

T.C.
BAHCESEHIR UNIVERSITY
GRADUATE SCHOOL
THE DEPARTMENT OF INFORMATION TECHNOLOGIES
MASTER PROGRAM IN EDUCATIONAL TECHNOLOGY

**THE IMPACT OF COGNITIVE LOAD ON EFL LISTENING
COMPREHENSION: A COMPARATIVE ANALYSIS OF NOTE-TAKING
AND WHILE LISTENING**

MASTER'S THESIS
TUĞÇE AYBİKEM KIRAN

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THESIS ADVISOR
ASST. PROF. AYŞEGÜL LİMAN KABAN

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Program Name:	Educational Technology
Student's Name and Surname:	Tuğçe Aybikem Kıran
Name Of The Thesis:	The Impact of Cognitive Load on EFL Listening Comprehension: A Comparative Analysis of Note-taking and While Listening
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Assoc. Prof. Yücel Batu SALMAN
Institute Director

This thesis was read by us, quality and content as a Master's thesis has been seen and accepted as sufficient.

	Title/Name	Institution	Signature
Thesis Advisor	Asst. Prof. Ayşegül Liman Kaban	Bahcesehir University	
2nd Member	Asst. Prof. Ufuk Keleş	Bahcesehir University	
3rd Member (Outside Institution)	Assoc. Prof. Alev Ateş Çobanoğlu	Ege University	



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Name, Last Name: Tuğçe Aybikem Kıran

Signature:

ABSTRACT

THE IMPACT OF COGNITIVE LOAD ON EFL LISTENING COMPREHENSION: A COMPARATIVE ANALYSIS OF NOTE-TAKING AND WHILE LISTENING

Kıran, Tuğçe Aybikem

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This study investigates the effects of two types of listening tasks while listening (WL) and note-taking (NT) on the cognitive load of English as a Foreign Language (EFL) learners at different proficiency levels (B1 and B2). Utilizing a mixed-method approach, quantitative data were collected through a Cognitive Load Scale (CLS) developed by Leppink (2013), while qualitative data were gathered via structured interviews with six volunteer students. A total of 62 students participated in the WL task, and 58 students participated in the NT task. The findings reveal significant differences in cognitive load between B1 and B2 learners. During WL tasks, B1 students experienced higher extraneous load (EL), particularly in understanding instructions and explanations, compared to B2 students. Conversely, during NT tasks, B2 students reported higher intrinsic load (IL), indicating greater difficulty with task complexity and content. No significant differences were found in overall cognitive load scores between the two tasks or between genders. Qualitative data highlighted mixed responses: while some students found WL tasks helpful others struggled with their complexity. Similarly, NT tasks were perceived as beneficial by some, but others found them challenging. The most common suggestion for improvement across both tasks was reducing the audio speed to enhance comprehension. This study underscores the importance of tasks design in managing cognitive load and offers insights for

educators and curriculum designers to optimize listening activities for EFL learners. The findings suggest that tailoring tasks to proficiency levels and reducing extraneous load can significantly improve listening comprehension and learning outcomes.

Key Words: Cognitive Load Theory, Cognitive Load Scale, English as a Foreign Language, While Listening, Note taking



ÖZET

BİLİŞSEL YÜKÜN DİNLEDİĞİNİ ANLAMA ÜZERİNDEKİ ETKİSİ: NOT TUTARKEN VE DİNLERKEN KARŞILAŞTIRMALI ÇALIŞMASI

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Bu çalışma, farklı iki seviyede İngilizceyi yabancı dil olarak öğrenen öğrencilerin iki farklı dinleme becerisinin (dinlerken ve not tutarken) bilişsel yüke etkisini ele almaktadır. Nicel veri Leppink (2013) tarafından geliştirilmiş bilişsel yük ölçeği ile toplanmıştır, nitel veri 6 gönüllü öğrenci ile bireysel görüşme aracılığıyla yapılmıştır. Not tutarken dinlemeye 58 öğrenci, dinlerken ise 62 öğrenci katılmıştır, öğrenciler google form linki ile cevaplarını kaydetmişlerdir. Nicel sonuçlara göre B1 ve B2 seviye öğrencilerinin bilişsel yüklerinde dinlerken ve not tutarken fark bulunmuştur. B1 öğrencilerinin dışsal bilişsel yükleri B2 öğrencilere göre daha fazladır. Not tutarken dinleme esnasında ise B2 öğrencilerinin içsel bilişsel yükleri B1 öğrencilere göre daha fazla çıkmıştır. Fakat toplam bilişsel yük ve cinsiyete bakıldığında fark çıkmamıştır. Nitel çalışmada öğrencilerin bu iki dinleme uygulaması hakkında düşünceleri ve bu uygulamaları yaparken karşılaştırdıkları zorlukları ele almak için yapılmıştır. Nitel veride pozitif, negatif, ve nötr cevaplara rastlanmıştır. Öğrencilerden bazıları dinlerken yapılan uygulamayı yararlı bulurken diğerleri zor bulmuştur. Not tutarken dinleme uygulamasında bazı öğrenciler uygulamayı uzun ve karışık bulurken diğerleri faydalı bulmuştur. Sonuçlara göre B1 ve B2 öğrencileri benzer önerilerde bulunmuştur. En belirgin öneri dinleme hızının yavaşlatılmasıdır. Öğrenciler dinleme hızının yavaşlatılmasının anlamalarına yardımcı olacağını düşünmektedir. Öğrenciler bu iki dinleme uygulamasının dinleme becerilerini geliştirdiğini düşünmektedir. Bu çalışma eğitimcilere ve müfredat tasarımcılarına dinleme etkinliklerinin tasarımının önemi ve

öğrenciler tarafından sunulan öneriler sunmaktadır. Dışsal bilişsel yükün azaltılması dinlediğini anlamayı geliştirdiğini göstermektedir.

Anahtar Kelimeler: Bilişsel Yük Teorisi, Bilişsel Yük Ölçeği, Yabancı Dil olarak İngilizce, Dinleme, Not tutarken Dinleme





To my parents and my boyfriend

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LIST OF ABBREVIATIONS

CLT	Cognitive Load Theory
CLS	Cognitive Load Scale
EFL	English as a Foreign Language
EL	Extraneous Load
GL	Germane Load
IL	Intrinsic Load
M	Mean
NT	Note Taking
SPSS	Statistical Package for the Social Sciences
WL	While Listening

Chapter 1

Introduction

This chapter provides a theoretical framework, a statement of the problem, the purpose of the study, research questions, the significance of the study, and definitions.

English is the universal language that is used by everyone to communicate (Rao, 2019). English as a universal language consists of four skills. When we learn a foreign language, we first listen, then talk, read, and finally write that language. Listening is a crucial part of our daily life and plays an important role in our educational life, professional life, social life, and personal life (Nemtchinova, 2013).

Listening is one of the four main language skills and the most used in everyday life. When we ask learners who have difficulty in a foreign language in terms of speaking or listening most of them will say listening (Nemtchinova, 2013).

EFL learners deal with listening comprehension because it is a continuous process and when students listen to audio, they try to understand the meaning of the audio and it leads them to a heavy cognitive load. Many people agree that listening is crucial for learners, however, it is neglected when compared to any other language skills. Research demonstrates that hearing in another language is a difficult activity for learners (Bacon et al., as cited in Rahimi & Sayyadi, 2019).

Many factors can affect this difficulty level such as contextual setting, EFL setting, gender, age, background knowledge, motivation, and anxiety variables (Ikezawa et al., as cited in Rahimi & Sayyadi, 2019).

The first rating scale was introduced by Fred Pass during the 1990's. The cognitive load scale developed by Pass (1994) is widely used and further developed to measure cognitive load. It was the most popular scale which measured cognitive load and was used by many researchers. It was easy to use, and it required less than one minute to complete. Nevertheless, it is criticized because of some limitations and making it difficult for learners to make connections between the difficulty of the material and inadequate instructions (Kirschner et al., as cited in Andersen & Makransky, 2021). Cognitive load scale which is developed by Leppink (2013) widely used in educational environments. The CLS is one of the most validated scales used

for self-report measures of IL, EL, and GL (Andersen & Makransky, 2021). IL is imposed by the learning task itself, EL is imposed by the design of instruction, and GL is about the quantity of cognitive resources that participants have accessible for learning. Several studies show that the validity and reliability of the instruments including reliability can be examined through Cronbach Alpha or similar estimates (Cronbach, 1951).

In EFL contexts, listening can impose a high cognitive load, especially in lower-level students because of the limited capacity, while higher levels may manage cognitive load more effectively.

There are two while-listening activities used in preparatory schools in Turkey which are called WL and NT. Within EFL classrooms in Turkey listening and note-taking are two common listening activities used to assess and improve students' listening comprehension. These two activities vary in terms of complexity, duration, and cognitive demands, influencing students' ability to manage cognitive load. Note-taking while listening is a challenging activity for learners. The fast speaker in lectures makes note-taking difficult (Al Musalli, as cited in Ipek, 2018).

While completing the activity, pupils must be selective and take notes. It is a difficult undertaking that necessitates understanding and selecting information. Note-takers as readers should understand information and store the information in long-term memory by writing it down. It often leads students to time pressure because students need to take notes quickly.

1.1 Theoretical Framework

The cognitive load theory (CLT) established by Miller (1956) and further developed by Sweller (1998) provides a framework to comprehend how the mental demands of tasks impact learners' ability to process and retain knowledge. CLT categorizes cognitive load into three types which are intrinsic, extraneous, and germane load. Each of them influences the learning experience and the outcome (Sweller, 2011). The effective cognitive load, or GL, is the consequence of the positive cognitive load. IL refers to the difficulty of the learning task. EL are mainly about how the material is presented. According to Miller, working memory must deal with new

information, and it can only keep seven pieces (Miller, 1956). The mental effort which learners face while doing a task is called cognitive load (Sweller, 2011).

The cognitive load theory aims to comprehend how learner's ability to grasp new information and store it in long-term memory might be impacted by the information processing load triggered by learning activities. The main concept of cognitive load is basic. When new knowledge is acquired, the brain is limited. Thus, people can process a limited amount of information simultaneously. CLT is a cognitivist theory that aims to help educators create unique instructional designs that are compatible with the limits of human cognitive architecture (Orru & Longo, 2019). This architecture is essentially the human cognitive system that stores, retrieves, and processes information for thinking and decision-making (Orru & Longo, 2019).

Human memory can be classified into two types. These include working and long-term memories. Learning outcomes may be impacted by the cognitive load theory on working memory, which is the consequence of processing new information and storing it in long term memory schemas (Shiffrin,1968). Moreover, Atkinson and Shiffrin's model (1971) reflects that human cognitive architecture includes an effectively unlimited long-term memory that connects with a working memory of very limited capacity. The cognitive theory of multimedia learning focuses on the limited capacity of the human working memory (Mayer, 2005). In addition to this, working memory processes in two different channels which are verbalized and visual pictorial information. For essential learning and maximization of mental resources, instruction should address verbalized and visual pictorial information. As a result, the main concept is to lower the external load to set up more capacity for real learning, resulting in improved learning and transfer performance (Bannert, 2002).

Task complexity is a key influence on human performance and behaviour (Sweller, 1998). The cognitive load theory (CLT) is mainly concerned with the learning of complicated tasks, where students are often overwhelmed by too much knowledge (Paas et al., 2004). Listening has high cognitive load. Students deal with high cognitive load during listening activity because they try to understand the meaning of the content and it led them to heavy cognitive load (Rahimi and Sayyadi, 2019). High level of cognitive load can hinder learning process, and it affects students negatively (Nizar et al., 2023). Understanding how cognitive load affects students listening performance during while listening and note-taking and identify when and

why cognitive load occurs during WL and NT help optimize listening activities and reduce unnecessary load. CLT help to identify which listening activity imposes more mental demand and interpret differences in CL experienced by students during WL and NT audio.

1.2 Statement of the Problem

EFL learners face many challenges in developing listening comprehension skills because of the high cognitive load demands associated with listening activities. Many learners struggle with fast-paced audio which can hinder students' ability to understand the language (Bingöl et al., as cited in Hermida, 2021). The presence of unknown words can be difficult for students as students are not able to infer the meanings from the context (Graham, as cited in Hermida, 2021). In addition, poor grammatical knowledge can lead students to misunderstand the spoken text (Vandergrift, as cited in Hermida, 2021). While listening and note-taking activities used in Turkish preparatory schools impose varying levels of cognitive load affects students' comprehension and retention. There is limited research exploring how these specific listening tasks impact cognitive load, specifically about task complexity and students' proficiency levels. Understanding these factors important for teachers, educators, and curriculum designers to optimize instructional strategies and reduce cognitive load. There are some studies conducted in the EFL context among students however, there is a limited study about the comparison between while listening and note-taking among cognitive load scale. For example, many researchers used the cognitive load scale developed and modified by Leppink (2013) in their study. They are used in reading comprehension, listening comprehension, science, math, and so on. The scale is suitable and easy to use and adapt to educational environments. For instance, Nizar et al. (2023) used CLS to see the relationship between reading comprehension and CL. Another study done by Timothy et al. (2023) focused on science teacher education and CLS. Rahimi and Sayyadi (2019) used CLS to measure the listening comprehension of students. Al-Sarry (2022) used CLS to measure math and wanted to see the relationship between math and CL. Nevertheless, there is a limited study about the comparison between WL and NT in cognitive load scale among EFL learners.

1.3 Purpose of the Study

This study aims to investigate the cognitive load experienced by EFL learners during two different audio which are called while listening and note-taking. It is important to understand spoken language which is crucial for academic success and social interaction. By comparing cognitive load measurement and listening tasks, the research seeks to offer insights for developing instructional design and facilitating listening comprehension between EFL students at a university. It is essential to understand the cognitive load and how it differs across different listening audio. The research seeks to offer insights for educators, curriculum designers, and EFL teachers to optimize instructional strategies, enhancing students listening comprehension.

1.4 Research Questions

1. Is there a statistically significant difference in the cognitive load experienced by B1 and B2 level students during while listening audio?
2. Is there a statistically significant difference in the cognitive load experienced by B1 and B2 level students during note-taking audio?
3. Is there a statistically significant difference in cognitive load between NT and WL audio?
4. Is there a significant difference in cognitive load during WL and NT experienced by female and male students?
5. What are the experiences of the preparatory students on cognitive load in two different listening audios?

1.5 Significance of the Study

This study provides valuable insights into the cognitive demands of different listening tasks, particularly in the context of Turkish preparatory schools. By evaluating and comparing the impact of while listening and note-taking activities on cognitive load and comprehension the study aims to guide teachers, in refining instructional techniques. Findings from this study can inform curriculum designers,

and EFL teachers, helping them adopt strategies that alleviate cognitive load overload and support listening comprehension in the EFL context. Proper measurement tools especially different types of CL would be beneficial for researchers, instructional designers, and educators to understand better appropriate and essential instructional design (Choi & Lee, 2021). To improve students' listening comprehension problems, teachers should be aware of the student's mistakes and adapt their listening materials and listening strategies in terms of their audience.

1.6 Definitions

Cognitive Load Theory (CLT): Based on our understanding of human cognition, CLT is an educational theory (Sweller, 2011). The theory focuses on how the brain processes and stores knowledge during the learning process. The theory was developed by John Sweller during the 1980s.

Cognitive Load Scale (CLS): Leppink and his colleagues developed the cognitive load scale, which has become one of the most verified and commonly used self-report measures of intrinsic, extraneous, and germane load (Andersen & Makransky, 2021). The scale consists of 13 items.

