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INSTRUCTION

AN INSTRUCTIONAL DESIGN FOR NEW COGNITIVE STRUCTURE
CONSTRUCTION IN NATIVE LANGUAGE ON SECOND LANGUAGE
LEARNING

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To Bilge

and Yiğit...

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LIST OF ABBREVIATIONS

CLT	Cognitive Load Theory
ELT	English Language Teaching
ESL	English as a Second Language
NP	Noun Phrase
PPT	PowerPoint Presentations
RC	Relative Clause
SOV	Subject+ Object+ Verb
SVO	Subject+ Verb+ Object

ABSTRACT

The aim of this study was to design a second language instruction through the construction of new cognitive structures in the mother tongue, and to determine its effect on the learner's cognitive load and achievement in learning complex structures. The study was undertaken in a public university in Istanbul with 79 prep school students and designed as a quasi-experimental study. A subjective cognitive load scale developed by Paas (1992), and an achievement test were utilized as the data collection tools. A covariance analysis (ANCOVA) was employed to determine student achievement between the experiment and control groups, the results of which produced a significant difference in favor of the experiment group. The results of the one-way ANOVA showed that there is a statistically significant decrease with regards to the cognitive load of the students in the experiment group. The efficiency of instruction was also measured utilizing efficiency formula developed by Paas and van Merriënboer (1994). The results corroborated the hypothesis that when designed in a way to construct new structures in the native language, thereby reducing the cognitive load, this instruction yields to an increase in the achievement of the students for the learning of complex structures in second language. The results call for more attention that the instructional design utilized as the treatment of this study is efficient on the academic achievement of the students in their learning.

Key Words: *Cognitive load; instructional design, instructional efficiency; Second Language instruction*

ÖZET

Bu çalışmanın amacı, anadilde yeni bilişsel yapıların inşası yoluyla ikinci dil öğretimi tasarlamak ve bu tasarımın öğrencinin bilişsel yükü ve karmaşık yapıların öğrenilmesindeki başarısı üzerine etkisini belirlemektir. Araştırma, İstanbul'daki bir devlet üniversitesinde 79 hazırlık öğrencisi ile yapılmış ve yarı deneysel bir çalışma olarak tasarlanmıştır. Veri toplama araçları olarak Paas (1992) tarafından geliştirilen öznel bir bilişsel yük ölçeği ve bir başarı testi kullanılmıştır. Deney ve kontrol grupları arasındaki öğrenci başarısını belirlemek için kovaryans analizi (ANCOVA) kullanılmış ve sonuçları deney grubu lehine önemli bir farklılık yaratmıştır. Tek yönlü ANOVA sonuçları, deney grubundaki öğrencilerin bilişsel yüklerinde istatistiksel olarak anlamlı bir düşüş olduğunu göstermiştir. Öğretimin etkinliği ise, Paas ve van Merriënboer (1994) tarafından geliştirilen verimlilik formülü kullanılarak ölçülmüştür. Çalışmanın sonuçları, ana dilde yeni yapılar inşa ederek bilişsel yükü azaltacak şekilde tasarlandığında, bu öğretimin, öğrencilerin ikinci dilde karmaşık yapıları öğrenme başarısında bir artışa yol açtığı hipotezini doğrulamıştır. Sonuçlar, bu çalışmanın tedavisi olarak kullanılan öğretim tasarımının öğrencilerin öğrenmelerindeki akademik başarıları üzerinde etkili olduğuna dikkat çekmektedir.

Anahtar Kelimeler: *Biliş yükü, öğretim tasarımı, öğretim yeterliği, ikinci dil öğretimi*

CHAPTER I

INTRODUCTION

It has not been an easy task for adult language learners to process language forms of a second language in order to produce and comprehend them without difficulty while using the complex structures of the target language. Among such complex structures, one that causes difficulties and raises the learners' cognitive load is the relative clause (RC).

Especially when the target language belongs to a language family different from the native language, this language structure (RC) creates more complexity in the process of learning. Learners who have Ural-Altaic languages as their mother tongue face some problems while mastering languages that belong to other language families such as English. While dealing with the problems related to such structural differences related to the native and target languages, adult learners end up with increased cognitive load, which is crucial to learn a second language.

According to the Cognitive Load Theory, when such new information does not fit into the currently available schemas, instructors should try restructuring existing schemas to help learners by calling in their available cognitive forces; so that less mental effort is spent for the acquisition of complex structures (Sweller, 1999). Therefore, they should design an instruction in such a way should be in alignment with learners' cognitive architecture (Kirschner et al., 2006). This was

considered as the starting point of this study through which the main conclusions were drawn depending on the results.

Therefore, underlying an instructional design theory, namely the Cognitive Load Theory, the present study tries to offer an instructional design which brings a solution to the problem of learners' mastering complex grammatical structures in second language learning. By reducing the cognitive load of the adult learners through construction of a new cognitive structure in working memory, the design employs a method that uses the previously organized material in the long-term memory; and help learners successfully process the relative clauses during second language instruction.

1.1. Focus of the Study

This research focuses on designing an instruction of English relative clause structures to adult second language learners in a Turkish public university setting; and tries to reduce the cognitive load of the students through construction of new cognitive structures whilst learning this complex structure and increase academic achievement in second learning education.

Cognitive load theory (Sweller, 2015) is an instructional design theory that utilizes our knowledge related to human cognition in order to design the instructional procedures. It reflects our cognitive architecture, or the way that we process information. During learning, information must be held in our working memory until it has been processed sufficiently to pass into our long-term memory.

The cognitive theories assert that human working memory has a limited capacity as a part of human brain architecture. Because of this, it is possible to process only a small amount of information because it may be overloaded by too many elements. This in return, reduces the effectiveness of processing. For this very reason, it is highly recommended that techniques that are used to reduce unnecessary amount of load in the working memory must be considered as one of the most important parts of instructional design (Paas and van Merriënboer, 1994). Such a design would be also utilized in second language learning especially when the complex structures are taught. It was, therefore, assumed that while instructing relative clause structures in English, the cognitive load of the adults might be reduced through construction of similar Turkish structures thereby facilitating a better learning experience and leading to academic achievement .

