27*(1), 33-52. https://doi.org/10.1017/S0272263105050023

Webb, S., Yanagisawa, A., & Uchihara, T. (2020). How effective are intentional vocabulary learning activities? A meta analysis. *the Modern Language Journal*, *104*(4), 715-738. https://doi.org/10.1111/modl.12671

Wells, J. C., & Hung, T. T. N. (1990). Longman pronunciation dictionary. *RELC Journal*, *21*(2), 95–97. https://doi.org/10.1177/003368829002100208

Wijesuriya, K., & Dissanayake, S. (2020). The Impact of Online Monolingual and Bilingual Dictionaries on Vocabulary Learning. *SLIIT Journal of Humanities and Sciences*, *1*(1).

Wylie, E. C., Lyon, C. J., & Goe, L. (2009). Teacher professional development focused on formative assessment: changing teachers, changing schools. *Ets Research Report Series*, *2009*(1), i-32. https://doi.org/10.1002/j.2333-8504.2009.tb02167.x

Xhaferi, B. (2009). Teaching and learnig ESP vocabulary. *LFE: Revista de lenguas para fines específicos*, (15), 229-255.

Yaeger, R. E. (1983). The importance of terminology in teaching K12 science. *Journal of Research in Science Teaching*, *20*(6), 577-588.

https://doi.org/10.1002/tea.3660200610

Yan, S., Shen, Y., & Ma, Y. (2023). A Quasi-Experimental Study of English Vocabulary Teaching Based on Incidental Acquisition. *Open Journal of Applied Sciences*, *13*(2), 224-239.

Yanagisawa, A., & Webb, S. (2019). Measuring depth of vocabulary knowledge. In *the Routledge Handbook of Vocabulary Studies* (Pp. 371-386). Routledge.

Yüksel, H. G., Mercanoğlu, H. G., & Yılmaz, M. B. (2022). Digital flashcards vs. wordlists for learning technical vocabulary. *Computer Assisted Language Learning*, *35*(8), 2001-2017.

Zahar, R., Cobb, T., & Spada, N. (2001). Acquiring vocabulary through reading: effects of frequency and contextual richness. *Canadian Modern Language Review*, *57*(4), 541-572. https://doi.org/10.3138/cmlr.57.4.541

APPENDICES

1. Appendix 1- Vocabulary Size Test

Vocabulary Size Test[1]

Circle the letter a-d with the closest meaning to the key word in the question.

1. SEE: They **saw** it.
   a. cut
   b. waited for
   c. looked at
   d. started

2. TIME: They have a lot of **time**.
   a. money
   b. food
   c. hours
   d. friends

3. PERIOD: It was a difficult **period**.
   a. question
   b. time
   c. thing to do
   d. book

4. FIGURE: Is this the right **figure**?
   a. answer
   b. place
   c. time
   d. number

5. POOR: We are **poor**.
   a. have no money
   b. feel happy
   c. are very interested
   d. do not like to work hard

6. DRIVE: He **drives** fast.
   a. swims
   b. learns
   c. throws balls
   d. uses a car

7. JUMP: She tried to **jump**.
   a. lie on top of the water
   b. get off the ground suddenly
   c. stop the car at the edge of the road
   d. move very fast

8. SHOE: Where is your **shoe**?
   a. the person who looks after you
   b. the thing you keep your money in
   c. the thing you use for writing
   d. the thing you wear on your foot

9. STANDARD: Her **standards** are very high.
   a. the bits at the back under her shoes
   b. the marks she gets in school
   c. the money she asks for
   d. the levels she reaches in everything

10. BASIS: This was used as the **basis**.
    a. answer
    b. place to take a rest
    c. next step
    d. main part

[1] The test is created by Paul Nation, Victoria University of Wellington, and found at http://www.lextutor.ca/. This test is freely available and can be used by teachers and researchers for a variety of purposes.