Intrinsic Load (IL): Intrinsic load is a factor linked to task diversity and complexity that learners must manage. It is based on the learner's past experiences (Choi & Lee, 2021).

Extraneous Load (EL): Inappropriate instructional design and procedures contribute to extraneous cognitive load by increasing the demand for the learner's working memory (Choi & Lee, 2021).

Germane Load (GL): Germane cognitive load occurs when a student takes a cognitive effort to transfer knowledge in working memory (Choi & Lee, 2021). Germane cognitive load develops when new information is combined with pre-existing intrinsic knowledge (Choi & Lee, 2021).

English as a Foreign Language (EFL): Teaching English to learners whose mother tongue is not English.

While Listening (WL): Depending on the demands of the activities, this stage is subdivided into extensive and intensive listening (Field, as cited in Athi, 2019).

Note-taking (NT): Taking notes is one of the most crucial strategies for students since it allows them to record their notes for subsequent use (Siegel, as cited in Al-Ghazo, 2023).



Chapter 2

Literature Review

This chapter consists of historical background of CLT, and research studies related to cognitive load and listening. There are nine main sections within this chapter: cognitive load theory, types of cognitive load, measuring cognitive load, listening comprehension and cognitive load, listening, cognitive load among EFL learners, stages of listening, research studies about note-taking among EFL learners, research studies about while listening, and cognitive load studies conducted in Turkey.

2.1 Cognitive Load Theory

According to Miller, the human brain can process only seven pieces of information, simultaneously (Miller, 1956). The foundation of cognitive load theory (CLT) was developed by George Miller, who discusses the concept of “the magical number seven, plus or minus two,” considering cognitive capacity and information processing in humans (Miller, 1956). The human mind has a limited capacity to process knowledge; people can hold about seven items, such as chunks of information, in their short-term memory at a time, with a range of almost five to nine items (Miller, 1956). Miller's field of study focuses on investigating the recall of items, such as auditory sounds, taste sensations, and colours. As emphasized by Miller, the human brain can acquire various topics and stimuli together, but the knowledge transferred to long-term memory is limited (Miller, 1956). Moreover, when people learn something new, if they try too much at once, their brains become overloaded, and they deal with learning something new. According to Kirshner, CLT is founded on cognitive theories of human architecture, with one fundamental assumption being that a human's working memory capacity is limited (Kirschner, as cited in Bannert, 2002). When humans learn, they devote most of their cognitive resources to the activity, and in many situations, the instructional method creates overload (Bannert, 2002).

Cognitive load theory dates to 1982 (Sweller & Levine, 1982). However, Sweller (1988) provided the first definition. CLT was developed by John Sweller is educational

psychologist and his colleagues and focuses on how human cognitive systems handle knowledge and the implications of instructional design. The cognitive load theory (CLT) is an instructional theory that points to how the human brain acquires knowledge during the learning process (Sweller, 2011). John Sweller primarily focuses on the field of educational psychology, learning sciences, problem-solving, and cognitive sciences. He is best known with CLT which focuses on how cognitive processes affect learning and instructional design. According to Sweller, working memory which processes knowledge is limited in both capacity and duration (Sweller, 1988). Knowledge can only be stored in long-term memory (Sweller, 1988). Sweller remarked that the main purpose of CLT is to reduce extraneous load. According to Sweller and Chandler, cognitive load theory implies, effective teaching material must reduce extraneous cognitive load, and guide learner's cognitive resources toward activities that help them build mental frameworks and make problem-solving automatic, essentially making learning more efficient and effective (Sweller & Chandler, 1991). As emphasized by Chandler, there is a need for well-integrated teaching materials that cut out unnecessary mental efforts, allowing students to focus their cognitive resources on key concepts and build a mental framework for better learning (Chandler, 1991).

To sum up, these parts provide a brief history and give information about the definition of CLT and the historical background of CLT. Theory foundations roots back to the 1950s and Miller introduced 'the magical number seven, plus or minus two' (Miller, 1950). Sweller's field of study focuses on educational psychology, learning sciences, problem-solving and cognitive sciences. He is best known with CLT which focuses on how cognitive process affect learning and instructional design.

2.2 Types of Cognitive Load

There are three types of cognitive load, that may affect learning which are extraneous, intrinsic, and germane (Leppink et al., 2013). Based on cognitive load theory, learners deal with three types of cognitive load (Ortu & Longo, 2019). Sweller (1998) mentioned the degree of complexity as 'element interactivity'. Intrinsic load is the basic difficulty of what people trying to learn it depends on task complexity and how much people already know. Extraneous load is mainly about extra mental work

caused by how the information is presented. In other words, if the teaching method is complicated it makes the learning process harder to comprehend. Germane load is the mental work that helps people to learn and remember (Leppink et al., 2013). IL is a factor related to task diversity and task complexity. It depends on the learner's background knowledge or experiences. When the task becomes more difficult, learners need more information and higher IL is required (Choi & Lee, 2022). EL is related to inappropriate instructional design and procedures that increase the mental effort on learner's working memory. If an instructional design is appropriate, then EL becomes minimized (Choi & Lee, 2022). When the EL is low and IL is optimal, learners are more engaged in the task, and they feel more comfortable with the learning environment. In addition to IL and EL, there is one more cognitive load type which is GL. GL happens when a learner faces a mental effort to transfer knowledge from working memory to long-term memory. It occurs when the new knowledge is integrated by the preexisting knowledge (Choi & Lee, 2022). Orru and Longo (2019) mentioned that the purpose of cognitive load is to reduce unnecessary burden and the improvement of germane load. Germane load is connected to learning and it enhances schema construction (Orru & Longo, 2019).

A research study from Leppink (2014) focused on the results of different types of cognitive load in terms of task performance in educational settings. They used two-way subject analysis of variance (ANOVA) to focus on the effects of instructional conditions on post-test performance. The outcome of the study implies that all participants completed the post-test questions during the allocated time, with high Cronbach's alpha and p-value items showing a precise measurement of performance. Study 1 compared two different questionnaires to evaluate the cognitive load for language and static purposes. The researchers focused on different types of cognitive loads and their correlation with exam performance in statistics. Study 2 investigated task performance, problems, and examples. This was a randomized experiment, and the participants were first-year bachelor's students. They studied Bayes' theorem under various conditions. This study aimed to explore the effect of instructional conditions on post-test performance according to Bayes' theorem. The results of the first study emphasize the importance of cognitive load factors in educational settings and focus on the potential of psychometric instruments to evaluate and differentiate between intrinsic, extraneous, and germane cognitive loads in various learning

environments. The second study provided valuable insights into the impact of task choice on learning results and cognitive load. They emphasized the need for further research on the complexity of cognitive load implications for learning and instruction (Leppink et al., 2014).

To sum up, this part gives brief information about types of cognitive load. Research about this field supports the idea of three types of cognitive load and their impact on learning. Studies about cognitive load provide valuable insights into how cognitive load influences learning, instructional design, and task performance. For example, Leppink (2014) highlight that reducing extraneous load and increasing germane load facilitates learning. All things considered, these findings emphasize the need for educators to be aware of CL and apply them efficiently to instructional design.

2.3 Measuring Cognitive Load

According to the cognitive load theory, the cognitive load on working memory can be measured by indirect methods. The key components needed to measure cognitive load, mental effort and performance (Paas & Van Merriënboer, 1994). Paas (1994) created a single-item measure that has been extensively used and expanded to evaluate various forms of cognitive load (Ayres, as cited in Andersen & Makransky, 2021). The cognitive load scale developed by Paas and Van Merriënboer (1994) is a scale that can measure the mental effort of the participants with a value between 1 to 9. From the perspective of Paas and Van Merriënboer (1994), various complex cognitive tasks might be responsible for high mental load and high mental effort. For measuring effort identified indices (rating scale) and methods that use psychophysiological indices such as pupil diameter, heart-rate variability and event-related brain potentials (Paas & Van Merriënboer, 1994). Single-item scales have been criticized for several reasons, including being overly simplistic, which makes it hard for students to distinguish between insufficient education and the complexity of the subject matter (Kirschner et al., as cited in Andersen & Makransky, 2021). Measuring cognitive load help people figure out why some teaching methods work better than others and why people might work differently for different people (Leppink et al., 2013). Subjective rating scales like Paas (1994) consist of nine-point mental effort rating scales used intensively and identified as reliable and valid estimators of

cognitive load (Leppink et al., 2013). One tool that evaluates workload using five seven-point scales is NASA-TLX (Leppink et al., 2013). One of the most reliable self-report measures of intrinsic, extraneous, and germane burden is the cognitive load scale, which Leppink (2013) developed (Andersen & Makransky, 2021). To assess various forms of cognitive burden, Leppink et al. (2013) created a psychometric rating scale that ought to be able to differentiate between them in various educational settings. The scale which is developed by Leppink and his colleagues has 13 items to measure three types of cognitive load.

A research study investigating by Nizar, et al. (2023) determined the cognitive load and reading comprehension of Iraqi EFL preparatory students. Second, determining the relationship between reading comprehension and cognitive load in Iraqi EFL preparatory students (Nizar et al., 2023). In this study, a descriptive correlational analysis is being carried out. 345 pupils from Baghdad's AI-Karkh 2nd preparatory schools were chosen at random to make up the sample. Two instruments are utilized to meet the study's objectives which are a reading comprehension exam and a subjective cognitive load evaluation scale (Nizar et al., 2023). CL is measured in this study using a subjective scale. The scale was created and modified using Leppink's (2013) multiple-item scale, which was based on the original Paas (1992) scale. Participants answer eighteen questions. Likert scale questionnaire with nine items. The reading comprehension test is the second tool. Multiple-choice and short-answer questions are utilized in objective tests (Nizar et al., 2023). The results show that the pupil's reading comprehension and cognitive burden are both high. The results also show that while participants' germane load is positively connected with reading comprehension, their intrinsic and external cognitive loads are adversely connected. Students with a high level of these loads perform poorly on reading comprehension tasks, resulting in a low level of reading comprehension (Nizar et al., 2023). Nizar et al. (2023) the instrument coefficients are 0.77 and 0.70, which indicate reasonable reliability.

Another experimental study looked at the validity of a rating system for measuring cognitive load in science teacher education (Timothy et al., 2023). To evaluate three types of CL in a new teaching environment, 81 undergraduates registered in scientific program were placed random to one of three groups: solving problems, example-based, and control. They assessed cognitive stress with a modified

version of a rating scale adopted from Leppink (2014). The updated version of the rating scale included 13 items. Teachers answered the item using a 10-point Likert scale. Preservice teachers' diagnostic skills were assessed using an objective test with two portions. The first portion featured 32 multiple-choice questions. The second segment had 14 items that assessed procedural diagnostic knowledge. The findings revealed that Science teacher education program allows one to consistently measure the types of CL; moreover, instructional strategies that provide essential cognitive burden help preservice teachers build the diagnostic skills. The study identified systematic differences in cognitive burden between the three groups. The study demonstrated that the theoretical model underpinning the rating scale created by Leppink (2014) was valid in the setting of science teacher education. The scale was determined to be valid and dependable for assessing cognitive load in this learning environment (Timothy et al., 2023).

Overall, the study found that preservice teacher's cognitive load and diagnostic competence were positively impacted by the instructional designs employed in the training interventions (Timothy et al., 2023).

Rahimi and Sayyadi (2019) researched cognitive listening activities of a cognitive-based listening instruction of the EFL curriculum. The research was both quantitative and qualitative analysed by MANOVA and the scale in the study consisted of 10 items that measured three components of cognitive load including intrinsic load, extraneous load and germane load. The cognitive load of listening activities in the book was measured developed and validated by Leppink (2013). Participants were asked to fill the cognitive load after doing the listening activity in the classroom and evaluate the difficulty of the activity between 0-10. The results of the study highlight that the germane load of listening comprehension is high in comparison to the values of intrinsic load and extrinsic load. In addition to this, germane load was found related to familiarity with the learning topic (Leppink, as cited in Rahimi & Sayyadi, 2019). Male and female participants were found to be high in germane load thus, no crucial difference was observed among the genders of the participants (Rahimi & Sayyadi, 2019). Rahimi and Sayyadi (2019) the scale and its three components were found to have reliability coefficients (Cronbach's alpha values) of .73, .80, .75, and .82.

A study done by Al-Sarry et al. (2022) aims to examine the relationship between cognitive load and academic achievement in terms of the amount of cognitive load

students perceive which are study mathematics. There were 200 participants male and female, and all students were in the same field which is mathematics. Researchers used a scale to measure cognitive load. The scale consisted of 21 items with three dimensions which are intrinsic load, extraneous load, and germane load. In this research, the researcher used various instruments to measure cognitive load such as a cognitive load scale, academic achievement test, and statistical analysis tool. The research highlights that cognitive load is an important factor in terms of academic performance. Providing an educational setting where teachers try to minimize pressure and provide psychological stability can help reduce cognitive load. As an educator, we should be aware of cognitive load principles and design lessons in terms of this (Al-Sarry et al., 2022). Al-Sarry et al. (2022) employed the alpha Cronbach technique to calculate the scale's stability, and the overall stability coefficient was (0.8308), indicating that the scale is quite stable.

In a study done by Yang (2014), the participant's cognitive styles were examined using a learning styles questionnaire developed by Felder and Solomon (1997). The study was conducted in China and the participants were 103 students 18 males and 85 females in total their overall age was about 20. The questionnaire consists of 44 multiple-choice questions. Based on the participants' ratings, participants were categorized into one of three cognitive learning types which are type a: high-level visual learner, type b: mid-level visual learner and type c: low-level visual learner. Participants who rated 5 or above on the visual scale were categorized as high-level visual learners, participants who rated 3 on the visual scale were categorized as mid-level learners and participants who rated 1 on the visual scale were categorized as low-level visual learners. It was an experimental study both a control and experimental group. The participants in the control group experienced audio content (single code) other group experienced audio-visual content (dual code). Both groups listened to audio recordings, but the experimental group saw video clips. In the end, students in both groups measure cognitive load by a cognitive load measurement questionnaire. The questionnaire consisted of 8 items. 1 represents the lowest level and 7 represents the highest level in terms of difficulty. Participants in dual code who experienced audiovisual content outperformed compared to single code who experienced audio content only. As research provides, dual code enhances listening comprehension (Yang, 2014). Single code groups showed more mental effort and felt that listening

was more difficult compared to other groups in the research. All things considered, the study highlights the importance of dual coding regardless of participants' English level or their cognitive style. Providing verbal and visual information facilitates learning outcomes (Yang, 2014). Wang and Tragat (2019) believe that the use of written text like subtitles, and scripts alongside audio enhance the learning process.

This section gives brief information about cognitive load scale, measurement and various studies related to this field. CLT suggests that mental effort can be assessed using indirect methods such as subjective rating scales. The scale developed by Leppink and his colleagues (2013) to used to measure mental effort focusing on the level of cognitive load experienced by students during tasks. The scale developed by Leppink (2013) is a reliable and valid tool for perceiving mental effort in educational settings.

To sum up, these studies showed that cognitive load measurement is crucial for understanding how different instructional materials influence learning. All studies mentioned above focus on CLS and are conducted in different educational environments. For example, Nizar et al. (2023) focused on reading comprehension and CL, Timothy et al. (2023) focused on science teacher education, Rahimi and Sayyadi (2019) focused on listening activities, and Al-Sarry (2022) examined the relationship between mathematics and CL. The research highlights the importance of using multiple forms and effective instructional designs to enhance the learning process.