1.2. Statement of the Problem

According to human cognitive architecture theory, we have two main categories of knowledge: biologically primary and biologically secondary. Biologically primary knowledge is acquired easily without any effort as it is inherited at birth. On the other hand, biologically secondary knowledge is acquired with conscious effort and explicit instruction. Thus, learning a second language as an adult conforms to the structures and processes is associated with acquiring biologically secondary knowledge which actually has some general rules of instruction that can be applied to all stages of instruction. . There are also

numerous general rules which are applicable specifically to adult learning of second language. One of these rules is that instruction should be devised in such a way to decrease the excessive burden on working memory (Sweller, 2017). In addition, written or spoken instruction should be clear and explicit according to one of the main principles of CLT; the borrowing and reorganizing principle. This principle asserts that once knowledge is obtained, it is usually re-organised by combining it with previously stored information. Based on this principle, learning a second language requires instructors to explicitly present the grammar topics and rules, as well as the vocabulary of the target language instead of expecting learners to explore the information themselves (Kirschner et al., 2006).

With these in mind, this study aims to find out if this instruction designed to decrease the cognitive load of the adult learners by constructing new language structures in their native language help them organize their knowledge through the instruction and acquire it as a biologically secondary knowledge. In this way it is believed that this instructional design approach would enable adult learners to acquire the target grammatical structure (Relative Clause) successfully despite the structural differences between these two languages without much mental effort.

1.3. Significance of the Study

The purpose of this study is to determine the impact of an instruction that is specifically designed to decrease learner cognitive load through constructing new

language structures in the native language, and to lead to the acquisition of a complex structure in the second language.

Accepting the facts of the cognitive load theory (CLT), this study tries to purport that there could be alternative applications of language instruction especially when the native and the target languages belong to different languages such as Turkish and English to reduce the learners' cognitive load which complicates their learning process of this structure (RC). Therefore, it is hoped the study significantly contributes to the field and present new ideas for further applications of first language usage while learning complex structures that create cognitive load as well as recommending alternative ways of instructional design to reduce cognitive load.

1.4. Research Questions

There are three main questions to be answered in this study:

1. Does the instructional design efficiently yield to success of learners in learning complex structures through construction of new cognitive structures in their native language during second language education?
2. Does the instructional design significantly affect the cognitive load of learners in learning complex structures through construction of new cognitive structures in their native language during second language education?
3. Do cognitive load and success of students interact with each other to yield to efficient instruction?

1.5. Assumptions

The following assumptions were made regarding this study:

- The participants in the study freely provided the researcher with the ratings of subjective cognitive load scale regarding their mental effort.
- The delivery of the instruction was performed through distance learning settings. It was assumed that the conditions were equal for both the control and the experiment group during the online sessions of instruction.

1.6. Limitations

This research study is limited to its sampling method as a small number of subjects (N=79) who participated in this study. Additionally, this research had to be conducted in a particular prep school, which may create concerns related to validity and reliability of the data, and decreases the generalizability of findings.

Additionally, an achievement test (See Appendix E) specifically designed on relative clause structures, as well as a subjective cognitive load scale was utilized to collect data; it would be a better idea to support the findings with different measures of cognitive load, too.

1.7. Organization of the Study

Designed as quasi-experimental, this research was conducted in a prep school of a public university in Istanbul. The study consisted of 79 A level (beginner level) students who voluntarily participated in the online sessions of instructions. An

instruction was designed for the construction of new cognitive structures in the native language of the subjects for the second language learning. Its effect on cognitive load and achievement of learners was aimed to be measured. For this reason, the collection of research data included a subjective cognitive load scale developed by Pass in 1992, and an achievement test that was developed by the researcher. To investigate the effect of instruction on success achievement of these learners, a covariance analysis (ANCOVA) was used as well as the efficiency formula developed by Paas and van Merriënboer (1994) to measure instructional efficiency. To investigate if the cognitive load of the students significantly decreases after the treatment, the subjective cognitive load scale was utilized and the results were computed through one-way ANOVA.

1.8. Definition of Terms

Cognitive load: “mediating variable which transmits the effect of spatial contiguity as well as the moderating effect of spatial contiguity and prior knowledge on learning outcomes”

Mental effort: “amount of cognitive load invested during learning”

Instructional design: “process by which learning products and experiences are designed, developed, and delivered”.

Instructional efficiency: “teaching and managing a classroom in a way that yields desired outcomes while using no more time, effort, or resources than necessary”.



CHAPTER II

LITERATURE REVIEW

In compliance with the research goals and questions presented in the first chapter, this section will attempt to explain the language acquisition theories as well as language family differences, relative clause acquisition and related problems, cognitive load theory and its measurement.

2.1. Language Acquisition

With the growing requisition rate of having a second language all around the world, more people feel the need of learning a second language so as to meet the requests. To make the process of learning a language easier, different strategies of teaching and learning have emerged. However, when learning a language, the choice of language is also important. It is agreed by the researchers in the field of language acquisition that input is vital in order to have an accomplished acquisition (Ghorbani, 2011). For this very reason, one of the most controversial issues amongst linguistic theorists and psycholinguists is the manner in which human beings acquire their first and second language.

People use languages to understand each other and to be understood in different situations. So as to be able to use the language, it should be *acquired* first. At this point, the question how knowledge of language is acquired must be regarded as of paramount importance. Among many hypotheses, an explanation of this phenomenon was brought to the forefront by Noam Chomsky as the *innateness*

hypothesis. He proposes that if an inborn language faculty did not supervise the children while learning their first language, the process would not be that swift and smooth (Mitchell and Myles, 2004).

Along with this hypothesis, Mitchell and Myles (2004) also claim that “children’s quick and effortless learning of their mother tongue is made easier thanks to biologically endowed universal grammar”. This provides a hereditary design that circumscribes the shape of the future language, and also reveals the striking kinship among different languages of the world in many respects (Mitchell and Myles, 2004) p.55).

That is, in Chomskyan terms “all languages are very close to being identical, and almost fixed by the initial state” (Lightbown and Spada, 1993, p.52). Yet, it doesn’t necessarily mean that all the languages have the same grammar to some extent. Lightbown and Spada (1993) believe that when exposed to any language, children have the ability to get it easily in their earliest stages and adolescence, so that the same transmitted systems that are valid for English should be reckoned for the other languages as well.