Second 1000

1. MAINTAIN: Can they **maintain** it?
   a. keep it as it is
   b. make it larger
   c. get a better one than it
   d. get it

2. STONE: He sat on a **stone**.
   a. hard thing
   b. kind of chair
   c. soft thing on the floor
   d. part of a tree

3. UPSET: I am **upset**.
   a. tired
   b. famous
   c. rich
   d. unhappy

4. DRAWER: The **drawer** was empty.
   a. sliding box
   b. place where cars are kept
   c. cupboard to keep things cold
   d. animal house

5. PATIENCE: He has no **patience**.
   a. will not wait happily
   b. has no free time
   c. has no faith
   d. does not know what is fair

6. NIL: His mark for that question was **nil**.
   a. very bad
   b. nothing
   c. very good
   d. in the middle

7. PUB: They went to the **pub**.
   a. place where people drink and talk
   b. place that looks after money
   c. large building with many shops
   d. building for swimming

8. CIRCLE: Make a **circle**.
   a. rough picture
   b. space with nothing in it
   c. round shape
   d. large hole

9. MICROPONE: Please use the **microphone**.
   a. machine for making food hot
   b. machine that makes sounds louder
   c. machine that makes things look bigger
   d. small telephone that can be carried around

10. PRO: He's a **pro**.
    a. someone who is employed to find out important secrets
    b. a stupid person
    c. someone who writes for a newspaper
    d. someone who is paid for playing sport etc

Third 1000

1. SOLDIER: He is a **soldier**.
   a. person in a business
   b. student
   c. person who uses metal
   d. person in the army

2. RESTORE: It has been **restored**.
   a. said again
   b. given to a different person
   c. given a lower price
   d. made like new again

3. JUG: He was holding a **jug**.
   a. A container for pouring liquids
   b. an informal discussion
   c. A soft cap
   d. A weapon that explodes

4. SCRUB: He is **scrubbing** it.
   a. cutting shallow lines into it
   b. repairing it
   c. rubbing it hard to clean it
   d. drawing simple pictures of it

5. DINOSAUR: The children were pretending to be **dinosaurs**.
   a. robbers who work at sea
   b. very small creatures with human form but with wings
   c. large creatures with wings that breathe fire
   d. animals that lived a long time ago

6. STRAP: He broke the **strap**.
   a. promise
   b. top cover
   c. shallow dish for food
   d. strip of material for holding things together

7. PAVE: It was **paved**.
   a. prevented from going through
   b. divided
   c. given gold edges
   d. covered with a hard surface

8. DASH: They **dashed** over it.
   a. moved quickly
   b. moved slowly
   c. fought
   d. looked quickly

9. ROVE: He couldn't stop **roving**.
   a. getting drunk
   b. travelling around
   c. making a musical sound through closed lips
   d. working hard

10. LONESOME: He felt **lonesome**.
    a. ungrateful
    b. very tired
    c. lonely
    d. full of energy

Fourth 1000

1. COMPOUND: They made a new **compound**.
   a. agreement
   b. thing made of two or more parts
   c. group of people forming a business
   d. guess based on past experience

2. LATTER: I agree with the **latter**.
   a. man from the church
   b. reason given
   c. last one
   d. answer

3. CANDID: Please be **candid**.
   a. be careful
   b. show sympathy
   c. show fairness to both sides
   d. say what you really think

4. TUMMY: Look at my **tummy**.
   a. cloth to cover the head
   b. stomach
   c. small furry animal
   d. thumb

5. QUIZ: We made a **quiz**.
   a. thing to hold arrows
   b. serious mistake
   c. set of questions
   d. box for birds to make nests in

6. INPUT: We need more **input**.
   a. information, power, etc. put into something
   b. workers
   c. artificial filling for a hole in wood
   d. money

7. CRAB: Do you like **crabs**?
   a. sea creatures that walk sideways
   b. very thin small cakes
   c. tight, hard collars
   d. large black insects that sing at night

8. VOCABULARY: You will need more **vocabulary**.
   a. words
   b. skill
   c. money
   d. guns

9. REMEDY: We found a good **remedy**.
   a. way to fix a problem
   b. place to eat in public
   c. way to prepare food
   d. rule about numbers

10. ALLEGE: They **alleged** it.
    a. claimed it without proof
    b. stole the ideas for it from someone else
    c. provided facts to prove it
    d. argued against the facts that supported it

Fifth 1000

1. DEFICIT: The company had a large **deficit**.
   a. spent a lot more money than it earned
   b. went down a lot in value
   c. had a plan for its spending that used a lot of money
   d. had a lot of money in the bank