2.4 Listening Comprehension and Cognitive Load

Listening is an integral aspect of everyday communication in every language. It plays a crucial role in professional, educational and personal situations (Nemtchinova, 2013). Wang and Tragant, (2019) believe that listening is a fundamental language skill it points out how people receive, participate and allocate meaning to the aural stimuli. Listening comprehension is a fundamental skill for the listener to receive information or keywords and understand specific meanings (O'Malley et al., as cited in Al-Ghazo, 2023).

A study done by Chang et al. (2011) experimental study focused on the effect of media presentation mode (sound and text vs sound) on English listening comprehension and cognitive load. The study included 162 students aged between 18-

23 from a university in Taiwan. Students were given a single mode at random (82 participants) which is only sound and double mode (80 participants) which is sound and text. Media presentation modes single mode, which only includes sound, and double mode, which includes both sound and text were the study's independent variables. Cognitive load and listening comprehension were dependent variables. Researchers provided a listening test for the participants the test consisted of 20 multiple-choice questions and the cognitive load rating scale by Yeung et al. (2000) was adopted. The scale consists of four aspects which are difficulty level, incompetence, negative influence, and lack of effort (Yeung et al., as cited in Chang et al., 2011). The findings highlight that a text improved English listening comprehension while reducing cognitive burden. In the study, redundancy did not exist, but the modality effect did. There was a crucial difference between the two groups. The single-mode group had a higher cognitive load compared to the double-mode group. Participants in the double mode group outperformed both in listening comprehension and cognitive load. Learners in double mode have a lower cognitive load than the single mode. Listening comprehension is not easy for EFL learners because it is a continuous process and it requires learners to comprehend messages while listening to them which sometimes leads students to heavy cognitive load (Chang et al., 2011). According to the working memory model suggested by Baddeley (2000) working memory can get information from different channels auditory and visual (Baddeley, as cited in Chang et al., 2011). From the perspective of Chang et al. (2011) providing teacher materials with the support of multimedia (text, video, sound) In other words, providing a double mode enhances learning motivation and helps support of multimedia increase students motivation (Chang et al., 2011). The study suggested that text can enhance student's listening comprehension and lower students' cognitive load (Chang et al., 2011). Othman and Vanathas (2017) study the effects of subject familiarity on listening comprehension. Othman and Vanathas (2017) believe that listening plays an important role in the acquisition of a second language. From the perspective of Vandergrift, learners build necessary knowledge by listening. Listening gives important input for learners to learn the language to practice the language (Vandergrift, as cited in Othman & Vanathas, 2017). This study determines the problems that participants encounter when listening to a text. In addition to this, this study investigates if listening comprehension could be improved by bringing the

fundamental background information. Othman and Vanathas (2017) implied that listeners use both bottom-up and top-down processes to understand a text. Moreover, recognizing the context of a listening text reduces the burden of accuracy on the participants (Vandergrift, as cited in Othman & Vanathas, 2017). Othman and Vanathas (2017) are interested in figuring out how familiarity affects a listener's language output. The participants were 34 aged between 18 and 21 intermediate level English proficiency students from business and information technology in Malaysia. This study aimed to examine the influence of topic familiarity on listening comprehension a listening part in which participants are not familiar with the content. The listening passage was taken from a book. Students will focus on the listening passage and then answer 14 questions consisting of multiple-choice, true-false, and open-ended questions related to listening. The study studied pretests and posttests to determine their impact on subject familiarity and listening comprehension. Results of the study indicated that if the topic is familiar with the content, participants understand better the content. Familiarity with the topic enables students to identify the facts and details and recognize the main ideas. When you provide information with the students with background information and systematic knowledge it enhances comprehension of an unfamiliar topic (Andersen & Lynch, as cited in Othman & Vanathas, 2017). Othman and Vanathas (2017) point out that if learners are interested and listen with a purpose and relate to their environment and experience learners will be more motivated to listen and will be paying attention to listen. Students tend to tune out of the listening tracks that are overly long or boring to them (Nemtchinova, 2013). As a teacher, we should do more than just provide students with linguistic knowledge, new knowledge that is learned should be put into practice. In addition to this, we should provide opportunities for learners to communicate language in a meaningful context in the classroom environment (Othman & Vanathas, 2017). These findings highlight the importance of topic familiarity and guide teachers, curriculum planners, and textbooks to choose effective teaching and listening activities, and materials to provide learners (Othman & Vanathas, 2017).

To sum up, studies such as Chang et al. (2011) emphasize that using dual modes improves English listening comprehension and reduces CL compared to single mode. In addition to this, studies show that instructional conditions, media

presentations and material design affect cognitive load and learning. Othman and Vanathas (2017) highlight the role of topic familiarity and emphasize that students who are familiar with the topic better when identify the main ideas and details. It improves listening comprehension and topic familiarity is important in listening comprehension.

2.5 Listening, Cognitive Load among EFL Learners

Listening is the first ability that EFL students acquire in their mother tongue. (Berne, as cited in Al-Ghazo, 2023). A study done by Moussa-Inaty et al. (2012), highlights the effect of redundancy on participants learning English as a foreign language age exploring different groups of students asked to read and listen similar information. When students learn a foreign language, like other learning domains students face a heavy cognitive load (Moussa-Inaty et al., 2012). There were 3 experiments in this study. There were two groups in the study a read-only group and a read and listen group. The first group the only group received the materials only followed by the listening test and the read + listen group received the same material and simultaneously listened to the test. The participants were Arabic 38 students (27 men and 11 women) aged between 18 and 23 in undergraduate EFL language schools at the University in Balamand, northern Lebanon. They had some learning experiences in their background. Each group was allocated at random, and there were 19 people in the class. The first experiment consisted of acquisition and testing which is about six activities and two listening tests. Every student was assessed simultaneously, and the experiment was carried out in different rooms for each group. The first group (read-only) presented only written tasks, and the second group (read + listen) presented written and auditory tasks. The first group performed better comparing the second group in terms of listening tasks. Learning a second language is a difficult process containing interactions among two languages also various key literacy skills (Moussa-Inaty et al., 2012). The purpose of experiment 2 was to assess literacy abilities. The experiments consist of acquisition and testing. Experiment 1 consists of 3 essential skills which are reading, writing and listening. In two listening tasks both groups (read

only and read + listen) were required to listen and write down in English. That is why the first group (read-only) outperformed the other group. Experiment 2 focuses on determining which literacy abilities are improved in read-only versus other group. Participants were 40 students (31 men and 9 women) aged between 17 to 22. The experiment consists of acquisition and testing. For listening, students listened to English passages and responded to questions in their native language which is Arabic. Self-rating measured cognitive load which is extremely useful in the research to provide supporting evidence of CL effects (Paas & Van Merriënboer, as cited in Moussa-Inaty et al., 2012). To measure CL during the acquisition, two variations of subjective instruments were used. Participants were circled one number from 1 to 7 and described the task difficulty level. It was a 7-point scale range between 1 to 7. 1 represents easy and 7 represents difficulty level. For the second experiment, additional listening experience did not translate into better listening results. The results highlight that visual materials facilitate learning more than providing them with auditory material. Experiment 3, contributed to comprehending how different instructional methods affect listening skill development and influence the advantages of focusing on a single mode. The results show that reading alone is more effective for developing listening skills than reading + listening. Overall, the results of the study highlight that the only group outperformed and the study indicates the importance of cognitive load when designing instructional strategies for language learning (Moussa-Inaty et al., 2012).

A study done by Kanokpermpoon (2019) investigated the relationship between instructional materials and retention and recognition among EFL learners. In other words, the design and effectiveness of instructional materials and how these instructional materials facilitate information retention and recognition. Facilitate the understanding of how instructional materials support EFL participants' cognitive process. The research was mixed method combining both quantitative and qualitative data. Participants were 79 undergraduate students aged between 17 to 20 divided into two groups which are experimental and control groups. The experimental group consisted of 41 participants and assigned cognitive load variables, and the control group consisted of 38 participants hindering cognitive load variables. Instruments included listening-reading text about business innovation, numerous question formats, subjective ratings and interviews to see the relationship between cognitive load and

information retention among participants. Results of the study, the experimental group retained information from the listening text better than the control group. The research highlights the relationship between testing and recognition, especially short-term and long-term retention. The results of working memory after recognition highlight that there was a crucial difference between recognizing reading information and working memory reading tasks. Moreover, the participant's cognitive demand on working memory was boosted after the recognition phase because of a low average score on the test (Kanokpermpoon, 2019).

This section gives research studies about EFL learners and cognitive load. Moussa Inaty, Ayres, and Sweller (2012) highlight that reading alone is more effective than combining reading and listening for improving listening skills, because of cognitive load. The research highlights that focusing on a single mode may facilitate learning outcomes and reduce cognitive load. According to Kanokpermpoon (2019), well-designed materials improve EFL learners' retention and recognition. These studies show that appropriate cognitive load management is important for facilitating listening comprehension and language learning.

2.6 Stages of Listening

Listening consists of three stages (Movva et al., 2022). Pre-listening, while listening, and post-listening. Each listening has a set of objectives and activities to complete (Movva et al., 2022). In the listening stage, students get ready for the listening and try to understand the listening. Pre listening stage is critical and is the step before while listening stage (Field, 2008). In while listening stage, the main aim is to improve students' listening skills and understanding of listening, the teacher gives students to complete while students listen to audio (Movva et al., 2022). Students in while listening stage, listen for the meaning. They can listen to the audio more than once and each time they focus on purpose (Al Bloushi, 2024). While they are listening, students don't need to catch or know every single word in the listening audio, they should listen to understand for a specific purpose (Al Bloushi, 2024). In while listening stage, learners should engage in the listening material and enhance their listening skills. During this stage, several activities can be used in the classroom environment such as listening for specific information, gap-fill exercises, true-false statements and so on

(Field, 2008). This kind of activity helps students to enhance their engagement and comprehension of the listening material. Extensive listening is mainly about a general understanding of the context. In other words, students listen to the audio for a general understanding of the attitudes of the speakers in the audio. This can help students to familiarize themselves with the audio and they can understand the overall message of the material (Field, 2008). Intensive listening is mainly about detailed listening. In other words, after listening audio, students were more engaged and focused more on the audio. This helps students to focus on specific details and improves students' comprehension skills (Field, 2008). Overall, this stage is crucial for learners to develop, understand, and practice their listening skills (Field, 2008). In post listening stage, students work on exercises and broaden the topic and listening text (Movva et al., 2022).

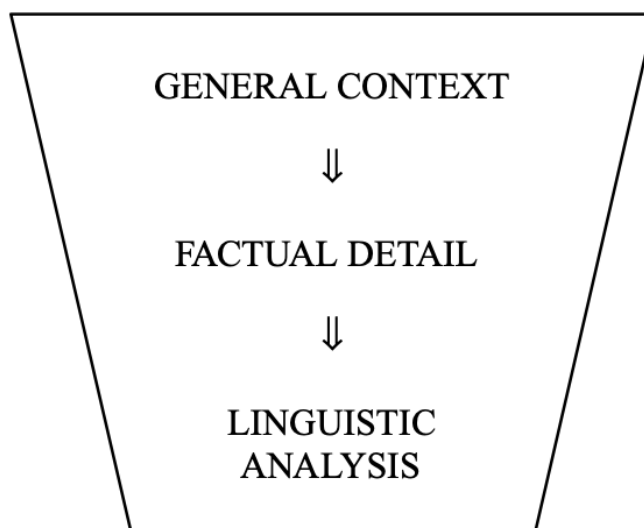


Figure 1. Narrowing in background (Field, 2008).

This figure highlights the structure of a listening lesson, and numerous stages involved in the listening process. It emphasizes the cyclical nature of the stages. Each stage is related to the other one and it builds on the previous stage it facilitates students' comprehension and engagement with listening material. The lesson begins with a broad, focus on general concepts, then specific details. This approach aims to facilitate listening skills by showing students through a logical sequence. Nevertheless, critics argue that this sequence can limit student engagement in the activity and may not meet

students' different needs. It should need adaptation and meet learner needs (Field, 2008).

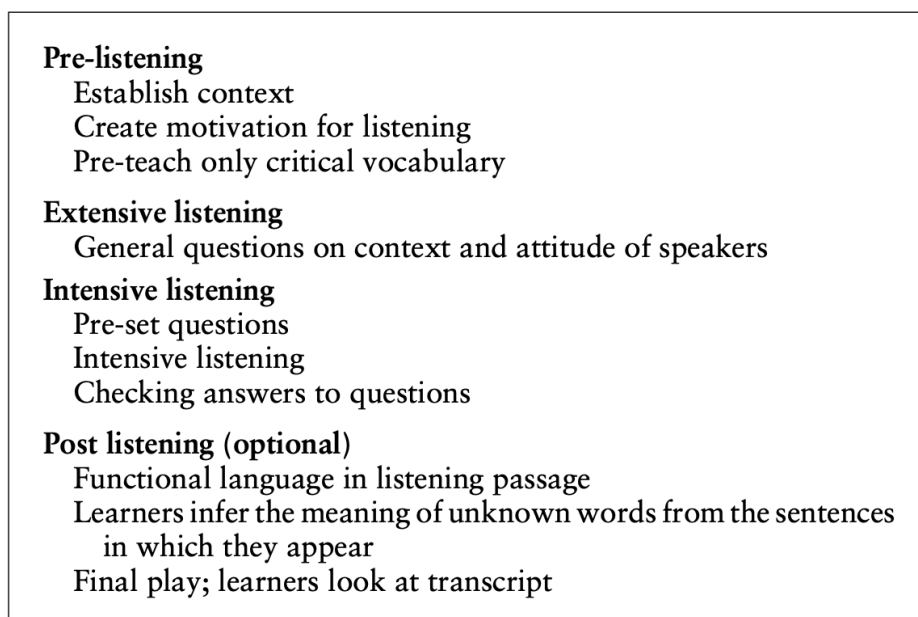


Figure 2. Current format for a listening lesson (Field, 2008).

This figure highlights the ‘‘current format for a listening lesson’’ (Field, 2008). It is detailed and shows phases in the listening lesson. It involves activities for each stage such as in pre listening stage focusing on establishing context and in the extensive listening stage general questions. This format highlights teaching listening skills with meaningful and effective. Students engage with this format. Overall, figure 2 provides a format of the detailed listening lesson, figure 1 represents the cognitive process of narrowing focus during the listening lesson (Field, 2008).

This section provides brief information about the stages of listening. Pre-listening, while listening, and post-listening are the three phases of the listening lesson. While listening is crucial for students. Figure 1 represents the cyclical structure of the listening lesson. Each stage builds upon the previous stage (Field, 2008). Figure 2 shows specific activities for each stage and provides a more specific format for a listening lesson.