According to Smith, (2004), regardless of the noticeable abundance of the languages around the world, we have only one language. For this reason, although we encounter a variety of different grammar, vocabulary and various structural usages, we have a sole theme that almost all the properties of languages drive from; they are innately given. This is quite true, yet the fact that we also tend to acquire a

second language because of the demands of the modern era leads us to endeavor more on the language acquisition issue.

Therefore, before looking into the relationship between the world languages and biological -as the cognitivists refer to- information we all have whilst processing languages in detail, we need to consider the important elements in acquiring languages. To understand in what way we acquire the second language, it is essential that we start with how we acquire our first language.

2.1.1. First Language Acquisition

According to Fromkin and Rodman (1997), children develop language the way they develop their abilities to do basic things in the first years of their lives such as sitting up, standing, crawling or walking. As if this isn't enough, they are not taught to do these things, many people never learn to read because they are not thought to do so but they all have a language (p.371). So, how is that possible?

Cook and Newson (1998) explain the process by emphasizing that at first, acquisition of the language is like the new-born baby who does not know any languages, which is defined as the initial (zero) state that includes the Universal Grammar (UG) itself, only. Later this turns out to be an adult mind, namely the native speaker who has the full competency of language "including the principles, parameters settings and lexicon" (p.50). Therefore, it is concluded that the

grammar is “a state of UG; the language capacity in our cognitive structure, and therefore it is not an outcome of UG” (Cook and Newson 1998, p50).

Added to linguists’ theories regarding first language acquisition, theories of human cognitive architecture emphasize the fact that we, as human beings, have expanded our knowledge of language by listening and speaking our mother tongue. Therefore, it is not very difficult for us to acquire such skills utilizing so much deliberate effort and *explicit instruction* (Sweller, 2017).

This sort of information, then, is called as the “biologically (or evolutionary) primary knowledge, an example of which is learning our first language”. As to Sweller (2016), our capability to learn our mother tongue might have expanded during a diverse time period, so we might have started to use different cognitive processes to analyze to recognize faces. In other words, while we are growing up, we also acquire the necessary knowledge in order to recognize faces and sounds of our mother tongue (Sweller, 2016, p.361). Thus, our biologically primary knowledge becomes of crucial importance when it comes to functioning; nevertheless, they are not included in the educational curricula no matter how important this sort of knowledge is (Sweller, 2016). Additionally, because of cultural and economic reasons, a community needs secondary knowledge, as a result of which institutions such as schools arise and fill the void amongst primary and the secondary abilities that we need to overcome the problems under certain circumstances which we go through in our lives (Sweller, 2016).

2.1.2. Second Language Acquisition

O’Grady and Archibald (2000) define the term Second Language Acquisition as the field of study, which explores how individuals develop language skills which are not their mother tongue. They claim that just like the children who are gaining the knowledge of their mother tongue have systematic grammatical structures similar to the adults, “second language learners, too, develop a systematic grammar, which is not necessarily native-like” (p.441). As O’Grady and Archibald (2000) also suggest it is not surprising that if First Language acquisition is the study of what people already know, then “*what people try to learn should be defined as the acquisition of the Second Language*”.

Looking from the cognitive perspective, “mastering a second language as a grown-up corresponds to the acquisition of biologically secondary knowledge through linguistic structures and processes” (Sweller and Sweller, 2006).

Additionally, cognitivist approach considers “second language acquisition as a cognitive process which necessitates learners’ consciously and explicitly spending time and effort on instructions given by the teachers” (Sweller, 2017). It should be noted that “it perfectly exemplifies the secondary knowledge acquisition to master a second language as an adult”; and, therefore, mastering on the verbal instructions, learning sub-skills and communicate necessitate a deliberate attempt of the adult learners and specific guidance of teachers. (Sweller, 2017).

2.1.3. Problems in Second Language Acquisition

In a study conducted by Ellis and Sagarra (2011), it was investigated why adults have a harder time learning a new language than children, as most learners never achieve native level competency in another language, and they focused on learned attention to cues and performed two experiments for searching the cause. According to Selinker's theory of inter-language, it is claimed that "learners construct their own language policy different from their native language in some ways and second language systems" (1974). Selinker calls it "*inter-language* which has been designated as the intermediate status of the learner's language system between his first and second language". In this way we can better understand the learners' problems and to help them improve themselves while they are mastering the target language (Selinker, 1974). According to Selinker's theory (1974), most essential central processes are responsible for the language transfer and overgeneralization.

The first of these processes are called *Language transfer*. First Language transfer (native transfer) is the impact that the learners' first language experiences while they are expertizing in the target language (Selinker, 1974). This influence can be anticipated in several ways throughout second language learning process. First Language is considered as "a source of learner-errors [...]" and whose influence is

named as negative transfer, yet, when first language helps construct correct language items in the foreign language, it is called positive transfer” (Selinker, 1974) .

The second most essential process is the overgeneralization, which is a language- learning process where words that need unusual/irregular modifications or associations/connections are wrongly added to standard ways of changing or linking words, which is still considered a natural part of this language-learning process (Selinker, 1974).

From a cognitivist perspective, as Housen and Simoens (2016) summarized in their article, “difficulty in mastering Second Language can be undertaken through subjective and or holistic ratings”, according to Silva and Roehr-Brackin (2016); by reflective methods, according to Cerezo, et. al., (2016); and through objective measurements of time spent on task, according to Godfroid (2016) (as cited in Housen and Simoens, 2016). There can also be “psycho-physiological measurements such as brain activity” as Morgan-Short, et. al., (2010) asserted; or “eye movements” as suggested by Godfroid and Uggen in 2013 (as cited in Housen and Simoens, 2016). To sum up, a language function is more complex than any other because we as single language learners spend more time and intellectual effort in a specific learning environment to be interpreted and learned (Housen and Simoens, 2016).