2. WEEP: He **wept**.
   a. finished his course
   b. cried
   c. died
   d. worried

3. NUN: We saw a **nun**.
   a. long thin creature that lives in the earth
   b. terrible accident
   c. woman following a strict religious life
   d. unexplained bright light in the sky

4. HAUNT: The house is **haunted**.
   a. full of ornaments
   b. rented
   c. empty
   d. full of ghosts

5. COMPOST: We need some **compost**.
   a. strong support
   b. help to feel better
   c. hard stuff made of stones and sand stuck together
   d. rotted plant material

6. CUBE: I need one more **cube**.
   a. sharp thing used for joining things
   b. solid square block
   c. tall cup with no saucer
   d. piece of stiff paper folded in half

7. MINIATURE: It is a **miniature**.
   a. a very small thing of its kind
   b. an instrument to look at small objects
   c. a very small living creature
   d. a small line to join letters in handwriting

8. PEEL: Shall I **peel** it?
   a. let it sit in water for a long time
   b. take the skin off it
   c. make it white
   d. cut it into thin pieces

9. FRACTURE: They found a **fracture**.
   a. break
   b. small piece
   c. short coat
   d. rare jewel

10. BACTERUM: They didn't find a single **bacterium**.
   a. small living thing causing disease
   b. plant with red or orange flowers
   c. animal that carries water on its back
   d. thing that has been stolen and sold to a shop

Sixth 1000

1. DEVIOUS: Your plans are **devious**.
   a. tricky
   b. well-developed
   c. not well thought out
   d. more expensive than necessary

2. PREMIER: The **premier** spoke for an hour.
   a. person who works in a law court
   b. university teacher
   c. adventurer
   d. head of the government

3. BUTLER: They have a **butler**.
   a. man servant
   b. machine for cutting up trees
   c. private teacher
   d. cool dark room under the house

4. ACCESSORY: They gave us some **accessories**.
   a. papers allowing us to enter a country
   b. official orders
   c. ideas to choose between
   d. extra pieces

5. THRESHOLD: They raised the **threshold**.
   a. flag
   b. point or line where something changes
   c. roof inside a building
   d. cost of borrowing money

6. THESIS: She has completed her **thesis**.
   a. long written report of study carried out for a university degree
   b. talk given by a judge at the end of a trial
   c. first year of employment after becoming a teacher
   d. extended course of hospital treatment

7. STRANGLE: He **strangled** her.
   a. killed her by pressing her throat
   b. gave her all the things she wanted
   c. took her away by force
   d. admired her greatly

8. CAVALIER: He treated her in a **cavalier** manner.
   a. without care
   b. politely
   c. awkwardly
   d. as a brother would

9. MALIGN: His **malign** influence is still felt.
   a. evil
   b. good
   c. very important
   d. secret

10. VEER: The car **veered**.
   a. went suddenly in another direction
   b. moved shakily
   c. made a very loud noise
   d. slid sideways without the wheels turning

2. Appendix 2- A Reading Text Sample

The Fundamentals of Interior Architecture
Materials/Texture

Stone, slate & marble

Stone has been used as a building material for thousands of years and therefore has acquired connotations of permanence, tradition and solidity. A hard and heavy material, it tends to create noisy environments unless balanced by sound-absorbing materials. Modern **quarrying** and cutting techniques make it possible to create very large thin slabs of stone, which may be used for flooring or as a wall-cladding material. A natural and eminently reusable resource, the energy used in its transportation is of environmental concern. The appearance of stone, **slate** and marble will depend on the particular rock formations in which they are found and on the extent to which they are finished and jointed. Rough, **hewn stone** with obvious joints will evoke a sense of rusticity, polished stone with **hairline joints** a more urbane aesthetic.

Concrete & terrazzo

Used by the Assyrians, Egyptians and Romans it was not until the early 1900s that the use of concrete became widespread in civil engineering projects. **Terrazzo** is a refined concrete, traditionally using marble chips as the aggregate, with the surface ground flat and polished after curing. This produces a very hardwearing material, which may be employed as flooring or moulded to create basins and **splashbacks**.

Metals

The use of metals as structural and industrial materials provides appropriate resonances for their use in contemporary interior architecture. Metals are available in sheet form (flat, **embossed** or **perforated**) or as woven mesh as well as structural sections.