2.7 Research Studies About Note-taking among EFL Learners

Note-taking is one of the important techniques for students because it provides a recording vehicle for learners to use their notes later (Siegel, as cited in Al-Ghazo, 2023). Students listen and note necessary information keywords (Atli, 2019). Note-taking occurs in everyday life situations such as planning future activities, preparing a talk, make purchases (Piolat et al., 2005). Comparative statistics demonstrate that taking notes requires more work than reading or learning (Piolat et al., 2005). Research by Sun (2023) investigates numerous aspects related to note-taking practices, challenges, and effective strategies among Chinese EFL students. The research focuses on the correlation among note-taking habits, challenges and techniques used by these participants. Participants were 363 undergraduate students at a university in China and majoring in English. In addition to this, the participants had been studying English for more than 10 years. Sun (2023) used a questionnaire supplemented by random observations in a college setting. The questionnaire consists of four sections which are background information, note-taking habits, challenges encountered in taking notes and strategies for facing these challenges. The researcher collected data by using SPSS quantitative data. In the study main obstacle clarified by students was recalling information from memory without any notes. Participants had a difficult time when they recall information. It highlights the importance of effective note-taking skills. The findings of the study show that necessary strategies to enhance note-taking skills. Participants in the study realized that taking too many notes or trying to write each word does not help them understand the listening material. Chinese students discovered the significance of personal symbols while listening. Participants generally developed a good organization method for taking notes during the listening. In addition to this, using horizontal and vertical formats while note-taking enhances the quality of listening (Sun, 2023).

A research study investigating by Al-Ghazo (2023) investigates the effect of the note-taking strategy on EFL students' listening comprehension skills (Al-Ghazo, 2023). This study was conducted with 80 participants 24 females and 20 males for the experimental group and 18 females and 22 males for the control group. All participants were in the same department which is English language and literature and their ages among 19 to 23. Participants in the experimental group used a note-taking method and received certain therapies with it, whereas participants in the control group received no experience or therapy with the note-taking technique. Instruments in this study were

listening to comprehension tests taken from the TOEFL textbook and standardized tests. It consists of 50 multiple choice questions and the duration was 60-70 minutes. The researcher used a test with both groups in pretest and post-test. There is a crucial difference among the listening comprehension means group in terms of listening post-test. As the analysis states the note-taking strategy affects participants positively and effectively. The t-test for a collection of experiments gives a difference between males and females. In terms of gender, females result outperformed comparing to males in the study. As a result, this strategy builds on meaningful listening comprehension and facilitates mental and cognitive structure related to the topic they listened to. This study suggests that EFL learners particularly female EFL learners in this study use the note-taking strategy efficiently. This strategy affects learners' listening performance positively. Based on this study, EFL teachers can provide different types of note-taking strategies as part of their lessons to help learners (Al-Ghazo, 2023).

A study done by Ipek (2018) investigates listening and note-taking skills and perceptions of students before and after listening and note-taking courses. The content of the course includes training about identifying main ideas, using abbreviations, leaving spaces, and any other strategies according to note-taking. The participants were in the English language teaching department. They were 1st year students, and the total number was 61. All participants were volunteered. The researcher was conducting research by using a questionnaire. The questionnaire consists of 8 items in total, and it was a self-evaluation checklist. For each item, there were 3 good options, needs improvement, and bad. Moreover, to support quantitative data, the researcher used open-ended questions as well. Participants were asked to share their experiences about what they have learned during listening note-taking courses. Most of the students were good in terms of organizing the main ideas and details. Nevertheless, some of the students felt inadequate in terms of organizing the main ideas. Most of the students shared positive perceptions of the course training and note-taking abilities. Some students mentioned further development in writing keywords and paraphrasing. Overall, the findings highlight the importance of note-taking instruction in facilitating academic performance. The study focuses on listening and note-taking training for second-language learners. The researcher highlights the importance of providing EFL learners with training in note-taking and listening is vital (İpek, 2018).

Balaban and Camlibel-Acar (2016) investigated two while listening techniques. The participants were 82 EFL learners (36 males and 48 females) aged between 18-20 who studied different fields in preparatory classes at a state university in Turkey. They were randomly separated into two groups which are shadowing and note-taking groups. Data for this study analysed exams and students' opinions both qualitative and quantitative. The researcher used SPSS and generated results through this program. According to pre and post-test results, there were significant differences among the shadowing compared to other groups in terms of listening comprehension. The results highlight that the shadowing technique improved students' listening comprehension and was more effective compared to other techniques. As a result, both shadowing and note-taking are beneficial while listening techniques, however, the shadowing technique is more essential and recommended for teachers to use in their lessons to improve students' listening comprehension (Balaban & Camlibel-Acar, 2016).

Research by Sadeghi and Zeinali (2015) examined the effects of two factors on listening test performance multiple-choice items in terms of oral vs. written and the note-taking allowance during the listening test. The major focus is to determine whether these factors affect the participant's listening performance. The main aim of this study is to evaluate the ability of upper-intermediate EFL students to comprehend spoken language in an academic environment. This study was conducted in Iran. Participants in the study were 66 students with upper intermediate level 31 males and 35 females ages between 18 to 25. They had been studying English for almost three years, and they enrolled in English courses at Shukuh Iran language school. In this study, two different tests were used to evaluate the participant's listening performance. The first test consists of 20 multiple-choice questions and focuses on item modality (written vs oral). This test is designed to investigate the effect of item modality (written vs. oral) talks that were randomly selected from a pool of TOEFL tests. The second test consists of 20 multiple-choice questions and the effects of note-taking. The test aimed to examine the effect of note-taking on listening comprehension. It comprises two extended conversations, three speeches, and four multiple-choice questions. The test was selected from the same source as the first test. In the test, one set of participants may take notes while listening, while the other group was not permitted to. Each test duration is almost 20 to 25 minutes. The data collected from the test and analysed independent samples t-test analysed the performance of the participants in terms of

different conditions (written vs oral and note-taking vs no note-taking). There was a significant difference in terms of listening test performance based on item modality (oral versus written). Participants in the written format outperformed those in the oral format. This suggests that the written format provides psychological advantages and makes participants feel more secure. Improving the listening ability of EFL learners is a crucial task for language teachers, course administrators and test designers as well as students themselves (Sadeghi & Zeinali, 2015). Taking these into account, the research findings provide theoretical and practical implications for language teachers, course administrators, curriculum designers, and test developers. EFL teachers may increase students' note-taking by considering the focus on certain skills in terms of note-taking such as identifying main ideas (Sadeghi & Zeinali, 2015).

A research study by Ahour and Bargool (2015) determines the impact of these two different kinds of listening strategies on participants' listening comprehension and compares their effectiveness. The goal of the study is to determine if taking notes while listening and writing summaries afterwards have significantly different effects on students' listening comprehension skills. This study consists of pretest and post-test and research called quasi-experimental research. Independent variables are note-taking and summary writing, and the dependent variables are listening to comprehension. Participants were 60 students from two advanced-level classes and a study conducted in Azerbaijan and Iran. They ranged in age from 18 to 25 and were both male and female university students pursuing various fields of study. Students were divided into note-taking and summary writing classes at random. Each class consist of 30 students in total. The study's instruments included listening to a comprehension exam consisting of 15 multiple-choice questions from Barron's IBT TOEFL book. Participants studied for main skills which are listening, speaking, reading, and writing but the focus of this study is to evaluate the listening part which was about 20 minutes. The findings of this study revealed that listening improved the listening comprehension skills of Iranian EFL participants. Nevertheless, the independent samples t-test shows that there was no crucial difference in the post-test results among the two groups. It implies that both strategies were equally helpful in terms of improving listening comprehension skills despite the different treatments applied for each class. This research helps enlighten the importance of teaching essential listening

strategies supporting teachers to focus on how learners can learn to process and gain information better while listening activities (Ahour & Bargool, 2015).

All the studies about numerous research studies mentioned above focus on investigating the impact of note-taking on listening comprehension. Studies discuss different approaches to listening instruction and note-taking. For example, Sun (2023) investigates note-taking practices, challenges, and strategies among Chinese EFL learners. Results show that taking too many notes does not help students in terms of listening comprehension. Instead of taking too many notes, using personal symbols improves note-taking better. Al Ghazo (2023) explored the effect of note-taking on EFL student's listening skills. The findings demonstrate that taking notes enhances listening comprehension. Balaban and Camlibel-Acar (2016) compared two listening techniques which are shadowing and note-taking. The study found that shadowing was more effective in facilitating listening comprehension. Sadeghi and Zeinali (2015) investigated listening performance in terms of written and oral tests and note-taking allowance. The results highlight that written tests provide psychological benefits and note-taking positively affects listening comprehension. Ahour and Bargool (2015) in their research contrasted note-taking while listening with summary writing after hearing. Two methods enhance listening comprehension, and results show that no significant difference was found among the two strategies. Overall, these findings highlight that numerous strategies can enhance listening comprehension such as note-taking techniques, and the format of listening tasks.

2.8 Research Studies about While Listening

While listening is the stage where the actual listening occurs (Atl1, 2019). This stage is a sub-divided stage consisting of extensive and intensive listening based on the demands of the activities (Field, as cited in Atl1, 2019). Extensive listening is mainly about the main idea or gist. Intensive listening is mainly about details. For extensive listening students can decide on the topic of the listening task and for intensive listening students deal with true-false, comprehension questions (Atl1, 2019). Listening is a complex cognitive skill that plays a crucial role in language acquisition, and language development. Listening as a skill one of the main four language skills and common language skills used in daily life and communication (Flor & Juan, as

cited in Rahimi & Sayidi, 2019). Various scholars believe that listening is important for second language learners (Nunan et al., as cited in Hartshorn & Stephens, 2023). Nevertheless, people do not receive enough care or attention to listening compared to other language skills such as reading, writing, or speaking (Vandergrift et al., as cited in Hartshorn & Stephens, 2023).

Sohler (2020) researched reading transcripts while listening. The researcher investigates the benefits of reading a text while listening and its effects on participants. The participants were 18 intermediate-level international students at Brigham Young University ages ranged between 18-40. Listening tasks were taken from the coursebook, and the topics were mainly about common issues they see and talk about in daily life such as environment or technology. One group included reading and listening together other group only listened. The test was a CAPE test, and it consisted of multiple-choice questions. The results were analyzed by using Jamovi which provides statistical analysis. Participants for 14 weeks showed improvements in both listening activities. Statistical analysis showed no crucial difference between the two groups. In other words, the treatment group which received the reading while listening strategy and the control group which utilized listening only showed progress (Sohler, 2020).

This section gives brief information about while listening and highlights the importance of this stage. Listening plays an essential role. For example, Sohler (2020) examined the benefits of reading while listening and found no significant difference in listening comprehension among participants who read transcripts while listening and those who listened without reading.

2.9 Cognitive Load Studies Conducted in Turkey

Odacı and Uzun (2024) investigated attitudes and their cognitive burden for the revised exam utilizing the multimedia component one of the ideas of message design. In this sense, this study applied a qualitative and quantitative research approach. There were 32 participants. Mersin university foreign language school provided the questions that would be part of the English knowledge exam, which was to be administered in a computer-based setting. This study employed a cognitive load

scale. The school of foreign languages question pool was used to choose the English knowledge test. In total, there were nine reading passages, and the reading sections were set up so that two of them had both text and videos, while the other two solely contained text listening materials. The study's findings demonstrated how participant views regarding the computer-based setting were influenced by elements such as students' advantages in terms of equipment, time, success, flexibility, and reduced cognitive load. There were notable discrepancies between the participants' cognitive load scale scores and the exam's duration. The participants' cognitive load score on the listening test showed a low and positive connection, whereas their correct answer scores showed a low and negative association (Odacı & Uzun, 2024).

Research by Karalık and Merç (2025) attempted to develop a comprehensive model of L2 listening that includes both linguistic and cognitive variables. This study was conducted at two state Turkish preparatory schools. Out of the 212 Turkish university students, 95 were men and 117 were female. They were taking English language classes and ranged in age from 18 to 21. Students' levels of English ability varied from intermediate to upper intermediate. Students' listening comprehension was evaluated using a researcher-designed exam rather than a standardized one due to proficiency limitations. The sections were taken from coursebooks designed for students with varying skill levels. True-false, matching, and multiple-choice questions were included with the sections. Test of vocabulary level. Students were asked to match definitions and grammatical test for each item. The foreign language listening anxiety scale was used to quantify listening anxiety. The findings of this study highlighted important implications for L2 classes. Taking advantage of every chance to increase an individual's grasp of grammar and vocabulary to enhance listening comprehension. Selecting appropriate materials will benefit students in several ways, including enabling them to successfully employ cognitive resources to improve their cognitive representations of the listening exam (Karaklık & Merç, 2025).

Karabıyık, Arslan, and Kavaklı (2022) examined L2 based presumptions of the cognitive load theory and the cognitive theory of multimedia learning. This study employed a quasi-experimental approach with non-equivalent groups. The content of the inputs was the same, but the delivery formats were different. Listening item, listening item + video, listening item + text, and video + listening item + text. In total 139 pre-service English teachers participated, including 44 females and 95 males.

They all had at least an upper-intermediate English level and were native Turkish speakers. The materials were developed by National Geographic. Two cognitive load measurements for perceived cognitive effort and task complexity. Participants were asked to assess their cognitive effort during the learning process, as well as the difficulty of the activity. When learning in a second language, the study found that individuals learn more well with visuals and spoken words (video + listening item) than with spoken words (listening item). This finding implies that multimodal presentations using video assisted audio were more effective than listening item only presentations at fostering second language acquisition. Participants found it easier to understand visual and spoken words than spoken words. Their cognitive load similarly reduced by pictures and spoken words. This finding implies that learning in L2 was less demanding when multimodal presentation in the form of video-assisted listening item was used as opposed to listening item only. The cognitive demand can be decreased via spoken words (Karabıyık, Arslan, & Kavaklı, 2022).

All three studies mentioned above focuses on relationship between cognitive load and learning performance. Research by Odacı and Uzun (2024), Karalık and Merç (2025), and Karabıyık, Arslan, and Kavaklı (2022) highlighted that well-designed materials combining video and audio can reduce cognitive load and facilitate listening comprehension. Selecting appropriate level and materials help learners to manage their cognitive load.

Chapter 3

Methodology

The design and methodology of the current study are presented in this chapter. The chapter consists of research design, setting and participants, data collection, data collection procedures, data analysis procedures, validity and reliability, and lastly, limitations.

3.1 Research Design

A mixed-method approach was utilized to investigate the while listening and note-taking activities and their impact on the cognitive load. This study uses a concurrent embedded model to examine the cognitive burden experienced by students while performing while listening and note-taking activities. The concurrent embedded strategy of mixed-method research may be defined by the utilization of a single data collection phase in which quantitative and qualitative data are collected (Creswell, 2009). There are several applications for the concurrent embedded model (Creswell, 2009). By employing a variety of approaches rather than just the most popular, this model enables researchers to obtain a wider range of viewpoints (Creswell, 2009). A researcher can gather both sorts of data simultaneously within a single data collecting period. It gives a study with the benefits of both quantitative and qualitative research (Creswell, 2009). Quantitative data were acquired using a questionnaire cognitive load measure created and verified by Leppink (2013). The scale has 13 items for measuring intrinsic, extraneous, and germane load (Leppink, 2013). SPSS used to conduct statistical analysis and analyse the results. Students used a 10-point Likert scale to rate the difficulty of each listening task and respond to each item. According to the normality test, the data is not normally distributed. For this reason, non-parametric tests were applied in this research. Mann-Whitney U test is a non-parametric variant of the t-test for independent samples. A non-parametric alternative for the one-way ANOVA is the Kruskal-Wallis H test (McKight & Najab, 2010). Structured interview questions were used to gather qualitative data from students who volunteered to take part in the study. The qualitative data interviews were conducted separately utilizing

video conferencing techniques and each meeting lasted between 5 to 10 minutes. The meetings have been recorded and then written down. Two different field specialists conducted a thematic analysis of the student's transcriptions to determine their reliability. A qualitative research technique called thematic analysis is used by academics to systematic arrange and examine large, complicated data sets (Dawadi, 2020). The interview transcripts were evaluated using thematic analysis. Reading and rereading the transcripts systematically is part of the constant comparison process known as thematic analysis (Cavendish, 2011). Theoretically, themes may be found, described, and interpreted in great depth within a data set using thematic analysis (Braun & Clarke, 2006).