Looking at the issue from the same perspective, there can be “subjective, learner-centered or (intra)individual difficulties” in learning complex structures

during the Second Language acquisition; such difficulties related to the target language result from the student's individual sufficiency and ability. In other words, a difficulty for a Second Language learner may be change from learner to learner. As Housen and Simoens (2016) indicated in their studies, the most important learner factors could be:

- differences that arouse from individual cognitive abilities, especially in mastering the language (Carroll, 1981; Robinson, 2005; Yalçın and Spada, 2016),
- the capacity of the working memory (Daneman and Carpenter, 1980; Juffs and Harrington, 2011; Tagarelli, et. al., 2016),
- implicit and transactional learning ability (Granena, 2013; Short, et.al., 2014; Suzuki and DeKeyser, 2015; Tagarelli et al., 2016; Yalçın and Spada, 2016).
- learner's prior first language knowledge or another previously learned second language (Putta, 2016),
- total Second Language proficiency and development in Second Language (Pienemann, 2005),
- some socio-affective and character traits (being highly motivated, extraverted, or anxious; Dörnyei, 2005; Robinson, 2002).

(as cited in Housen and Simoens ,2016)

Such variations between individual learners are key concepts regarding the difficulties experienced in Second Language learning. Owing to the fact that they comprise the challenge, the learners continue to experience them in learning their second language.

Additionally, for all language learners, certain language features are more cognitively taxing, independent of their specific learner characteristics, which represents objective, or “*inter-individual*” difficulty becoming the second main cause of learning difficulty; which is in line with the *notion of structural complexity*” described by Housen and Simoens (2016) before. As was stated by these researchers, fundamental intricacy of language characteristics or structures relies on what kind of grammatical theories as generative, typological, or cognitive linguistics a learner develops.

Looking at the problems encountered in Turkey regarding second language acquisition, we realize that although we can detect various reasons for above-mentioned problems in second language acquisition process in Turkey, we cannot find any claims that try to explain the failure with a cognitivist perspective. For example, in a study conducted by Gedikoğlu in 2005, “most remarkable problems in ESL are considered as absence of professional teachers and technological devices [...and] the position of the native language in expertizing a foreign language needs to be highlighted”.

Additionally, Çelebi (2006) studied “the Turkish policies in foreign language education” and proposed that what we encounter as a problem during the instruction of native language might be the main reason for the problems we experience in the second language instruction. He also emphasized the fact that “course-books and numerous materials that are used do not go along with the approaches Turkish culture, way of thought and learning styles have”. In a study conducted by Altun (2006), computer technologies in Turkish foreign language education system was examined. The results revealed that the chief issues stated were not only about the computers or inadequate software usage, and or the absence of equipment in the learning processes, therefore, it was suggested that in order to solve the problems related to language learning encountered, we had to deal with the problems from the learners’ point of view (Altun, 2016).

There is another research conducted by Akalın and Zengin (2007) which deals with the student perceptions on second language learning in Turkey. According to their findings, there were two major issues with second language education: First, it is “the absence of realistic objectives and second, it is to waste time on teaching grammar rules instead of working on other language skills”. In addition to these studies, through the teachers’ viewpoint, Karcı and Vural (2011) published a report on teaching English in multi-graded classrooms. Study findings revealed that teachers of elementary schools held negative views related to English language teaching although the learners had positive attitudes towards English. In addition, it

was added that the instructors did not find themselves enough eligible to teach English.

Another study by Aydın and Zengin (2008) tried to identify the importance of student anxiety in language education in their study. According to their conclusions, anxiety is one of the main elements during foreign language instruction. The research showed that not only the exams and negative assessment but also the behaviors of the instructors, learners' various learning styles and cultural differences were found to be the other causes for language learning anxiety (Aydın and Zengin, 2008). In addition to these studies, Büyükyavuz and İnal (2008) performed a study on problems in foreign language teaching. They classified the problems according to the data they received from 132 in-service teachers and found out that many classes at public schools are crowded and filled with students with mixed proficiency and they are not supervised, and assessment of the language is done through either traditionally designed tests using multiple-choice format or as projects and portfolios.

Additionally, in a study carried out by Kızıldağ (2009) three main problems, related to “institutional, instructional and socio-economic problems” that language instructors at public schools experienced during foreign language instruction were scrutinized. Kızıldağ, 2009 emphasized that “over-crowded classrooms the heavy workload assigned to them negatively affect the language instructors as well as the schools that fall short of extra materials or technological utilities such as projectors

and computers”. In another study, the main challenges in language instruction at the university level were analyzed by Gökdemir (2010). It was found out in the study that “English lessons did not include practice-based activities and focused more on mostly theories, lessons were generally teacher-centered rather than learner-centered, the classroom environment was not suitable for foreign language education, there was a lack of supplementary materials in English” (Gökdemir 2010). In addition, Çetintaş (2010) conducted a research in which she found that “the most important problem in language teaching in Turkey was the lack of sustainability of the education, course books and curriculum”. Moreover, other reasons for the failure were the inadequate number of teachers graduating from ELT programs/schools and their lack of in-service experience. Finally, Öz, et. al., (2015) examined the “willingness the EFL learners have in order to start communication and maintain talks in English”. Their study revealed that learners should be given opportunity to interact in a stress-free classroom environment during second language instruction.

2.2. Language Family Differences

According to linguistic sources, there are 142 different language families named in the world. Six of these, emerge as world’s leading language families. Along with the other 136 language families, there are also special groups for constructed languages, pidgins, deaf sign languages, lingua franca, mixed languages, creoles, language isolates and unclassified languages in the genetic classification

system. For this very reason, it might create some complexities with regards to structures in learning a language if the mother and the target languages belong to different language families, especially when the Second Language learners are instructed the “rules of grammar that explain or describe forms, functions, linguistic components; and when their first language grammar rules differ from those of the target language components , then the complexity of the target language features increases” (Housen and Simoens, 2016).

2.2.1. Linguistic Characteristics of Ural-Altaic and Indo European Language Families

Knowledge of language includes learning syntactical entries. Although there are many criteria such as vocabulary, morphology, and lexicon that help us compare the linguistic features of Ural-Altaic and Indo European language families, it is the syntax that shows us how these language families are strikingly different from each other.

To begin with, “the syntax of the Altaic languages has been remarkably stable and resistant to foreign influence, and that their lexicon is less distinct than the languages in other families” (Binnick, 1998). Altaic languages use linguistic items that can construct “phrases with the preceding noun, rather than prepositions, which form phrases with the following noun, and neither do they have articles” (Binnick, 1998).

In Altaic languages, the basic word order is subject+object+verb (SOV).