Glass

If there is one material that has surpassed all expectations in the course of the past twenty years, it must be glass. In the modern architectural environment it is used as a replacement for walls and roofs, as a **stair tread**, **balustrade** and flooring material and as a replacement for timber in doors, shelves and work surfaces.

Answer the questions according to the text.

1. What kind of effect does hewn stone give to the decoration?

Rough, hewn stone with obvious joints will evoke a sense of rusticity,

2. What is terrazzo used for ?

For basins or splashbacks.

3. What are the available forms of metals?

Metals are available in sheet form (flat, embossed or perforated).

4. What is the usage area of glass in interior design?

As a replacement for walls and roofs, as a stair tread, balustrade and flooring material and as a replacement for timber in doors, shelves and work surfaces.

Put the bold words in the blanks.

1. Most gold diggers **quarried** gold ore with little knowledge of the condition of the soil they worked.
2. The windows have been covered with **perforated metal** screens. So that it both prevents the direct sunlight and lets the light in.
3. A well-known decorative object producer imported glass bottles **embossed** with their logo.
4. The sink was decayed and old fashioned, with a white **splashback** and a tilting mirror.
5. The **balustrade** of the stairs leading from lobby to the floor above was of decorated molded (decorative iron) capped with a timber rail.
6. The site of an ancient place called Khirbet Haiydn still has dams made with rocks, excavated tombs and remnants of **hewn stone** that surved as a decorative wall.
7. Natural colour, texture and grain of **slate**, when applied to a pitched roof or a façade deliver a clean, sculptured and strikingly beautiful appearance.
8. Flooring materials tend to be tiles made from ceramics or terracotta, wide wooden planks, travertine, **terrazzo**, or marble with decorative inlays.
9. The **stair treads** were so slippery that I just fell down on my first step on them.
10. In decoration, rough, sculpted stone with visible connections will arouse a rustic vibe, whereas polished stone with **hairline joints** which are barely visible will arouse a more urban vibe.

English-English Description

1.hairline joint

Between two connecting units, a joint not more than 1⁄64 in. (0.38 mm) wide.

2.slate

a dark grey rock that can be easily divided into thin pieces, or a small, thin piece of this used to cover a roof for flooring, roofing, panels (both decorative and electrical), and chalkboard, and in granular form as surfacing on composition roofing.

3.quarry

to dig stone, etc. from a large hole in the ground that workers dig in order to use the stone and sand for building material

4.hewn stone

stone shaped with a tool

5.splashback

A board which provides protection against water splashes, as behind a sink.

6.terrazzo

Marble-aggregate concrete that is cast in place or precast and ground smooth; used as a decorative surfacing on floors and walls.

7.emboss

To raise or indent a pattern on the surface of a material; sometimes produced by the use of patterned rollers.

8.Perforated metal

Sheet metal usually having a regular pattern of holes; available in many designs.

9.balustrade

a set of posts or a screen to prevent people from falling over the edge of stairs, a balcony, etc., often with a wooden, metal, or stone bar on top that you can hold.

10.stair tread

The horizontal surface of a step; often has a rounded edge that extends beyond the upright face of the riser below it.

English-Turkish Description

hairline joint

kılcal birleşim yeri

slate

kayrak taşı

quarry

taş ocağında taş çıkarmak

hewn stone

yontulmuş taş

splashback

pişirme esnasında yemekten sıçrayan parçaların duvara değmesini engelleyen koruyucu panel

terrazzo

dökme mozaik

emboss

üzerine kabartma yapmak

Perforated metal

delikli metal

balustrade

merdiven korkuluğu

stair tread

merdiven basamak düzlüğü

English-Picture Description

Perforated metal 

Quarry 

Emboss 

Balustrade 

Splashback 

Hewn stone 

Terrazzo 

Slate 

Stair tread 

Hairline joint 

3. Appendix 3- Immediate Tests

Test 1

1. S______________ were built throughout the house to create a more effective ventilation system.

2. As the contract is carried out, the actual sums are measured by a q______________ and the contractor is paid on the basis of these amounts.

3. Chemical w______________ is of the greatest importance in producing fine material, as clay minerals are formed by this process.