3.2 Setting and Participants

The study was conducted at private university in Istanbul. The academic year is divided into five eight-week modules, and the curriculum provides four levels (A1-A2-B1-B2) as well as proficiency exam preparation (PREP-C). The curriculum involves intense hybrid education. Students come to school for 3 days and attend classes online for 2 days. The school use Microsoft Teams for online classes. Students must successfully finish each level before progressing to the next level. The target population of the study is young adult EFL students. The research included 62 preparatory school students. Participants were B1 and B2 level preparatory students in Istanbul, aged between 17 to 25. The study was conducted in 4 classrooms in prep school. It was a multicultural classroom. The participants had similar academic proficiency since they had all taken a proficiency exam at the very beginning of the year. Students took a placement exam on the first day of the term and enrolled in an appropriate grade level. Each classroom has one main English teacher and a writing teacher. In other words, there are 2 English instructors in each classroom. The main English teacher focuses on listening, reading, speaking, vocabulary, and so on and the other teacher (writing teacher) focuses on writing skills. The skills are called integrated and academic skills. Each instructor has 16 hours of integrated skills and 8 hours of academic skills. The English instructors who agreed to assist the researcher administrated the questionnaires to the students.

3.2.1 Gender. For while listening 62 students participated in the questionnaire, descriptive statistics reveal that 33 of them (53.2%) are male and the other 28 (45.2%) are female. For note-taking, 57 students participated in the questionnaire, descriptive statistics reveal that 30 of them (51.7%) are male and the other 26 (44.8%) are female.

3.2.2 Age of students. Results have shown that for while listening, 55 of the students (88.7%) are between 17 to 20 years old, and 7 students (11.3%) are between the ages of 21 to 24 years old. For note-taking, 50 of the students (86.2%) are between 17 to 20 years old, and 8 students (13.8%) are between the ages of 21 to 24 years old.

3.2.3 Nationality of students. The findings indicate that while listening, 45 Turkish students (72.6%), 10 Iranian (16.1%), 2 Turkmen (3.2%), 1 Syrian (1.6%), 1 Yemen (1.6%), 1 Palestine (1.6%), 1 Tajik (1.6%) and 1 other (1.6%) are participated in the study. For note-taking, 43 Turkish students (74.1%), 9 Iranian (15.5%), 2 Turkmen (3.4%), 1 Syrian (1.7%), 1 Yemen (1.7%), 1 Palestine (1.7%), 1 Burkina (1.7%) have participated in the study.

3.2.4 Level of proficiency. Results have shown that for while listening, there were 27 students (43.5%) B1 level and 35 students (56.5%) B2 level. For note-taking, 27 students (46.6%) are B1 level, and 31 students (53.4%) are B2 level.

3.2.5 The faculty they enrolled in. The findings show that for while listening, 21 students (33.9%) are enrolled faculty of engineering and natural sciences, 14 of them (22.6%) enrolled faculty of economics, administrative and social sciences, 7 of them (11.3%) enrolled faculty of health sciences, 6 of them (9.7%) enrolled faculty of communication, 5 of them (8.1%) enrolled faculty of architecture and design, 2 of them (3.2%) enrolled faculty of medicine, 2 of them (3.2%) enrolled faculty of dentistry, 2 of them (3.2%) enrolled faculty of pharmacy, 2 of them (3.2%) enrolled conservatory, 1 of them (1.6%) enrolled faculty of law. For note-taking, 18 students (31%) are enrolled faculty of engineering and natural sciences, 13 of them (22.4%) enrolled faculty of economics, administrative and social sciences, 8 of them (13.8%) enrolled faculty of health sciences, 6 of them (10.3%) enrolled faculty of communication, 5 of them (8.6%) enrolled architecture and design, 2 of them (3.4%)

enrolled conservatory, 2 of them (3.4%) enrolled faculty of medicine, 2 of them (3.4%) enrolled faculty of dentistry, 1 of them (1.7%) enrolled faculty of educational sciences, 1 of them (1.7%) enrolled faculty of law.

Table 1

Demographic Information of Students for While Listening

	Number
Gender	
Female	33
Male	28
Prefer not to say	1
Age	
17-20	55
21-24	7
Nationality	
Turkish	45
Iranian	10
Turkmen	2
Syrian	1
Yemen	1
Palestine	1
Tajik	1
Other	1
English Proficiency Level	
B1	27
B2	35
Faculty	
Faculty of Engineering and Natural Sciences	21
Faculty of Economics, Administrative and Social Sciences	14
Faculty of Health Sciences	7
Faculty of Communication	6

Table 1 (cont'd)

Faculty of Architecture and Design	5
Faculty of Medicine	2
Faculty of Dentistry	2
Faculty of Pharmacy	2
Conservatory	2
Faculty of Law	1

Table 2

Demographic Information of Students for Note-Taking

	Number
Gender	
Female	30
Male	26
Prefer not to say	1
Age	
17-20	50
21-24	8
Nationality	
Turkish	43
Iranian	9
Turkmen	2
Syrian	1
Yemen	1
Palestine	1
Burkina	1
English Proficiency Level	
B1	27
B2	31
Faculty	

Table 2 (cont'd)

Faculty of Engineering and Natural Sciences	18
Faculty of Economics, Administrative and Social Sciences	13
Faculty of Health Sciences	8
Faculty of Communication	6
Faculty of Architecture and Design	5
Conservatory	2
Faculty of Medicine	2
Faculty of Dentistry	2
Faculty of Educational Sciences	1
Faculty of Law	1

3.3 Data Collection

3.3.1 Data collection instruments. The study aims to investigate the while listening and note-taking activities and their impact on the cognitive load. To see the cognitive load and difficulty of the task, data were gathered via a questionnaire. The following instruments were utilized in the current study to obtain the relevant data. Cognitive Load Scale and While listening and Note-taking tasks. To collect quantitative data, use the CLS measure, and for qualitative data, used structured interviews. Data gathered in a classroom setting that is managed to reduce distractions. The cognitive burden of two listening tasks was assessed using a cognitive load scale. Quantitative data was obtained using a cognitive load scale created and verified by Leppink (2013). The scale includes 13 items for measuring intrinsic, extraneous, and germane load. The 13-item measure is based on a 10-point Likert scale, which ranges from 0 to 10. Respondents were asked to complete the CLS measure just after listening to each listening task and assess the difficulty of the activity. For each task, students listen and judge the difficulty of the task and evaluate. 0 represents strongly disagree and 10 represents strongly agree in CLS.

6 participants (4 female and 2 male) participated in structured interviews to provide additional context for the quantitative study's findings. During the interview,

the researcher asked 7 questions. The interview questions focused on the problems of listening activities and compared the difficulty of listening. The interview lasted about 5 minutes for each student and was recorded. The structured interview questions are also included as appendices.

3.3.1.1 While listening & note-taking task. Each listening task included 4 options only 1 option is correct. While listening task and Note-taking tasks were utilized in the present study to determine their performance, beliefs, and suggestions. For the B1 level, there were 7 questions for while listening task and 6 questions for note-taking. While listening task was prepared by level coordinators. The source of the task was the Language Leader Book. The content of the task was about personality types. Students heard three people talking about each other personalities. The duration of the audio was 2.16 minutes. For note-taking task, there were 6 questions and note-taking sheet. For the note-taking sheet, there were headings about the listening audio. Note-taking task was prepared by level coordinators. The source of the book was a blog website, and she adapted it from the website. The content of the task was about radio podcast about learning a new language. The note-taking task consisted of 3 parts. For the first part, students match the words to their meanings. Second part, students share their experiences and talk with their classmates. In the third part, they listen to podcasts, take notes, and then choose answers by using their notes. The duration of the audio was 3.55 minutes. For the B2 level, there were 5 questions for while listening task and 10 questions for note-taking. While listening task was prepared by level coordinators. The content of the task was about open sources. Students listened to an interview. The duration of the audio was 11 minutes. For the note-taking task, there were 10 questions. Note-taking task was prepared by level coordinators. The content of the task was about Joseph Stalin. The duration of the audio was 8 minutes. Preparatory schools use the Mentora English coursebook and level coordinators design the books. It is written specifically for preparatory school students who are young adults learning English for academic purposes. The coursebook covers a variety of subjects. The topics and content of the coursebook include academic, up-to-date issues, and real-life scenarios. (See Appendix A for the tasks.)

3.3.1.2 Questionnaire - cognitive load scale. The data-gathering tool asked demographic questions. The first component of the questionnaire requests participants to submit demographic information such as gender, age, nationality, English proficiency level, and the faculty they enrolled. The second part is about the cognitive load scale. The cognitive load rating scale developed by Leppink (2013) was used in the current study. There are 13 items in total to measure types of cognitive load IL, EL, and GL. The last two questions are open-ended and related to students' overall performance, suggesting improving while and note-taking tasks. The Likert scale ranges from 0 to 10. '0' indicates significant disagreement (strongly disagree) and '10' indicates strong agreement (strongly agree). The questionnaire was provided to participants via a Google Form link and was predicted to take 5 to 10 minutes to complete. (See Appendix B for the questionnaire.)

Table 3

Questionnaire Used in the Research

	N of Items
1. Demographic Questions	5
2. Cognitive Load Scale	13
3. Open-ended Questions	2

3.3.1.3 Structured interview. Structured interviews were the second data-collecting tool used to gather qualitative data from students. The interview is an essential data collection strategy that requires verbal communication among the researcher and the subject (Mathers et al., 2000). A structured interview was conducted with 6 volunteer students for this study. Questions were designed and prepared by the researcher to understand students' expectations, and beliefs, suggesting two different listening tasks. In addition to this, to investigate students' experience with two different listening tasks. There were 7 main questions about students' cognitive load perceived in two different listening tasks. Structured interviews allow the interviewer to ask each responder the same questions in the same format (Mathers et al., 2000). The interviews were estimated to take 5 to 10 minutes to complete. (See Appendix C for the Structured Interview Questions.)

3.3.2 Data collection procedures. A questionnaire was used to obtain quantitative data, and it was given to participants online using a Google Form link. Participants listen to each task and then evaluate the difficulty of the task by using CLS which is developed and validated by Leppink (2013). Before the questionnaire, participants received information on the research's goals and methods, as well as details about how their data would be handled and that their involvement in the study was entirely voluntary. Additionally, participants had the freedom to leave the research at any time. The questionnaire form was filled out by all participants, and the data were transferred to an Excel sheet for analysis. Quantitative data was analysed using SPSS. To collect qualitative data, open-ended questions were used to gather qualitative data from students who participated in the study. The interview was conducted via Microsoft Teams. Students who are volunteered to participate the study are contacted via email to schedule a convenient time for the interview. After each interview, the researcher review and transcribe the recording. The researcher included seven open-ended questions. Questions were designed by the researcher and investigate students' experiences during while listening and note-taking and investigate their beliefs and preferences related to while listening and note-taking in terms of difficulty and cognitive demand. Students provided answers for each listening task. The qualitative data interviews were conducted separately utilizing video conferencing techniques and each meeting lasted 5 minutes. The meetings have been recorded and then written down. The ethical conduct form (E-85646034-604.01-93588) was taken from the university reviewed in ethics committee meeting (October 31, 2024, no: 2024/09) and found ethically compliant. (See Appendix D for Ethical Conduct Form).

3.3.3 Data analysis procedures. This research study applies a mixed-method research design and utilizes to investigate the while listening and note-taking activities and their impact on cognitive load. One data collection phase where both quantitative and qualitative data are gathered simultaneously is known as the concurrent embedded model (Creswell, 2009). Qualitative data is integrated with quantitative data to offer additional context. It offers the benefit of combining quantitative and qualitative data to research. A researcher may get broader viewpoints via the use of different data. To collect quantitative data, cognitive load scale was used and analysed using the

Statistical Package for Social Sciences (SPSS). For the analysis of qualitative data, two different field specialists conducted a thematic analysis of student's transcriptions and evaluated. The study aims to investigate how different listening audios influence participants' cognitive load and the amount of mental effort during which they perceive listening. Open-ended questions demonstrated and examined. Firstly, initial codes were created using students' transcripts as a guide. Then, these codes were categorized which resulted in development of themes. Each rater analysed students provided answers for open-ended questions. Two experts in the field combine themes, categories, and codes identified similarities and evaluated results. Two experts in the field discussed what each represent and determine which themes more appropriate. Lastly, each rater come up with an agreement and provided similar ratings.

3.3.4 Validity and reliability. The CLS has been widely utilized in educational contexts, and various investigations have shown that the instruments are valid and reliable (Leppink, 2013; Hadie & Yusoff, 2016). This includes construct validity, which is examined using exploratory or confirmatory factor analysis, as well as item response theory (Leppink, 2013; Hadie & Yusoff, 2016). The reliability has also been studied, often using Cronbach's Alpha (1951) or comparable values, and the external validity has been examined by evaluating how the scales relate to learning outcomes (Andersen & Makransky, 2021). To ensure the scale's reliability, the Cronbach's Alpha coefficient was determined using SPSS. The scale was utilized to measure cognitive load for while listening to audio and note-taking audio. According to the analysis, for while listening good level of internal consistency and reliability with a 0.788 Cronbach's alpha score (shown in Table 4). For note-taking, the excellent level of internal consistency and reliability with a 0.882 Cronbach's alpha score (shown in Table 5). Scores indicate that items effectively measure cognitive load during listening tasks.

Table 4

Reliability Statistics for While listening

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.788	.786	13

Table 5

Reliability Statistics for Note-taking

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.882	.876	13

For structured interviews, two independent experts in the field analysed students' transcripts individually to facilitate the reliability of the structured interviews. Inter-rater reliability refers to the agreement of two or more individuals while evaluating subjects (Gisev, Bell, & Chen, 2013). This analysis provided different perspectives about the transcriptions and reduced individual bias. The experts, later met to discuss their interpretations about student transcriptions and decide on themes and codes.

3.4 Limitations

Because the study will only be conducted at private university in Istanbul, the findings might not be representative of the situation at other universities. Although there were students of different nationalities, it would be preferable to have more students. The findings might not apply to all age groups or skill levels. It focuses on a particular level of students which are B1 and B2 level students.

Chapter 4

Findings

This chapter of the research study describes the outcomes of the quantitative data analysis and the qualitative data findings concerning the research questions. Initially, the scale findings are given to answer the first, second, third, and fourth questions. The fifth research question is addressed by the analysis of open-ended questions, structured interviews, and qualitative analysis.

4.1 RQ1 Is There a Statistically Significant Difference in the Cognitive Load Experienced by B1 and B2 Level Students during While Listening Audio?