Added to this, modifiers such as adjectives and adverbs generally precede what they modify, while quantifying terms and auxiliary verbs follow the specified nouns like *pencils many* or *many pencils*. Just like it is so in morphology, syntactic structure is also left-branching. As Binnick (1998) exemplifies “word order is not inverted, for example in questions; rather those are formed either by use of a question particle or by use of a question word, as in Turkish” -*Mert nerede-dir?*- -*Where is Mert?*- (literally: *Mert where-is?*). Binnick (1998) also emphasizes that verb affixes mark the passive and causative structure and combine them in *passive-causative* or *causative-passive forms*.

Additionally, “Altaic languages have no relative clauses as such, participial constructions being used instead” (Binnick, 1998), such as Turkish *toplantiya katılan kadın* _the woman (who is) attending the meeting (literally: meeting- to attending woman). Also, “subordinate constructions such as subordinate clauses are much preferred to paratactic (coordinate) ones such as independent clauses”; for instance, the following structure --*having gotten up, he left*-- is more common than -*he got up and left*-- (Binnick, 1998).

There is also some variance in word order to show some emphasis or flow of information in the discourse. Finally “grammatical agreement is rare: quantifying words do not agree with the noun (two-three woman), and there is no agreement of the adjective with the noun in gender, case, or number” (Binnick, 1998).

On the other hand when we look at some characteristics of Indo-European Languages we see syntactically that the “subject of an intransitive verb received the same case marking as the subject of a transitive verb; agreement in case, number, and gender between adjective and noun; and the use of singular verbs with neuter plural subjects were originally collectives and grammatically singular” (Binnick, 1998). The word order in the Indo-European Languages was flexible, but basic declarative sentences typically had the structure subject+object+verb (SOV).

2.2.2. Differences between Turkish and English

The syntax organization is not entirely arbitrary. There is a central word called *a head* in the phrases, and other words are supposed to modify the head. Heads and modifiers may occur in regular patterns. In neutral clauses of English adjectives precede their head noun *beautiful lady shoes*, and relative clauses follow their head noun --*the car that he bought*--. Languages such as Turkish, are more regular than English, and both adjectives and relative clauses precede their head noun. Direct and indirect objects of different kinds follow the verb in neutral clauses.

In other languages, as Binnick (2019) explains, “the verbs and modifiers are arranged in patterns that put all the modifiers either before or after the verb”. For example, the verb is preceded by all the modifiers in neutral clauses and comes last in written Turkish.

According to Özçelik (2006), although Turkish RCs are similar to English RCs from a functional point of view, they are different from a syntactic and

processing point of view. The same argument has already been proposed for similar languages like Japanese and Korean (eg. Murasugi, 2000, as cited in Özçelik, 2006). Also, as Binnick asserts (1998), it is very hard to identify where words begin and end while listening to a language you do not know such as German, Finnish or Turkish. However, it is not so hard to identify the gaps between the words or the meanings of particular words in a written text in one of these languages. These are the core elements regarding the syntactical differences of Turkish and English languages that are centered at the heart of this study.

2.3. Relative Clause Acquisition and Related Problems

According to Gass and Lee (2007) it is assumed that there are “two types of RCs: gap-filler relatives and gapless relatives. Gap-filler relatives are more syntactically converted while gapless relatives are semantically converted”. Gass and Lee (2007) and Eckman et al. (1988) examined two different the projection instruction areas, which tried to gauge the acquisition theories of ESL learners while acquiring the RCs in the second language. According to both studies “maximum generalization following instruction on RC types lower on the accessibility hierarchy, and in most languages, four basic types of restrictive relative clauses can be distinguished” (Gass and Lee, 2007; Eckman et al., 1988), examples of which are as follows:

(1) The dog that is white is sitting.

(2) The dog that the girl is chasing is brown.

(3) They saw the bird that is red.

(4) They saw the dog that the cat is watching.

Studies that have been conducted about the comprehension of RC by adult native speakers demonstrated that object relative clauses are more vulnerable to errors than subject relative clauses. In one of such studies, subjects were asked to paraphrase sentences with relative clauses and it was observed that object relative clauses were more prone to errors when paraphrased. Izumi (2003) focuses on three hypotheses which examine relative clause acquisition;

NPAH (Noun Phrase Accessibility Hierarchy Hypothesis): That theory focuses on the noun phrase, which can be the subject, object or any verb agreement of the main clause. It has some kind of hierarchy hypothesized: --subject > direct object > indirect object > oblique object > genitive > object of comparison--.

PDH (Perceptual Difficulty Hypothesis): That theory suggests that brain's center embedding system is interrupted while making RC sentences, so it cause some perceptual difficulties. Thus, "the RCs in subject position are more difficult to use than RCs in object position" (Izumi, 2003).

SOHH (SO Hierarchy Hypothesis): It is kind of a mix of previous two hypotheses. It suggests a relationship among four kinds of RC sentences which show an alteration in their positions in the matrix clause. It also has a difficulty order predicted in the article, which follows as: --object-subject > object-object > subject-subject > subject-object--.

In past three decades, many psycholinguistic research have focused on the processing of head-initial RCs. It has been demonstrated that the head nouns in head-initial relative constructions function as fillers that search for gaps in sentence comprehension. Since the filler appears prior to the gap in these head-initial RCs, it is reasonably argued that “once the head noun is encountered, the parser initiates a search for the gap, following the Active Filler Strategy” (Frazier and Clifton, 1989).

Across languages, relative constructions vary regarding whether the head noun precedes or follows the RCs. Languages with head-initial RCs, such as English, appear with the head nouns preceding the RCs. Languages with head-final RCs such as Chinese and Japanese appear with the head nouns following the RCs (Frazier and Clifton, 1989). With such typological diversity regarding head positions, a natural question is whether head-initial and the head-final relativizations observe similar structural representations and derivations.

The processing of head-final RCs has received increasing attention in the past decade, particularly regarding the comprehension of RCs in Chinese (Hsiao and Gibson, 2003; Hsu, 2008; Hsu and Chen, 2007; Lin and Bever, 2006, 2007). In languages with head-final RCs, the gap precedes the filler. Due to the filler following the gap, languages with the same basic word orders but opposite head positions such as English and Chinese turn out to demonstrate opposite distance patterns. In Chinese, RCs with subject extractions appear with longer distances between the filler and the head.

An important reason why it is difficult to define head-final RC is due to diverse forms of prenominal modification in these languages. In Chinese, prenominal modifiers of diverse form – bare adjectives and a wide range of DE-phrases which bear diverse internal structures.