4. The perspective can be to a point at such an e______________ that the projection lines appear to be parallel.

5. Rays of afternoon light poured through the s_______________ windows, drenching the sanctuary with splashes of color.

6. You need to make use of c_______________ Pans to shape the concrete into a purposeful form during the construction process.

7. Thanks to a aluminum b_______________ floating above its roof to prevent the direct sunlight, the Modern Wing enhances the Art Institute's identity both architecturally and civically, announcing in a fresh way its importance as a player on the city's cultural scene.

8. B________________ lower-floor windows, preferred against any huge source of stress, for New York's One World Trade Center building under construction will come from northeast China's Shandong Jin Jing Technology Co.

9. You can L____________ a thin transparent plastic coating to paper or board to provide protection and give it a glossy finish.

10. O___________ was formerly largely used by wood-carvers, and is still in some demand for those artists, being harder and more durable than lime and other woods that yield more readily to the sculptor's tool.

Test 2

1. In the cast i_____________ concrete, column, slab etc. elements are casted on site in the open environment and hence it is difficult to control mix, placement and curing.

2. I began from base of a column, divided the column in four segments. Then decorated the p___________ at the bottom with some ornaments styled to Doric column.

3. One has to be meticulous during work with p____________ concrete because the units can be damaged during transportation and handling.

4. Building f____________ are one of the most critical elements of any project, even though they aren't visible when the home or structure is complete because in most cases they are built under the ground.

5. Leading from the Library, the visitor enters a circular building, about 45-yard width with an outer Greek p___________.

6. The theater was built with steel f___________ with concrete and masonry walls.

7. The plastic was poured into the m_________ and left to set until it was firm.

8. The intrinsic brittleness of ceramics has limited their use in critical L____________ structural components.

9. The p___________ which enables adequate drainage of rainwater or snow in moderate to severe rainfall regions generally varies between 45Â°-60Â°.

10. The c__________ of the entrance of the building was washed away because of the strong breeze this morning.

Test 3

"1. 1. The s___________, which supports the concrete while it hardens, is employed in his architecture to give the completed structure texture."

2. Some designs end with a process that leaves a wood g_____________ pattern on the finished face of the concrete. The texture softens concrete's notoriously cool appearance, but still stays on trend with modern design.

3. By the 1920s the choice of r______________ for major structures in earthquake zones was so common as to be axiomatic.

4. Masonry c_____________ can be arranged in various orientations, according to which side of the masonry unit is facing the outside and how it is positioned.

5. The design of the entrance is a standard two-arc dome t____________ to a sharp edge.

6. This site does not contain pyramids; instead the buildings here are made of a_____________ brick, a very unusual construction material for this place and time.

7. The furniture designer preferred to attach the armrest to the main body with nuts and b_____________.

8. During the hurricane, the slope stayed stable thanks to a breathable construction covered with g____________, which prevented landslides.

9. The major factors that affect the stability of the structure are rotational angle of the v____________ beam, ratio of length and height, rock type and height of carrying rock strata.

10. Our range of reinforcement m_____________ is primarily used as a fabric to strengthen concrete slabs, walls and other constructions.

Test 4

1. P____________ screens have been used to cover the glass doors to prevent the excessive sunlight.

2. It is a masonry bridge of five elliptical arches with a stone b____________.

3. In terms of decoration, rough, carved stone with evident connections will stimulateÂ a rustic mood, while other polished stone with barely visible h_______________ will stimulateÂ a more urban atmosphere.

4. The gray limestone in this area was once q___________ for use in bridges and buildings.

5. T______________ marble in Venetian mosaic is used for the floors of the entrance hall and corridors, and the steps of the staircase.

6. I slipped and fell badlyÂ on the s____________ because they were so wet.

7. If you've got pale or neutral-coloured kitchen bench, a s_______________ is the perfect place to inject a blast of colour.

8. Dams formed of rocks, excavated graves, and pieces of h_____________ that surved as an ornamental wall may still be seen at the site.

9. The council immediately inspected the roof, and it found that 24 s___________ had been maliciously damaged.

10. A well-known firm of decorative object manufacturers imported glass bottles with their name e_____________ on the glass.

Test 5

1. This dear woman brought the clean washing in a black bag to church and left it in the v___________.

2. Reluctantly, he walked up the sloping hill and to the p__________ that opened automatically for its master.

3. Unfortunately, as the dry land views are being used as b_____________, none of the actors will be coming to Seaford for the filming.