The first research question was provided for the investigation of differences in cognitive load experienced by different levels of students during while listening audio. There were 13 items in this section of the scale. The students provided their answers on a 10-point Likert scale. 0 represents strongly disagree and 10 represents strongly agree. The items in this section measure students' cognitive load for while listening to audio. The normality test was applied and seen that data was not normally distributed. When the data do not match the normality assumption, non-parametric tests are recommended instead of parametric tests such as t-test (Kwak & Kim, 2019). For this reason, the Mann-Whitney U test was used for this study. Mann-Whitney U test is used for comparing two independent groups and if only normality criteria are not met (Kwak & Kim, 2019). The p-value for the Shapiro-Wilk test was 0.012 which is less than 0.05. This highlights that the data is not normally distributed. A Mann-Whitney U test was conducted to evaluate differences between English proficiency level and cognitive load during while listening. There is a statistical difference between English proficiency groups for item numbered 5, "The explanations and instructions for the listening audio were very unclear". B1 level has a higher mean rank (M=37.28) compared to B2 level (M=27.04). For Item 6, "The explanations and instructions in the listening audio were full of unclear language". B1 level has a higher mean rank (M=39.73) compared to B2 (M=24.51). For Item 7, "The explanations and instructions in the listening audio were, in terms of learning very ineffective". B1 level

is higher (M= 37.33) compared to B2 (M=27). The results for Item 8 ‘‘ I invested a very high mental effort in unclear and ineffective explanations and instructions in this listening audio.’’ Results also indicate B1 has a higher (M= 36.13) compared to B2 (M= 26.93). By looking at the results, the significant differences in mean ranks between B1 and B2 levels highlight that B1 students deal with more understanding of instructions and explanations in while listening tasks. B1 students experienced a higher cognitive load compared to B2 students. Results are shown in Table 6.

Table 6

Ranks of Students Cognitive Load during While Listening by English Proficiency Level

	English Proficiency Level	N	Mean Rank	Sum of Ranks
1.The content of the listening audio was very complex.	B1	27	29.57	798.50
	B2	35	32.99	1154.50
	Total	62		
2.The topics covered in the listening audio was very complex.	B1	27	34.07	920.00
	B2	35	29.51	1033.00
	Total	62		
3.In this listening audio, very complex terms were mentioned.	B1	27	35.72	964.50
	B2	35	28.24	988.50
	Total	62		
4.I invested a very high mental effort in the complexity of this listening audio.	B1	27	34.70	937.00
	B2	35	29.03	1016.00
	Total	62		
5.The explanations and instructions for the listening audio were very unclear.	B1	27	37.28	1006.50
	B2	35	27.04	946.50
	Total	62		
6.The explanations and instructions in the listening audio were full of unclear language.	B1	26	39.73	1033.00
	B2	35	24.51	858.00
	Total	61		
7.The explanations and instructions in the listening audio were, in terms of learning, very ineffective.	B1	27	37.33	1008.00
	B2	35	27.00	945.00
	Total	62		

Table 6 (cont'd)

8.I invested a very high mental effort in unclear and ineffective explanations and instructions in this listening audio.	B1	27	36.13	975.50
	B2	34	26.93	915.50
	Total	61		
9.This listening audio really enhanced my understanding of the content that was covered.	B1	27	30.22	816.00
	B2	35	32.49	1137.00
	Total	62		
10.This listening audio really enhanced my understanding of the topics that was covered.	B1	27	29.37	793.00
	B2	35	33.14	1160.00
	Total	62		
11. The listening audio really enhanced my knowledge of the terms that were mentioned.	B1	27	30.15	814.00
	B2	35	32.54	1139.00
	Total	62		
12.This listening audio really enhanced my knowledge and understanding of how to deal with topics covered.	B1	27	28.22	762.00
	B2	35	34.03	1191.00
	Total	62		
13.I invested a very high mental effort during the listening audio in enhancing my knowledge and understanding.	B1	27	32.93	889.00
	B2	35	30.40	1064.00
	Total	62		

Table 7

Mann-Whitney U test for Cognitive Load during WL audio

	Mann - Whitney U	Wilcoxon W	Z	p
1.The content of the listening audio was very complex.	420.500	798.500	-.745	.456
2.The topics covered in the listening audio was very complex.	403.000	1033.0000	-.998	.318
3.In this listening audio, very complex terms were mentioned.	358.500	988.500	-1.636	.102
4.I invested a very high mental effort in the complexity of this listening audio.	386.000	1016.000	-1.239	.215

Table 7 (cont'd)

5.The explanations and instructions for the listening audio were very unclear.	316.500	946.500	-2.242	.025
6.The explanations and instructions in the listening audio were full of unclear language.	228.000	858.000	-3.360	<.001
7.The explanations and instructions in the listening audio were, in terms of learning, very ineffective.	315.000	945.000	-2.273	.023
8.I invested a very high mental effort in unclear and ineffective explanations and instructions in this listening audio.	320.500	915.500	-2.034	.042
9.This listening audio really enhanced my understanding of the content that was covered.	438.000	816.000	-.500	.617
10.This listening audio really enhanced my understanding of the topics that was covered.	415.000	793.000	-.831	.406
11.The listening audio really enhanced my knowledge of the terms that were mentioned.	436.000	814.000	-.526	.599
12.This listening audio really enhanced my knowledge and understanding of how to deal with topics covered.	384.000	762.000	-1.277	.201
13. I invested a very high mental effort during the listening audio in enhancing my knowledge and understanding.	434.000	1064.00	-.565	.572

According to the Mann-Whitney U test results, the p-value provides insights. Items 1 to 4 which are called intrinsic load assess the complexity level of the task. None of these items showed significant differences in terms of English proficiency level ($p > 0.05$). Items 5 to 8 which are called extraneous load related to explanations and instructions of the task showed significant differences. Item 5 p-value was .025 indicating a significant difference. Item 6 p-value was $p < .001$ indicating a highly significant difference. Item 7 p-value was .023 indicating significant difference. Item 8 p-value was .042 which also indicated a significant difference. Items 9 to 13 which is called germane load assesses effective learning. All the items had $p > 0.05$ indicating no significant differences in terms of English proficiency level.

4.1.1 Detailed analysis of cognitive load types for WL.

Table 8

Ranks of Three Types of Cognitive Load for WL

	English Proficiency Level	N	Mean Rank	Sum of Ranks
Intrinsic Load	B1	27	34.09	920.50
	B2	35	29.50	1032.50
	Total	62		
Extraneous Load	B1	26	38.33	996.50
	B2	34	24.51	833.50
	Total	60		
Germane Load	B1	27	29.31	791.50
	B2	35	33.19	1161.50
	Total	62		

According to Table 8, for IL which is about task difficulty and content, B1 (M=34.09), B2 (M=29.50), for EL which is about explanations and instructions B1 has a higher mean rank B1 (M=38.33) compared to B2 (M=24.51) level. The B1 level has a significantly higher mean rank compared to the B2 level. For GL, which is about effective learning B1 (M=29.31) and B2 (M=33.19).

Table 9

Mann-Whitney U Test for Three Types of CL during WL

	Mann-Whitney U	Wilcoxon W	Z	p
Intrinsic load	402.500	1032.500	-.995	.320
Extraneous load	288.500	833.500	-.3.045	.002
Germane load	413.500	791.500	-.840	.401

According to Mann-Whitney U test results, for IL, the p-value of .320 highlights no statistical difference between English proficiency levels. For EL, the p-value of .002 indicates statistical differences in EL between B1 and B2 levels. As mentioned

above, B1 learners experienced higher EL compared to B2-level students. For GL, the p-value of .401 highlights no statistical differences between English proficiency levels.

4.2 RQ2 Is There a Statistically Significant Difference in The Cognitive Load Experienced by B1 and B2 Level Students during Note-taking Audio?

The second question was provided for investigation of differences in cognitive load experienced by different levels of students during note-taking audio. As mentioned earlier, the same cognitive load scale was used for this audio. There were 13 items on the scale students judged the difficulty level of the task and evaluated their answer on the Likert scale. 0 represents strongly disagree and 10 represents strongly agree. The normality test was applied and seen that data was not normally distributed. All the items were less than $p < 0.05$ and seen that the data was not normally distributed. A Mann-Whitney U test was conducted to investigate differences between English proficiency level and cognitive load. There is a statistical difference between English proficiency level groups for item numbered 3 ‘‘ In this listening audio very complex terms were mentioned’’. The B2 level has a higher mean rank ($M=34.39$) compared to the B1 level ($M=23.89$). By looking at the results, the significant differences in mean ranks between B1 and B2 levels highlight that B2 students experienced a higher cognitive load compared to B1 level students. Results are shown in Table 10.

Table 10

Ranks of Students Cognitive Load during Note-taking audio by English Proficiency Level

	English Proficiency Level	N	Mean Rank	Sum of Ranks
1.The content of the listening audio was very complex.	B1	27	24.72	667.50
	B2	30	32.85	985.50
	Total	57		
2.The topics covered in the listening audio was very complex.	B1	27	25.28	682.50
	B2	31	33.18	1028.50
	Total	58		
3.In this listening audio, very complex terms were mentioned.	B1	27	23.89	645.00
	B2	31	34.39	1066.00
	Total	58		

Table 10 (cont'd)

4.I invested a very high mental effort in the complexity of this listening audio.	B1	27	24.91	672.50
	B2	31	33.50	1038.50
	Total	58		
5.The explanations and instructions for the listening audio were very unclear.	B1	27	26.65	719.50
	B2	31	31.98	991.50
	Total	58		
6.The explanations and instructions in the listening audio were full of unclear language.	B1	27	30.89	834.00
	B2	31	28.29	877.00
	Total	58		
7.The explanations and instructions in the listening audio were, in terms of learning, very ineffective.	B1	27	28.24	762.50
	B2	31	30.60	948.50
	Total	58		
8.I invested a very high mental effort in unclear and ineffective explanations and instructions in this listening audio.	B1	27	27.31	737.50
	B2	31	31.40	973.50
	Total	58		
9.This listening audio really enhanced my understanding of the content that was covered.	B1	27	29.48	796.00
	B2	31	29.52	915.00
	Total	58		
10.This listening audio really enhanced my understanding of the topics that was covered.	B1	27	32.61	880.50
	B2	31	26.79	830.50
	Total	58		
11.The listening audio really enhanced my knowledge of the terms that were mentioned.	B1	27	29.69	801.50
	B2	31	29.34	909.50
	Total	58		
12.This listening audio really enhanced my knowledge and understanding of how to deal with topics covered.	B1	27	31.26	844.00
	B2	31	27.97	867.00
	Total	58		
13.I invested a very high mental effort during the listening audio in enhancing my knowledge and understanding.	B1	27	26.46	714.50
	B2	31	32.15	996.50
	Total	58		

Table 11

Mann-Whitney U test for Cognitive Load during NT audio

	Mann-Whitney U	Wilcoxon W	Z	p
1.The content of the listening audio was very complex.	289.500	667.500	1.856	.063
2.The topics covered in the listening audio was very complex	304.500	682.500	-1.787	.074
3.In this listening audio, very complex terms were mentioned.	267.000	645.000	-2.377	.017
4.I invested a very high mental effort in the complexity of this listening audio.	294.500	672.500	-1.948	.051
5.The explanations and instructions for the listening audio were very unclear.	341.500	719.500	-1.210	.226
6.The explanations and instructions in the listening audio were full of unclear language.	381.000	877.000	-.591	.554
7.The explanations and instructions in the listening audio were, in terms of learning, very ineffective.	384.500	762.500	-.535	.592
8.I invested a very high mental effort in unclear and ineffective explanations and instructions in this listening audio.	359.500	737.000	-.930	.352
9.This listening audio really enhanced my understanding of the content that was covered.	418.000	796.000	-.008	.994
10.This listening audio really enhanced my understanding of the topics that was covered.	334.500	830.500	-1.327	.185
11.The listening audio really enhanced my knowledge of the terms that were mentioned.	413.500	909.500	-.079	.937
12.This listening audio really enhanced my knowledge and understanding of how to deal with topics covered.	371.000	867.000	-.750	.453

Table 11 (cont'd)

13.I invested a very high mental effort during the listening audio in enhancing my knowledge and understanding.	336.500	714.500	-1.296	.195
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According to the Mann-Whitney U test results, the p-value provides insights. Item 1 p-value was .063, Item 2 p-value was .074, and Item 4 p-value was 0.51 highlighting that task difficulty alters in terms of proficiency level, however, these differences are not certain. Item 3 which is mainly about intrinsic load task difficulty p-value was 0.17 highlights significant differences in terms of English proficiency levels. Items 5 to 8 mainly about extraneous load instructions and explanations were $p > 0.05$ showing no significant differences among proficiency levels. Items 9 to 13 which are about germane load effective learning, p-values were $p > 0.05$ indicating no significant differences among proficiency levels.

4.2.1 Detailed analysis of cognitive load types for NT.

Table 12

Ranks of Three Types of Cognitive Load for NT

	English Proficiency Level	N	Mean Rank	Sum of Ranks
Intrinsic load	B1	27	23.63	638.00
	B2	30	33.83	1015.00
	Total	57		
Extraneous load	B1	27	28.17	760.50
	B2	31	30.66	950.50
	Total	58		
Germane load	B1	27	29.69	801.50
	B2	31	29.34	909.50
	Total	58		

According to Table 12, for IL which is about task difficulty and content, B1 level (M=23.63) and B2 level (M=33.83). The results highlight that B2 level students' mean

rank is higher compared to B1 level students. This suggests that the B2 level deals with task complexity and content compared to the B1 level of students. For EL, B1 level (M=28.17) and B2 (M=30.66). For GL, B1 level (M=29.69) and B2 level (29.34).

Table 13

Mann-Whitney U test for Three Types of CL during NT

	Mann-Whitney U	Wilcoxon W	Z	p
Intrinsic load	260.000	638.000	-2.320	.020
Extraneous load	382.500	760.500	-.562	.574
Germane load	413.500	909.500	-.078	.938

According to Mann-Whitney U test results, for IL, the p-value of .020 indicates statistical differences in IL between B1 and B2 levels. As mentioned before, B2 levels experienced higher IL compared to B1 levels of students. For EL, the p-value of .574 highlights no statistical difference between English proficiency levels. For GL, the p-value of .938 highlights no statistical difference between B1 and B2 level students.

4.3 RQ3 Is There a Statistically Significant Difference in Cognitive Load between NT and WL Audio?

The third question was provided for investigation of differences in cognitive load experienced by B1 and B2 level students during while listening and note-taking audio. A Mann-Whitney U test was conducted to see the differences between WL and NT audio. Total cognitive load scores were compared but no significant differences were seen. The students experienced similar mental efforts. WL's overall p-value was .201 and NT's overall p-value was .123. The results indicated that no significant differences between WL and NT.

Table 14

Mann-Whitney U test for Cognitive Load during WL and NT audio

Variable	Group	N	Mean Rank	Sum of Ranks	Mann- Whitney U	Sig. (2-tailed)
NT	B1	27	25.83	697.50	319.500	.123
Overall	B2	31	32.69	1013.50		
WL	B1	27	34.83	940.50	382.500	.201
Overall	B2	35	28.93	1012.50		

4.4 RQ4 Is There a Significant Difference in Cognitive Load during WL and NT Experienced by Female and Male Students?

The fourth question was provided for investigation of differences in cognitive load experienced by female and male students during while listening and note-taking audio. A Kruskal-Wallis H test was conducted to see differences between female and male students and cognitive load overall scores. Kruskal-Wallis H test is a non-parametric test for comparing three or more independent groups (McKight & Najab, 2010). In this study, there were three groups which are female, male, and prefer not to say. A Kruskal-Wallis H test was conducted for each task and the results are shown in Table 15 and Table 16.

Table 15

A Kruskal-Wallis H test for Cognitive Load during WL audio

	Gender	N	Mean Rank	Kruskal-Wallis H	p
WL Overall	Male	33	32.68	.318	.853
	Female	28	30.23		
	Prefer not to say	1	28.00		

According to Kruskal-Wallis H test results, a p-value of .853 indicated that there are no significant differences between female and male students in terms of overall cognitive load during WL audio.