“In languages with head-initial RCs, there has been a general agreement that subject-extracted RCs are processed with greater ease than object-extracted RCs” (see Lin 2006, for a typological review). We can understand that although head-final RCs are prenominal and superficially resemble prenominal adjectivals, they contain gaps that are located at specific structural positions. It was obvious that prenominal relative clauses have unique processing characteristics and should not be taken as bare adjectivals or subordinate clauses.

2.3.1. Previous Research on Relative Clause Acquisition

That the diversified forms of prenominal change in these languages make head-final relative clauses difficult to characterize is another important reason. In Chinese, prenominal modifiers of diverse form – bare adjectives and a wide range of DE-phrases which bear diverse internal structures. The proof provided in this article evidenced that prenominal relative clauses have unique processing characteristics and should not be taken as bare adjectivals or subordinate clauses. Some linguists made researches to examine acquisition problems faced by the First Languages of other language families.

Alotaibi (2016), for example ran tests that showed that advanced learners made less mistakes in tests than Intermediate Learners did. As the results indicated, OS was easily constructed by the subjects because only the NP (Noun Phrase) would be replaced by the relative pronoun. However, OO relative clauses were problematic to the subjects since they require relative pronoun fronting (Alotaibi, 2016).

According to Chien-Jer Charles Lin (2008), relative constructions vary regarding whether the head noun precedes or follows the RCs across languages. Languages with head-initial RCs, such as English, appear with the head nouns preceding the RCs (Hsu, 2008). Languages with head-final RCs (e.g., Chinese, Japanese and Korean) appear with the head nouns following the RCs. With such typological diversity regarding head positions, a natural question is whether head-initial and the head-final relativizations observe similar structural representations and derivations.

Prentza (2012) also tried to identify problems Greek learners faced while learning English relative clauses. Because of the diverse forms of prenominal modification in these languages, it is hard to define head-final relative clauses. The proof provided in his article evidenced that prenominal relative clauses have unique processing characteristics and should not be taken as bare adjectivals or subordinate clauses (Prentza, 2012). Greek learners choose different parameters when they are constructing restrictive relative clauses. English restrictive relative clauses are

different from Greek restrictive relative clauses in that their syntactic features and formations are diversified (Prentza, 2012).

Schumann (1980) examined some longitudinal speech data from Spanish learners of English as a Second Language and found out that “one subject whose inter-language was considered to have fossilized at the beginning stage used SU relatives almost exclusively compared to other relative types” (as cited in Schumann, 1980) .

These studies indicate that learners at the initial stage of RC development are less likely to use RC forms in natural production which are considered more marked/defined in the NPAH hierarchy. Also it seems that RCs acquisition in “European languages follow the predictions of the NPAH”, whereas the acquisition of RCs in Japanese does not necessarily follow the hierarchy (Schumann, 1980).

When we look at the studies carried out in Turkish settings, not much research can be found related to the English relative clause acquisition of Turkish learners. Ekmekçi (1990), for example, investigated the acquisition of RCs in Turkish children by using imitation and a production task. In the imitation task the children repeated the language items after the subject and object relative clauses. As a consequence, this experiment revealed that there was a remarkable association between the age and the achievement level. In addition, in all age groups the performance in object RCs is higher than the subject RCs. On the contrary, in the production task, the children performed better in subject RCs than object RCs.

Ekmekçi (1990) claimed that “better performance in object RCs in the imitation task could be due to similarity between the past tense morpheme and the object relativizing particle”.

L1 speakers also preferred to use these morphologically less complex structures over relative clauses as well as the L2 speakers in a study conducted by Özge, et. al., (2009). They concluded that, the children also employed avoidance strategy especially for object RCs in their L1 acquisition in Turkish (Özge, et. al., 2009). Their study attempts to identify that “even the advanced L2 speakers of Turkish are still struggling with the complex morphology and syntactic movement involved in RCs” (Özge, et. al., 2009).

Özcan (1997) investigated “the effect of RC type in combination with the grammatical role in the main clause” in younger children when compared to older children. “The outcomes showed a notable influence of age on comprehension; the children’s performance enhances with age, but there was no considerable effect of RC-Type or RC-Role” (Özcan, 1997).

In another study, Kükürt (2004) compared comprehension methods of 41-to-52 month old children with that of adults with Broca’s aphasia. Contributors were shown with three images and requested to select the one described by the sentence they heard. Both children and Broca’s aphasics showed high chance performance in subject RCs although below chance performance in object RCs. It was hypothesized

that the participant may lack the agreement morphology that checks the genitive case as a subject marker in object RCs.

Ordem (2016) revealed that “English uses certain stranded prepositions in zero relative clauses, whereas Turkish uses the same suffix in non-subject relative values constructions”. It is also understood from the study that “Turkish Word order in non-subject relative clauses affects the acquisition of zero relative clause in English” (Ordem, 2016). At this point, it becomes crucial to understand how such complex structures, especially the relative clauses, create a load for the learners with regards to cognition.

2.4. Role of Cognitive Load in Language Learning

According to CLT (Sweller, 2017), effective learning is promoted when a student’s cognitive capacity in a particular area/domain is not surpassed. If, at their awareness level, “the cognitive load of a lesson contains unnecessary units and components for that learner, then, working memory cannot hold the load and cannot easily send it to long term memory” (Sweller, 2017). Consequently, schemes are not built and there would be no instruction.

CLT was developed to address the two questions: what is learned, and how is it learned? According to Sweller (2017), “academic learning requires explicit instruction that facilitates the acquisition biologically secondary information”. When sufficient information is stored, then, its constraints vanish; the output increases; and

the purpose of the instruction can be said to have been accomplished (Sweller, 2017).

2.4.1. Definition of Cognitive Load

To explore the ways our brains process the information and generate the models of thinking and learning has been widely studied in the field. Actually, the known background information about cognitive science comes from mid-20th century psychologists' attempts to create a model. What cognitive load emphasizes is how human beings interact with the world while learning. This approach determines which part of information is processed and interacted by analyzing cognitive load theory (CLT) and background information. The results of analysis can help us to create more effective learning environment.