4. The current dome, as well as the d_____________ on which it sits, are wonders of beautiful line and harmonic proportion.

5. S______________ has been established around the tower and repair work will start next week.

6. It has a very high rusticated a____________ with severalÂ pointed arches that almost reach the mausoleum.

7. Plans for a new c______________ to increase the number of cultural events will go before the committee today.

8. The building (known locally as the second D_________) was started in the 13th century but the construction of its dome was not completed until the 15th century, supervised by the architect Filippo Brunelleschi.

9. A lot of factors had affected the design of La Tour, such as: social background of his age, M____________ , Classicism , Caravaggio, Baroque and religious factor.

10. On the p______________ of the main entrance, the gold hands of the blue-painted clock moved towards the hour.

Test 6

1. At the top of the atrium, an o____________ captures and reflects patterned light within the faceted dome.

2. The two-story mansion is a traditional adobe pueblo-style building including seven guest rooms with k_______________ for heating and private bathrooms.

3. He was forced to live in the top attic right, up against the east end g______________ of the building.

4. The architect had the o______________ of the church changed so that the front would face the big garden.

5. The style of the house was basically inspired by P_______________, a mixture of Spanish Colonial, mission, and Indian architectural forms with adobe-like materials.

6. This floor consists of a r_____________ with a dome at the top, and of halls and cabinets of sculpture.

7. The ceiling was decorated with gold and the f______________ was ornamented with mythical creatures and angels.

8. The p______________ at the top of the towers of the building give it a Gothic appearance.

9. A narrow b______________ of wood separated the greenhouse from the vegetable garden.

10. A Navajo religious song tells how the first h___________ was built for man by the god Coyote.

Test 7

1. Two s____________ rooms were discovered in an ancient monument in 1838. The archeologists believe that they probably belong to the king and queen.

2. The s__________ on the timber such as some names and dates were probably done by the teenagers living in this neighborhood.

3. The s___________ of the structure is 90 centimeters in diameter and goes down 287 centimetersÂ from the surface.

4. In architecture, a pyramid is a structure with a rectangular base and four triangularÂ sides that meet at an a_________.

5. Some of the Egyptian pyramids developed from the m_________a which were mainly the rooms where the important dead people were buried.

6. It is said that it took 20 years to e_________the Great Pyramid at Giza with 100,000 men.

7. The shapes of pyramids are not always triangular or equal to each other, but sometimes t_____________ with no parallel lines.

8. Long ago, before Sasha left the Council, he had stayed in a corner c___________ overlooking the forest.

9. As the previous road was frequently flooded and damaged , a raised concrete c___________ was built to give access to the other side of the lake.

10. Most of the dead bodies are autopsied and then sent to a m__________y temporarily for identification before burial.

4. **Appendix 4- Delayed Test**

1. To have a more effective ventilation system and let air move in and out, slo_____ o________ were installed throughout the house.

2. When the contract is completed, a qua______ sur______ will calculate the real sums, and the contractor will be paid on the basis of these amounts.

3. Chemical we___________ is important in the production of fine material because clay minerals are generated during this process.

4. The el_____________ on the paper shows only the entrance of the building with a courtyard.

5. During the 7th century, people realized the benefits of stai_____ g_______ and started building windows with colors to add to chapels and monasteries.

6. During the construction phase, you'll need to utilize con______ bo_______ to shape the material into a useful shape.

7. The hanging bru______ so______ above the roof to prevent direct sunlight improves the building's architectural character with its modern look.

8. The house of the ambassadors had to be installed with bla______-re_________ glasses to protect them against any kind of explosion.

9. The material can be la___________ with many layers in thick portions to prevent cracking.

10. Hardwoods like o_______ tree have a slower growth rate than softwoods and therefore tend to be denser and more durable for construction.

11. Cast i____ s______ concrete is prepared on the site and poured in formwork and then left to dry. It often requires more labours and even takes longer time.

12. The pl__________ at the bottom of the column distributes the weight and pressure coming down through a column evenly across a wider space.

13. Pr_____________ concrete is faster to produce and easier to install but if it is not properly handled, the units may be damaged during transport.