Table 16

A Kruskal-Wallis H test for Cognitive Load during NT audio

	Gender	N	Mean Rank	Kruskal-Wallis H	p
NT Overall	Male	30	31.12	1.173	.556
	Female	26	26.88		
	Prefer not to say	1	20.50		

According to Kruskal-Wallis H test results, p-value .556 indicated that there are no significant differences between female and male students in terms of overall cognitive load during NT audio.

4.5 Findings of Qualitative Data

The fifth question was investigating the experiences of the preparatory school students on cognitive load in two different listening audios. In this research, open-ended questions and structured interviews were carried out with students. Open-ended questions from the last part of the scale are demonstrated and examined. Structured

interview conducted with 6 volunteer students. The interview was conducted via Microsoft Teams. It lasted 5 minutes. The purpose of asking these open-ended questions to students was to learn about their experiences with cognitive load in two different listening audios. There were 62 students for while listening only 30 students responded to open-ended questions. For note-taking, 58 students participated only 26 responded to open-ended questions. For structured interviews, 6 students participated. The interview included seven open-ended questions to study students' thoughts and experiences about while listening and note-taking audio. The first three questions focus on the challenges of listening to audio. The following two questions are about the comparison between two listening audios. The last two questions are about students' beliefs and experiences about listening audios. Initial codes were created using the interview transcripts as a guide. These codes were categorized, which resulted in the development of themes. The qualitative analysis consists of two raters. Each rater analyzed students provided answers for open-ended questions and students' transcripts in structured interviews and both experts in the field compared the findings. Having more than one rater increases reliability (Abedi et al., 1995). Two experts in the field combining themes, categories, and codes identified similarities and evaluated results. Two analysts labelled similar themes and discussed what each represents engaged discussion and determined which themes were appropriate and more relevant. Two raters come up with a subjective judgment on the same data. Each rater analyzed, interpreted and came up with themes, codes, and categories individually and later compared their findings. If the raters provide similar ratings, it refers to high inter-rater reliability (Viera & Garrett, 2005). Two experts in the field came up with an agreement and provided similar ratings.

4.5.1 Findings related to open-ended questions. Students' responses were analyzed, and two themes emerged from the open-ended questions. Theme 1 is 'Experience and emotions.' The question was 'How would you describe your overall experience with this listening audio?' According to students' answers categories and codes are generated. Three categories appeared for this theme: they were positive, negative, and neutral responses. Theme two is 'Suggestion for improvement' the question was 'Are there any changes you would suggest improving your experience with this activity?' One category appeared for this

theme which is suggestions. Themes, categories, and codes are shown in table 17, table 18, table 19, and table 20.

Table 17

Theme 1: Experience and Emotions for WL audio related to open-ended question 1

Theme	Categories	Codes
Experience and Emotions	Positive Responses	Helpful (9 students)
		Confident (2 students)
		Amazing (2 students)
		Effective (1 student)
		Enjoyable (1 student)
	Negative Responses	Difficult (9 students)
		Anxious (3 students)
		Strange (1 student)
	Neutral Responses	Normal (2 students)

Among the students' responses to the first open-ended question three categories emerged: positive responses, negative responses, and neutral responses. 30 students responded to the open-ended question. As illustrated in Table 17, for positive responses, five codes emerged: helpful, confident, amazing, effective, and enjoyable. For negative responses, three codes emerged: difficult, anxious, and strange. For neutral responses, one code emerged: normal. Students provided short answers to open-ended questions. As indicated above, WL was perceived as helpful by most students, with nine students labelling them as helpful, two students labelling them confident, two students labelling amazing, and one student labelling effective. Nevertheless, nine students found WL audio difficult, and three students felt anxious due to the complexity of the audio. In addition to this, two students reported neutral responses and found normal.

Table 18

Theme 1: Experience and Emotions for NT audio related to open-ended question 1

Theme	Categories	Codes
Experience and Emotions	Positive Responses	Helpful (4 students)
		Confident (4 students)
		Easy (3 students)
		Effective (1 student)
	Negative Responses	Difficult (6 students)
		Long (5 students)
		Complex (3 student)

Among the students' responses to the first open-ended question two categories emerged: positive responses, and negative responses. 26 students responded to open-ended questions. As illustrated in Table 18, for positive responses, four codes emerged: helpful, confident, effective, and easy. For negative responses, three codes were generated: difficult, long, and complex. Students provided short answers to open-ended questions. As indicated above, NT received positive and negative responses, four students found it helpful, four students felt confident, three students found it easy, and one student found it effective. Yet, six students found it difficult, five students highlighted the length of listening, and three students mentioned the complexity of the audio.

Table 19

Theme 2: Suggestion for Improvement for WL audio related to open ended question 2

Theme	Categories	Codes
Suggestion for Improvement	Suggestions	Slower audio (8 students)
		Better sound quality (3 students)
		Clear explanations (1 student)

Among the students' responses to the second open-ended question, one category emerged: suggestions. 12 students responded to this question. As illustrated in Table 19, for suggestion, three codes emerged: slower audio, better sound quality and clear explanations. The most common suggestion for WL was adjusting slower audio and eight participants highlighted this suggestion. In addition to this, three students mentioned better sound quality and one student mentioned clear explanations as a suggestion.

Table 20

Theme 2: Suggestion for Improvement for NT audio related to open ended question 2

Theme	Categories	Codes
Suggestion for Improvement	Suggestions	Slower audio (10 students)
		Using symbols or abbreviations (4 students)
		Better sound quality (1 student)

Among the students' responses to the second open-ended question, one category emerged: suggestions. 15 students responded to this question. As illustrated in Table 20, for suggestion, three codes emerged: slower audio, using symbols or abbreviations, and better sound quality. As indicated above, ten students recommended slower audio, four students suggested using symbols or abbreviations and one student recommended better sound quality.

4.5.2 Findings related to structured interview. In addition to open-ended questions, to get a more detailed analysis the researcher carried out structured interviews with volunteer students. The structured interviews consisted of seven open-ended questions related to WL and NT audio. The following categories appeared from students' responses. The first three questions focus on the challenges of WL and NT audio. The following two questions are about the comparison between WL and NT audio. The last two questions are about students' experiences with two audios and their preferences. Three themes emerged from the structured interview related to students' transcripts. Challenges in listening, activity preferences and effectiveness, and listening habits and preferences. Themes, categories, and codes emerged from interviews shown in table 21, table 22, and table 23.

Table 21

Theme 3: Challenges in Listening

Theme	Categories	Codes
Challenges in Listening	External factors	Background noise (2 students)
		Accents and pronunciation (2 students)
		Pace (1 student)
		Duration (2 students)
	Cognitive overload	Too much information at once (1 student)
		Vocabulary (3 students)
		Content (3 students)
		Unfamiliar topic (3 students)

Regarding student's transcripts about challenges in listening, three categories emerged. External factors, cognitive overload, and vocabulary and content complexity. These categories are formulated by clustering eight codes. The question was investigating challenges during listening audios.

External Factors

The first category is external factors. Four codes were generated according to the student's answers. As shown in Table 21, two students mentioned background noise, two students mentioned accents and pronunciation, one student mentioned pace, and two students mentioned duration as an external factor. S2 and S6 included the following comments about background noise and pace:

“S2: Background noise, because my friends were talking to each other.”

“S6: Pace, he was using difficult terms it was too long.”

Secondly, two students mentioned duration and S3 added:

“S3: Duration, it was hard to understand especially WL audio.”

Cognitive Overload

The second category is cognitive overload. One code was generated based on students' transcripts. One student mentioned cognitive overload and believed that too much information is presented at once and S5 added:

“S5: I believe that too much information is presented at once. A lot of details, I found overwhelming.”

Vocabulary and Content Complexity

The third category is vocabulary and content complexity. Three codes were generated according to students' answers. As shown in Table 21, three students pointed out vocabulary, three students pointed out content, and three students pointed out unfamiliar topics. Students provided comments about vocabulary and content complexity and added:

“S3: *Content. It was hard to understand especially while listening audio was very challenging.*”

“S5: *Content, some sentences were complex. I found it very challenging. Some sentences were longer while others were shorter, but it was confusing for us.*”

Secondly, three students mentioned unfamiliar topics and two of them added comments about unfamiliar topics:

“S6: *Unfamiliar topic. He was talking about the Soviet Union.*”

“S1: *They were different topics. Unfamiliar topic caused difficulty.*”

Table 22

Theme 4: Activity Preferences and Effectiveness

Theme	Categories	Codes
Activity Preferences and Effectiveness	Experiences with	Helpful (3 students)
	Listening	Difficult (3 students)
	Ease of Listening	WL (3 students)
		NT (3 students)
	Effectiveness of the activity	WL (3 students)
		NT (3 students)

Regarding students’ transcripts about activity preferences and effectiveness, three categories emerged: experiences with listening, ease of listening, and effectiveness of the activity. These categories were formulated by clustering six codes according to students' provided answers. The questions were investigating overall experience with listening activity.

Experiences with Listening

The first category is experiences with listening. Two codes were generated for this category. Students shared their overall experience with listening audio. As shown in Table 22, three students found it helpful for listening audios and three students found it difficult to the audios. In addition, three students pointed out helpful and added:

“S3: Found it helpful. I took notes and learned new expressions. Both activities were helpful, but WL was difficult.”

“S5: I felt confident for WL. For NT, I thought I should write everything that I listened I felt anxious.”

Three students mentioned difficulty and S2 added:

“S2: While listening was so difficult. There were three people in the audio. I could not understand who was talking.”

Ease of Listening

The second category is the ease of listening. Students provided two codes for this category: WL and NT. Students pointed out which activity was easier than the other and shared their experiences. As shown in Table 22, three students pointed out WL and the other three pointed out NT.

Firstly, three of the participants mentioned that WL is easier than the NT and added:

“S5: While listening is easier than the note-taking. For note-taking, we cannot see questions and we cannot predict questions but while listening we can see questions.”

“S6: While listening is easier than the note-taking. It is easy to follow, I can see questions during listening.”

Secondly, three of the participants pointed out NT is easier than the WL and added:

“S1: Note-taking is easier than while listening. We are taking notes, and I find it more useful and beneficial.”

“S3: I found Note-taking easy. It’s a good opportunity to take notes.”

Effectiveness of the activity

The third category is the effectiveness of the activity. The questions were investigating the most useful activity for comprehending the content. Regarding the students’ transcripts about the effectiveness of the activity, two codes emerged: WL and NT. Students shared their preferences about two listening audios. As shown in Table 22, three students preferred while listening and three students preferred note-taking.

Firstly, three students mentioned that WL is more effective than the NT and added:

“S5: I remember that the note-taking activity little bit long, and confusing, we were not familiar with the topics, too many details. While listening is more useful and effective than note-taking.”

“S6: While listening is easy to follow.”

Secondly, three students pointed out NT is more effective than the WL and added:

“S2: Note-taking was useful. I took notes and it was easy to comprehend the content.”

“S3: I wrote everything. It’s a good opportunity to take notes.”

Table 23

Theme 5: Listening Habits and Preferences

Themes	Categories	Codes
Listening Habits and Preferences	Benefit of activities on	Pronunciation (2 students)
	English language skills	Vocabulary (3 students)
		Grammar (1 student)
	Types of content	Podcast (3 students)
		Music (4 students)
		TV shows (4 students)

Regarding students' transcripts, two categories emerged: the benefit of activities on English language skills and types of content. These categories are formulated by clustering six codes according to students' transcripts.

Benefit of activities on English language skills

The first category is the benefit of activities on English language skills. Regarding the students' transcripts, three codes emerged: pronunciation, vocabulary, and grammar. As shown in Table 23, two students pointed out that this kind of activity is beneficial in terms of pronunciation practice. Two students mentioned vocabulary and one student mentioned grammar.

Firstly, Students who said pronunciation added:

“S3: 100% agree. Both are beneficial in terms of practicing pronunciation and vocabulary. It helps to improve my English skills.”

“S1: Both are beneficial because while listening we can see questions and for note-taking, we can take notes. They are different kinds of listening tasks, and they provide us to practice pronunciation more and we can improve our English language skills.”

Secondly, three students pointed out vocabulary and S4 and S5 added:

“S4: They are beneficial. I focus on listening to audio. I can learn new vocabulary.”

“S5: So important and beneficial. We can improve our vocabulary knowledge and facilitate our English language skills by listening to this kind of activity.”

Lastly, one student mentioned grammar and added:

“S2: This kind of activities improve my grammar skills. I believe it is beneficial and useful for us.”

Types of Content

The second and last category is types of content. Regarding student's transcripts, three codes emerged: podcast, music, and TV shows. As shown in Table 23, students provided more than one answer for this category. Three students mentioned that they listen to podcasts, four students pointed out music, and four students mentioned TV shows.

Firstly, three students said that they listen to podcasts, and they believe it is beneficial for them. S5 and S2 included:

“S5: Podcasts are beneficial and valuable for us. For example, psychological podcasts are very beneficial for our mental health. I believe it is more beneficial and informative.”

“S2: I listen to podcasts, and I believe it helps to improve my listening skills.”

Secondly, four students mentioned music and S5 and S6 added:

“S5: I always listen to music. I tried to understand all the sentences.”

“S6: I listen to music, especially RAP music.”

Lastly, four students mentioned TV shows, and they believe it helps to improve their listening skills. S1 and S6 added:

“S1: *I listen to TV shows. TV shows are useful because I can learn a variety of new words.*”

“S6: *TV shows are beneficial.*”



Chapter 5

Discussion and Conclusions

This chapter investigates the findings in the previous section and provides a detailed explanation of the research questions and existing literature. The chapter consists of a summary of this study, a discussion of research questions, a conclusion, and recommendations for future research.

5.1 Discussion

This research focuses on investigating the cognitive load experienced by B1 and B2 level students during WL and NT audio. There are some differences in cognitive load between English Proficiency levels. The first research question was aimed at seeing differences in cognitive load experienced by B1 and B2 level students during WL audio. There is a statistical difference between the two groups. According to the results of this study, B1 learners experienced higher EL compared to B2 level. EL is mainly about the mental effort, poorly instructional designs, lessons, and materials (Choi & Lee, 2021). EL is the load that is unnecessary for learning. According to results, all the scale items related to EL and lack of instructions and explanations. B1 students struggle with understanding the task instructions. Similarly, Yang (2014) students have low proficiency levels probably made it hard to understand the listening parts. Sweller (1998) remarked that the main purpose of CLT is to reduce this type of load. In many other studies, researchers focused on reducing this type of load. For example, Orru and Longo (2019) mentioned in their study that, CL's aim is to the reduction of EL. Leppink (2014) highlighted that reducing EL enhances learning. Du (2023) EL might may hinder the learning process by making it harder for students to focus on essential information. As the CL increased, listeners perceptual awareness decreased making them less able to reliably distinguish phonemes (Mattys et al., 2014). These findings revealed that EL is not sufficient for learning. In addition to this, the design of listening activities can dramatically influence students cognitive load (Yang, 2014). The other types of cognitive load do not indicate any significant differences between English proficiency levels. To sum up, it can be clearly stated that

B1 learners experienced higher EL compared to B2 students and EL negatively affect listening comprehension. The second research question was designed to see differences in cognitive load experienced by B1 and B2 students during NT audio. According to the results of this study, B2 level students compared to B1 level students deal with task complexity and content. The main factor which affects students negatively is content (Pratiwi & Andriyanti, 2019). This item is called intrinsic load and is mainly about task complexity. Taking notes is a complicated activity that needs information and selection, as well as the written output process (Piolat et al., 2005). Comparative findings suggest that taking notes requires more work than reading or learning (Piolat et al., 2005). Research done by Nizar and colleagues (2023) focused on IL and EL to investigate the relationship between these loads and see that IL and EL are connected. Research done by Nizar et al. (2023) to see the relationship between reading comprehension and cognitive load, revealed that student's high levels of these loads perform poorly on reading comprehension. These findings are supported by existing literature and revealed that intrinsic load is related to task difficulty and complexity and high level of this load do not help learners during activities. All things considered, B2 levels compared to B1 level students deal with task complexity and content and IL affects student negatively on learning process.