CLT focuses on the possibility of decreasing extraneous, in other words external and secondary, cognitive load in order to make people learn by using their all available cognitive forces and capacity. In CLT, the theorists think that if we can reduce the cognitive load of our brains, then our learning capacity will increase. Thus, a devoted learning will come up as a result.

A question may arise such as *Why do we need new methods in CLT?* The researchers explain the need for new methods to manage cognitive load (van Merriënboer and Sweller, 2005). It means that tasks we take on in real life have a high amount of complexity that the old instructional methods of CLT are now

insufficient for solving those issues so, scientists try to develop new methods in order to cope with cognitive load in human brains.

Long-term memory capacity of human beings is enormous over which we base our intellectual abilities (Sweller and Chandler, 1994). Apparently, working memory is not where our intellectual ability reside. A schema is defined as “a cognitive construction which categorizes information according to according to how it will be dealt by the working memory.” (Sweller and Chandler, 1994). Additionally, it was proved that “they lower cognitive load as they allow us to ignore most of the information impinging on our senses and these numerous schemas can be ignored because of our own schemas” (Sweller and Chandler, 1994). The enormous complexity of the details provided by *a tree* in our working memory cannot be stored, however; there is no need to do so due to the tree scheme existing in long term memory. To sum up, while coping with higher mental tasks, our cognitive structure basically comprises of a strong long term memory, a limited working memory, and the learning methods, schema storage and automation that utilize information kept in long term memory to decrease the load on working memory.

In the degree of their components, subjects that people need to know vary. Some areas might be composed of highly interacting components that place a high cognitive load. As Sweller and Chandler (1994) put forward, there might be some other areas with a variety of elements with low degrees of interactivity, which leads to limited cognitive load. Also, each and every step in the learning process may be

treated as “a component of the overall learning integrity to multiply a denominator” (Sweller and Chandler, 1994). The difficulty here is that it is hard to learn such elements in *isolation*, since when considered, none of them can make a *mathematical sense* on their own.

CLT is an instructional theory that has *instructional* applications. According to this theory, the primary focus of the instruction is to construct a broad knowledge store efficiently in the long term memory. However, as Sweller (2017) suggested, when we have limited working memory because of the narrow limits of change principle, then we have an obstacle to achieving our aims. In order to avoid that obstacle, the borrowing and reorganizing principle provides the best way. Therefore, the information should be transferred to a learner directly. All applications of the theory include some ways to help reduce the load of working memory.

“Natural information processing systems such as biological evolution and human cognition organize information used to govern the activities of natural entities” (Sweller and Sweller, 2006). According to these researchers, those five principles underlie natural information processing systems:

1. The information store principle

- a. All natural information processing systems include a central information store. Long-term memory is the central information store for human cognition and similarly, a genome is the central information store for evolution.

2. The borrowing and reorganizing principle

- a. The information in a central information store generally comes from others. For example, we listen to other humans, so we learn words from them. In other words, we borrow the knowledge of words from other humans' long-term memories. If you observe children, you will see that they imitate others because borrowing is the main way of gathering information. And also, while learning mathematics or other lessons we prefer worked examples because of the same reason.
- b. We don't exactly borrow information. While or after borrowing, we think and reorganize the information.
- c. We can observe the borrowing and reorganizing principle in biological evolution too. When the next generation is reproduced, it borrows genetic information from the parent generation.

3. The randomness as genesis principle

- a. The borrowing and reorganizing principle reorganize rather than create new information. But sometimes new information requires. In that case, natural information processing systems need some distinct ways to create new information.
- b. Humans randomly create new information during problem-solving. If a successful solution can be found, it will store in long-term memory.

c. Biological evolution uses the structurally same procedure to create new information. New information is created by random mutation. As in the case of problem-solving, because mutations are random, most of the mutations are not successful.

4. Narrow limits of change principle

a. If natural information processing system must deal with novel information, the information must be limited. Because combinations of that information have to test for effectiveness and if the information consists of more than a few elements, there will be too many combinations. Testing so many combinations requires a lot of time and therefore it won't be possible to find the right combination for a time restricted system. Consequently, the randomness as genesis principle causes narrow limits of change principle.

b. Due to the narrow limits of change principle, working memory has limited capacity while dealing with novel information. Similarly, because of the same principle, the epigenetic system restricts mutations.

5. The environmental organizing and linking principle

a. Working memory is limited because there is no executive that decides how to use or organize the novel information. But if we have the necessary knowledge that can act as an executive, new information can be used or organized by knowledge. In that case, there is no need for limits of working memory and a lot of information can be processed. Also, a huge amount of

organized information in long-term memory can be used by working memory without any restriction and we can adapt to the environment. Working memory that uses organized information and hasn't any limits is called as long-term working memory.

b. Similar to long-term working memory, the epigenetic system controls the genetic knowledge which stored in DNA and provides appropriate phenotypes in order to adapt to a particular environment.

The theory assumes that “learning consists of an accumulation of large amounts of domain specific knowledge in long term memory and therefore learners must learn the particular linguistic forms that are” (Sweller, 2017).

At this point, as to Sweller (2017), it is of high importance to realize that through the direct introduction of instruction, learners could better gain the domain specific knowledge to improve the impact of the borrowing principle. During the learning process of reading in a specific area, examples of particular textual knowledge in that area is required. Thus, the principles of cognitive load theory are invaluable in showing the program designers the way that lead the learners to the desired outcomes of the learning processes.

2.4.2. Types of Cognitive Load

CLT is the major theory of cognition main doctrine of which is the relation between short and long-term memories. Working memory has limited capacity and can be overloaded easily. Overloading prevents learning. In order to get the most

effective learning overloading must be avoided. If learning performance is higher than expected, it's claimed that an instructional strategy is more effective. Cognitive load has two important dimensions; mental load and mental effort. The manner in which the individual elements of a task engaged with others is referred as the element interactivity. As Ayres (2006) claims, "expertise develops, element interactivity (intrinsic load) decreases as the interactions become learnt and incorporated into schemas".

Intrinsic cognitive load: "Each information component hold a natural cognitive load", which is considered as a heap forced by learning a component and its *relata*. It tends to decrease to repetition segments at first, but we can still find the traces of cognitive load, there (Van Merrienboer and Sweller, 2005).