14. Without fo_____________, your house would quickly sink into the ground unevenly, resulting in cracks and damage to your home.

15. The por__________ with columns in the entrance of the structure in Classical Architecture gives a glamorous view to the building.

16. The house was built with fr________ cons________ with columns and beams to carry the load which looked like the skeleton of the house in the first phase.

17. The fluid mixture of materials was placed into the mo_________ and allowed to harden.

18. If a wall or beam is directly connected to the foundation of your house, it is lo_____-b______ which means it carries the burden of the house.

19. The pi_____ r_______ design at the top of the house helps to move the water away from the home and leaves little chance of floods.

20. We went out but waited for the rain to stop under the can_________ not to get wet before we go out.

21. Shu___________ is used to hold the wet concrete in place until the concrete has hardened and fixed.

22. The cutting process and the characteristics of the wood itself can result in different wood gr_______.

23. As the term suggests, the re________ conc___________ provides extra strength to the structure compared to the traditional form.

24. Rows of bricks called cou__________ are laid on top of one another to build up a structure such as a brick wall.

25. The tap__________ columns in the entrance of the building are thinner towards the ground so that they do not cover a wide area.

26. The ad_________, or sun-dried brick, is one of the oldest and most common building materials known to man.

27. The furniture designer preferred to use screws and b______ to fix the armrest to the main part.

28. Gab_____ w______ are great ways to control land sliding on road sides and erosion.

29. Voi_________ are used to have arch shaped structures with no corners at the edges.

30. One of the usage areas of wire m_______ is to strengthen concrete slabs, buildings, and other structures.

31. To reduce excessive sunlight, perf______ me_______ screens were installed to cover the glass doors.

32. Bal___________ on the stairs are useful not only for protective reasons but also for aesthetic purposes.

33. The hai______ jo________ between tiles is so invisible that the surface seems like a whole instead of merging different parts.

34. The machines to qu__________ the limestone from the ground have broken down. We need to postpone the start of the construction to another date.

35. The floors of the entrance hall and corridors are made of Ter________ marble with Venetian mosaic which gives a cozy atmosphere with its color and little shapes .

36. Be careful while stepping on the sta_____ tr________. They have just been cleaned and must be slippery.

37. If your kitchen bench is light or neutral in color, a spl____________ is a great spot to add a piece of color.

38. The outer he____ sto_____ shaped like a flower would add more to the appearance of the building façade.

39. Sl______ is a durable rock that is suitable for many uses. We can see it as pathway flooring in most of the specifically designed gardens.

40. A famous decorative object producer manufactured glass bottles with their name em___________ on the glass.

41. When the guests arrive, direct them to the v___________ first to leave their coats before coming inside the meeting hall.

42. The people need to be asked for their HES code at the po______ before they come inside to keep the Covid positive people away from the crowd.

43. The ancient architecture seems to be a perfect bac___________ for the scene of love in the theater play.

44. The existing dome, as well as the dr_____ on which it stands, is works of art in terms of line and harmonic proportion.

45. Sca__________ has been placed around the tower, and restoration work will begin the following week.

46. The long aisle between the two modern gigantic structures is actually an old ar_________ with many arches one behind another.

47. Atatürk Kültür Merkezi is an important civ______ c_______ for the whole city with many performances and theater plays.

48. The dome of Santa Maria del Fiore or Du_______ of Filippo Brunelleschi was the first octagonal dome in history to be erected without a temporary wooden support

49. A variety of factors influenced the design of La Tour, such as the social background, Classicism, M_____________, Caravaggio, Baroque, and religious beliefs.

50. The sculpture on the ped________ on top of the door symbolizes the family tree of the settlers.

51. At the top of the dome, an oc__________ was designed to capture and reflect the natural light.

52. A ki___________ is an indoor or outdoor heating source inspired by southwestern pueblo architecture.

53. The roof was domed, and there was probably a gab_________ at either end with a hole to let the smoke from the wood fire escape.

54. The ori____________ of the church was revised and changes so that the entrance would see the main road.

55. The home was designed in the Pu_____ Rev_______ style, which combines Spanish Colonial, mission, and Indian architectural elements with adobe-like materials.

56. One of the most common structures of Classical and Neoclassical style is rot____________ which is a round shape building with a dome.