The study aimed to investigate differences in cognitive load experienced by B1 and B2 students during WL and NT audio. Total cognitive scores were compared but no significant differences were seen. In general, students face similar cognitive load. Similarly, Yang (2014) investigated the relationship between CL and the usage of multimedia in educational environment. Results indicated that both high-level and low-level students had equal cognitive loads and degrees of anxiety (Yang, 2014). There was a limitation of this study because it is lack of previous research directly comparing cognitive load in WL and NT among English proficiency levels, it makes it challenging to investigate the findings withing existing literature.

The study conducted to investigate differences in cognitive load experienced by female and male students during WL and NT audio. According to results of the study, there were no significant differences among female and male participants among WL and NT audio. On the one that, a study done by Rahimi and Sayyadi (2019) about cognitive listening activities of cognitive-based listening instruction in the EFL curriculum also revealed no crucial differences among female and male students in

terms of cognitive load. On the other hand, Al Ghazo (2023) researched note-taking and listening comprehension and the results revealed that female students outperformed compared to male students. In short, there were no significant difference among cognitive load based on gender.

The experiences of the preparatory school students on cognitive load in different listening audios. A significant number of students found WL audio helpful, some students reported feeling confident and other students described amazing, effective, and enjoyable. Nevertheless, some students found the audio difficult. Listening is not easy since the listener must be able to discern between sound, comprehend the language and vocabulary (Pratiwi & Andriyanti, 2019). Listeners attention may be diverted by the speaker factor (Pratiwi & Andriyanti, 2019). Speakers who speak too fast students might miss important information or details in the text consequently, they get distracted (Birjandi & Lotfi, 2009). Similarly, the issue of the speaker's style, techniques, accent, speech rate becomes the major influence on students listening comprehension (Pratiwi & Andriyanti, 2019). Students feel complicated and get lost during the listening because of the speaker who speak too fast (Anandapong, as cited in Pratiwi & Andriyanti, 2019). Many learners struggle with fast-paced audio which can hinder learning process and learners' ability to comprehend the language (Bingöl et al., as cited in Hermida, 2021). According to Burgess and Hitch, memory traces are likely to deteriorate before practice and retain material in long term memory if auditory information is lengthy and complicated (Burgess & Hitch, as cited in Chen et al., 2024). For NT, a small group of students found note-taking beneficial. Some students felt confident managing the task others found the task easy and one student mentioned effective. A significant number of students found the task difficult and struggled with the task. Five of them found the task long and dealt with the length of the audio. Nemtcihnova (2013) mentioned that if the recording is too long or uninteresting, students tend to stop listening. Similarly, students are impacted by the audio's length since they encounter numerous new words in it (Pratiwi & Andriyanti, 2019). The length of the listening audio influences the difficulty, which contains some unfamiliar words (Pratiwi & Andriyanti, 2019). Similarly, students believe that listening to long text causes them to become fatigued and lose track of context (Birjandi & Lotfi, 2009). Three of them found the task demanding and mentioned complex. In short, the mixed responses suggested that while

some students benefit from note-taking others find it challenging because of length and complexity.

Students identified several challenges encountered during WL and NT audio. These difficulties can be grouped into three main areas: external factors, cognitive overload, and vocabulary and content complexity. External factors make it harder to focus on the audio during listening and it is related to EL. It has been discovered that external factors more likely to affect learners negatively (Pratiwi & Andriyanti, 2019). Studies show that the presence of background noise increases CL. Background noise increases EL and it makes it hard to focus on the task (Du, 2023). In addition to this, background noise hampers memory retention (Du, 2023). Challenging or unfamiliar words can hinder comprehension (Du, 2023). Moreover, students' speech recognition and memory processing will be impacted by background noise and low quality of audio (Pratiwi & Andriyanti, 2019). Texts that include a lot unfamiliar and challenging language are harder to grasp and cause a higher cognitive load (Cohen, as cited in Braganza et al., 2016). According to Onthman and Vanathas (2017) providing information and systematic knowledge can enhance comprehension. Similarly, an individual's interest and familiarity with the topic might influence memory (Chen et al., 2024). Interest can enhance understanding. Learners that are more motivated to interact and will retain the material better (Hidi & Harackiewicz, as cited in Chen et al., 2024). Accents play a significant role on students' ability to understand what they hear (Harding, as cited in Birjandi & Lotfi, 2009). One of the main barriers to students listening comprehension was the speaker's accent which was widely perceived by the students (Birjandi & Lotfi, 2009).

Students provided several recommendations to enhance WL and NT audio. The most common request for WL audio was slower audio. Students believed that slower audio could help improve comprehension and allow more time for effective WL. The second request was better sound quality. Some students found the audio quality problematic and enhancing the quality can improve comprehension. The quality of the audio causes the given input to be confusing, therefore, it can negatively affect learners (Pratiwi & Andriyanti, 2019). A student requested clear explanations indicating the complexity of the content or instructions. For NT, the most frequently mentioned suggestion was reducing the audio speed. The fast speaker in lectures makes note-taking difficult (Al Musalli, as cited in İpek, 2018). Some students suggested using

symbols or abbreviations. Instead of taking too many notes, using symbols or abbreviations improves note-taking (Sun, 2023). A student mentioned better sound quality. Environmental variables including noise and poor audio quality hinder listening comprehension (Birjandi & Lotfi, 2019). Despite the widespread assumption that slower speech rates enhance listening ability, speech rate has been found to be significant factor influencing listening ability and contradictory results have been obtained from empirical research (Hayati 2010). Zhao (1997) discovered several important findings concerning speech rates. He emphasized that speech rate is a personal, not a collective, controllable factor (Zhao,1997). His findings indicate that when participants had control over their speaking pace, they were better able to understand (Zhao, 1997). Teachers and students ought to think about the differences between slow and natural speaking rates, as well as the benefits and drawbacks of each (Hayati, 2010). According to Hayati (2010) for EFL learners listening ability, natural speech pace might demonstrate more gains than slow speed pace. In everyday life in both L1 and L2, naturalness is more noticeable than unnaturalness (Hayati, 2010). According to Hayati (2010) slow speech pace can be utilized as a quick practice method for understanding natural speech pace. The development of participants' listening comprehension was significantly impacted by their exposure to normal speech rates (Hayati, 2010). Compared to those exposed to slow speech rates, those exposed to normal speech rates improved more (Hayati, 2010). When designing any listening material, the fast or slow of the speech pace makes some distinction, but what makes the most impact is the naturalness of each of the material and the speech pace (Hayati, 2010).

Students mentioned numerous benefits of listening tasks. Gaining proficiency in listening comprehension helps students in improving their comprehension of input (Gilakjani & Sabouri, 2016). Vocabulary improvement was the most mentioned benefit. Some students found listening activities helped improve pronunciation. According to Bouach, listening comprehension helps students with their pronunciation (Bouach, as cited in Gilakjani & Sabouri, 2016). When students are exposed to more spoken English, they have a better understanding of pitch and intonation (Gilakjani & Sabouri, 2016). Pronunciation and listening skills development are two useful strategies that should be included in English classrooms (Gilakjani & Sabouri, 2016). The podcast was popular among some students. Music and TV shows are the preferred

content types. According to Verdugo and Belmonte, the use of recorded or digital audio encouraged students concentrate and focus on oral input (Verdugo & Belmonte, as cited in Branganza et al., 2016). The brief literature revealed that listening activities beneficial in terms of vocabulary development and pronunciation.

For the activity preferences and effectiveness, students highlighted their perceptions of listening tasks, focusing on their experiences. Some students found the listening activities helpful others found it difficult. Students mentioned that WL is easier than NT because they could see the questions while listening which help them to focus on key information other students preferred NT because they felt that taking notes helped them better retain and understand the content. According to Jones, students performed better when presented with both visual and verbal texts (Jones, as cited in Branganza et al., 2016). Similarly, reading while listening helps improve EFL learner's reading and listening skills (Asrimawati & Margana, 2020). Listening through written text helped the learner feel safe and increased their confidence in understanding (Chang, as cited in Asrimawati & Margana, 2020). Moreover, it helps learners expand their oral vocabulary and retain the meaning of spoken forms while listening (Chang & Read, as cited in Asrimawati & Margana, 2020). According to Kabayashi, note-taking improves learning by encouraging students to actively analyze the content and apply it to their prior knowledge (Kabayashi, as cited in Sadeghi & Zeinali, 2015). Similarly, taking notes can assist learners enhance their listening skills by increasing memory and paying greater attention (Ching Ko, as cited in Sadeghi & Zeinali, 2015). The brief literature mentioned above indicated that both (WL and NT) are helpful in developing students listening skills and students' preferences vary according to types of listening, content.

Students experienced different types of cognitive load. EL was higher for B1 level students during WL audio, indicating unclear explanations or explanations. EL reflects lack of instruction as it guides students' attention toward processing non-learning relevant information (Lange & Costley, 2017). EL represents inadequate instructional delivery, which generates unnecessary processing in short term memory resulting in a negative impact on learning process (Cierniak et al., as cited in Lange & Costley, 2017). IL was higher for B2 students during NT audio, indicating complexity of the content was more challenging for B2 students. No significant differences were found between English proficiency levels in terms of GL, indicating that both audios

were equally effective in promoting learning when CL was managed appropriately. When GL is high it means that the task motivates learners and engage them (Rahimi & Sayyadi, 2019). GL indicates how effectively learners comprehend the task and has direct impact on learning (Lange & Costley, 2017). According to Sweller, the best place to learn is one that encourages high level of GL and reducing EL (Sweller, 1998). Reducing EL has been demonstrated to improve learning outcomes (Lange & Costley, 2017).

5.2 Conclusion

This study aimed to explore the cognitive load experienced by B1 and B2 level EFL learners during two common listening tasks: while listening (WL) and note-taking (NT). By employing a mixed-method approach, the research provided valuable insights into how different listening activities impact learners' cognitive load and comprehension. The findings revealed significant differences in cognitive load based on proficiency levels, with B1 students experiencing higher extraneous load (EL) during WL tasks due to unclear instructions and explanations, and B2 students facing higher intrinsic load (IL) during NT tasks due to the complexity of the content. However, no significant differences were found in overall cognitive load between the two tasks or between genders, suggesting that both WL and NT tasks impose similar cognitive demands on learners.

Qualitative data highlighted the mixed experiences of students, with some finding the tasks helpful and engaging, while others struggled with challenges such as fast-paced audio, unfamiliar vocabulary, and complex content. The most common suggestion for improvement was reducing the speed of the audio, which students believed would enhance comprehension and reduce cognitive strain. Additionally, both WL and NT tasks were found to be beneficial for vocabulary development and pronunciation practice, underscoring their value in EFL learning.

The study underscores the importance of task design and proficiency level in managing cognitive load. Educators and curriculum designers should consider reducing extraneous load by providing clearer instructions, slower audio, and better-structured tasks, particularly for lower-proficiency learners. Tailoring tasks to the learners' proficiency levels can help optimize cognitive load and improve learning

outcomes. Furthermore, incorporating strategies such as using symbols or abbreviations during note-taking and improving sound quality can make listening tasks more accessible and effective.

In conclusion, this research contributes to the growing body of knowledge on cognitive load theory and its application in EFL listening tasks. By understanding the cognitive demands of different listening activities, educators can design more effective and learner-centered listening tasks that enhance comprehension and support language acquisition. Future research could expand on these findings by exploring additional factors such as the impact of multimedia support, the role of learner motivation, and the effects of different task designs on cognitive load and learning outcomes.

5.3 Recommendations for Future Research

Future research should consider expanding the sample size and diversity to include a larger and more varied group of EFL learners, encompassing different age groups, nationalities, and proficiency levels such as A1, A2, and C1. This broader scope would help generalize the findings and provide a more comprehensive understanding of how cognitive load varies across different learner profiles. Additionally, exploring the cognitive load experienced by learners at other proficiency levels, particularly A1, A2, and C1, could offer deeper insights into how task complexity affects learners at various stages of language acquisition.

Another promising area for future research is the incorporation of multimedia and technology. Investigating the impact of multimedia support, such as subtitles, visuals, or interactive elements, on cognitive load during listening tasks could reveal how dual-coding (audio-visual materials) influences comprehension and cognitive load, especially for lower-proficiency learners. Furthermore, examining the role of learner motivation and anxiety in cognitive load could provide valuable insights into the emotional and psychological factors that affect task performance, helping to design more engaging and less stressful learning activities.

Comparing different listening task designs, such as gap-fill exercises, true/false questions, and multiple-choice questions, could help identify which formats are most effective in managing cognitive load and enhancing comprehension. Longitudinal studies would also be beneficial, as they could track how cognitive load changes over

time as learners progress in their language proficiency, offering insights into how instructional strategies should evolve to support their development.

The impact of background noise and other environmental factors on cognitive load during listening tasks is another area worth exploring. Understanding how external distractions affect task performance could help educators design more effective listening activities for real-world contexts where noise may be a factor. Additionally, studying the effectiveness of scaffolding techniques, such as pre-teaching vocabulary, providing summaries, or using graphic organizers, could identify strategies that support learners in managing complex tasks.

Investigating the role of note-taking strategies, such as linear notes, mind maps, or abbreviations, could provide practical recommendations for teaching effective note-taking skills to EFL learners. Cross-cultural studies could also be conducted to examine how cognitive load during listening tasks varies across different cultural and linguistic backgrounds, identifying culturally specific challenges and informing the design of more inclusive listening activities.

The use of advanced measurement tools, such as eye-tracking, EEG, or heart rate monitoring, could complement self-report measures and offer more objective data on cognitive load, providing deeper insights into the cognitive processes involved in listening tasks. Finally, exploring the impact of task sequencing, such as starting with simpler tasks and gradually increasing complexity, could help design more effective lesson plans that optimize cognitive load management.

By addressing these recommendations, future research can build on the findings of this study and contribute to a more comprehensive understanding of cognitive load in EFL listening tasks. This, in turn, can inform the development of more effective instructional strategies and materials that support language learners in achieving their goals.

The study was implemented only one time and for future research, the researcher can implement more than one time and compare the results between proficiency levels. For this reason, we cannot generalize findings. Considering students' recommendations about WL and NT audio can also help for future research. For example, slow-paced audio can help students to comprehend the content. Many learners deal with fast-paced audio, and it can hinder students' ability to comprehend the content. As a researcher, teachers, or curriculum designers, we should minimize

EL and maximize GL for effective learning (Leppink et al., 2014). Effective teaching material must be reducing EL and guide learners' cognitive resources toward activities that help them build mental frameworks and make problem solving essentially, making learning more efficient (Chandler & Sweller, 1991).



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