57. The Corinthian painter's primary decorative device was the animal fri_________ on the columns.

58. An outstanding feature of Gothic architecture is the use of pin_________ at the top of the tower.

59. A wood ba_____ divides the wall into two horizontally separating it for different functions.

60. There are different styles of houses around the world one of which is ho________ which is an Indian style.

61. In 2020, two sep___________ rooms were uncovered in an antique structure. The archeologists believe they belonged to the prince and queen.

62. The sc________ on the wood, including some names and dates, were most likely done by youngsters in the neighborhood.

63. The sha______ of the structure to the grave is 90 centimeters wide and goes down 287 meters from the surface.

64. A pyramid is made of three main parts - face, base and ap_____ where the sides meet at the top.

65. The pyramids were mainly developed over mas_____________ which were Egyptian tombs previously.

66. It is estimated that 100,000 men worked for 20 years to er_________ the Great Pyramid of Giza.

67. Pyramid shapes are not usually triangular or equal, but can be trap___________ with no parallel lines.

68. Lady Eleanor was found dead in her cha__________.

69. The Nippon cau___________ that connects Betio and Bairiki islands has been severely damaged by strong waves.

70. His body was taken to Brighton mor___________ for identification.

5. Appendix 5- Ethics Committee Approval

YTÜ

YILDIZ TEKNİK ÜNİVERSİTESİ
Sosyal ve Beşeri Bilimler Araştırmaları Etik Kurulu

Toplantı Tarihi: 28.02.2022 **Toplantı No:** 2022.02

SOSYAL VE BEŞERİ BİLİMLER ARAŞTIRMALARI ETİK KURULU
TOPLANTI KARARI

Yürütücülüğünü Üniversitemiz Sosyal Bilimler Enstitüsü öğretim üyelerinden Prof. Dr. Hatice Gülru Yüksel danışmanlığında lisansüstü öğrencisi İLKNUR NURTEN BAĞCI tarafından yapılacak olan "TEACHING TECHNICAL VOCABULARY THROUGH UBIQUITOUS LEARNING" adlı çalışma ve bu çalışmada kullanılacak veri toplama araçları ve yöntemlerine ilişkin bilgilerde etiğe aykırı herhangi bir bulguya rastlanmamıştır.

Etik Kurul Üyeleri

Prof. Dr. Murat DONDURAN
Başkan

Prof. Dr. Ali ERYILMAZ
Üye

Prof. Dr. Gülhayat GÖLBAŞI ŞİMŞEK
Üye

Doç. Dr. Mehmet Emin KAHRAMAN
Üye

Doç. Dr. Senay OĞUZTİMUR
Üye

Doç. Dr. Yasin ŞEHİTOĞLU
Üye

Dr. Öğr. Üyesi Güzin AKYILDIZ
Üye

Taş Bina A-2013 Oda Davutpaşa Kampüsü Esenler/İstanbul Tel: (0212) 383 31 18
E-posta: sbemdr@yildiz.edu.tr - Web: sbe.yildiz.edu.tr
Rapor Doğrulama Adresi: "etik.yildiz.edu.tr/dogrula" Rapor No: 20220200189 Doğrulama Kodu: a91aa

6. Appendix 6-Informed Consent Form

An Investigation of Teaching Technical Vocabulary through Four Different Methodological Instructions

Participant Information Sheet and Informed Consent Form

Dear Participant,

This scale is part of a research study that we are carrying out in order to understand different methods of teaching technical vocabulary. The data collected through this scale will be used to understand to what extent students learn the technical vocabulary through various methods in English for Specific Purposes classes. By filling in the following scale, you agree to participate in this study.

Please note that your participation in the study is voluntary and whether you agree to participate or not will have no impact on your grades for the courses you are/were enrolled in. Your identity will not be revealed in any case to third parties. The data collected during the course of this study will be used for academic research purposes only and may be presented at national/international academic meetings and/or publications. You may quit participating in this study at any time by contacting us. If you opt out of the study, your data will be deleted from our database and will not be included in any further steps of the study. In case you have any questions or concerns, please contact us using the information below.

Inst. İlknur NURTEN BAĞCI

Prof. Dr. Hatice Gülru YÜKSEL

By signing below, you agree to take part in the study.

Name, signature:

____