According to Korbach, Brünken, and Park (2017), "complication of the learning task and results from element interactivity determines the intrinsic cognitive load". Additionally, "the number of interacting elements of knowledge belonging to the learning task characterizes the element interactivity and when the learning task is more complex, the intrinsic load will be higher" (Korbach, Brünken, and Park, 2017).

Extraneous cognitive load: According to Van Merrienboer and Sweller (2005), "redundant details, deficient guidance, inappropriate requests of conveyance and helpless utilization of media helps would all be able to add to extraneous cognitive load". Chandler and Sweller (1992) claim, for instance, that there is "split-

attention effect over cognitive load that takes place if cross-referencing sources are sent from different places”. When a diagram or a table and its informative text are given on different pages, the need to recall the content of each page increases the cognitive load. PPT slides, for example, or reading from such visuals also splits the learners’ attention. Also looking up the texts on different pages or reading the data from tables constantly, may affect the attention a learner put on the task. This is called the Modality Effect which might put a distance between the material and the learner. So it may be avoided by providing materials with all required information in one place in the necessary learning materials or split between different sensory systems for simultaneous delivery. Additionally, “it is important to avoid redundant presentation of identical material in different locations, if the modality effect is to be at function” (Van Merrienboer and Sweller, 2005).

Germane cognitive load: It is how much load we spare to process the applicable information while learning activities which are created to construct schemas (Sweller, Van Merrienboer, and Paas, 1998). Germane cognitive load is imposed by the examples studied at the correct stage. “Typing texts and or letters, for example help learners fluently perform the action thanks to the schema automation, and time that is devoted on this is effectively used by imposing germane cognitive load. The most important thing here is to provide the learners with relevant learning activities” (Pass and Van Merrienboer, 1994).

2.4.3. Applying Cognitive Load in Teaching and Learning Processes

The potential outcomes of CLT over educators, their training and preparing the curricula are not easily maintained. As was asserted by Collingwood, (2010), “there are many alternatives in education which actually do not have a solid background”. Among all these, for instance, there is “the Discovery Model of Experiential Learning”. Although the model necessitates extensive background knowledge and yet is preferred for learners with little or no field-related information, it is used a lot especially in problem solving activities (Collingwood, 2010). Shared projects might demand inter-student contact, however; students might learn mistakes mutually in the event of lack of sufficient guide in such a case.

Furthermore, when a project is shared, avoiding learning might not be worrisome for some students since it will be covered by someone else. “The best way to deal with the course design is to find out how much previous information there is available with the learners. Next step would be to introduce a minimal amount of new information where the subject is new. Then a clear instruction should be given, and accurate sources should be provided in a way increases visual attention at a specific point as clarifying the visuals verbally. Additionally, the learners should not be required to read and understand while they are looking at the visual aids and listening to the explanation” (Sweller, 1999).

Sweller (1999) also claims that “where there is prior knowledge, refer to it and include it to aid recalling existing relevant schemata and use worked examples with

incremental student participation. Move to less guidance with advancement until advanced learners have minimal guidance but directed practice”. At this stage the aim is to elicit schemata automation so that information can be applied to other problem-solving contexts. In short, cognitive load theory helps students understand the use of tenses and prevent the overload. It is hard to comprehend materials that contain high element interactivity; therefore, establishing cognitive schemata which embodies the interacting elements is the best way to encourage comprehension.

Additionally, while learning biologically secondary information, a second language, for instance, the cognitive architecture should be taken into close consideration by the learners. It is emphasized by Sweller (2017) over and over again that teachers should be aware of the fact that “this type of information should be handled by the new learners, in a limited-capacity, limited-duration working memory prior to their transfer to an unlimited-capacity, unlimited-duration long-term memory”. It is an undeniable fact that there are “numerous general rules of instruction that can be applied to almost all categories of biologically secondary information and some rules that can especially be applied adults’ second language learning processes” (Sweller 2017). One of them is to organize the instruction in a way that lowers the redundant working memory load (Kirschner et al., 2006). It has to be in line with the borrowing and re-organising principle which emphasizes that instructors should “explicitly present the grammar and vocabulary rather than expecting learners to induce the information themselves in second language

learning . In other words, novice learners should not try to induce the information by using the randomness-as-genesis principle.” (Kirschner et al., 2006).

One another rule is the quantity of biologically secondary knowledge given at the time must not surpass the working memory limits. “Instruction should be specifically designed to lower working memory load, for example, when learners need to have vocabulary translations provided, as they frequently do, provide translations close to the original, they should not be required to split their attention between novel vocabulary and the text” (Kirschner et al., 2006).

2.5. Measurement of Cognitive Load

Assessment of cognitive load in the most possible valid and reliable way is a hotly debated question among researchers. It is mostly agreed that cognitive load can be measured under two main categories: by subjective methods and objective methods.

Subjective techniques seem to be the mostly preferred technique in current research. They use rating scales to report the expenditure of experienced effort or capacity. In other words they are utilized to assess cognitive load based on the assumption that subjects are able to “introspect on their cognitive processes and to report the amount of mental effort expended” (Paas et al., 1994). On the other hand, the second category of assessment, is the objective methods such as dual-task measures or neuro-physiological. They measure cognitive load by using task- and performance-based techniques. It is essential to use objective task characteristics and

performance levels to obtain information on mental effort in this type of measurement.

In addition to these categories, there is a so-called third category that has been developing in recent years. Psychophysiological techniques, as they are called, such as pupillary diameter, and brain potentials are also utilized to gather information on mental effort and cognitive load. Since it was proved that when cognitive functioning is altered, physiological functioning also changes, these techniques are at use when the need urges. (Paas et al.,1994).

2.5.1. Paas Subjective Cognitive Load Scale

Objective and subjective cognitive load scales consist of rating scales which makes the administration process practical as well as reliable. One of the scales is the Paas Scale which was developed in 1992 by Paas. This uni-dimensional rating scale developed by Paas (1992) presents subjects with only one item and asks them to rate how much difficult they think they have with regards to a task, on a 7- or 9-point Likert scale, ranging from *very, very low* to *very, very high*. This scale focuses on the mental effort, that can be explained as “the aspect of cognitive load which alludes to the cognitive capacity that is actually allocated to accommodate the requirements of the task; hence, it tends to be considered to mirror the real cognitive load” (Paas, 2003). Therefore, according to the scale, the subjects indicate “their perceived amount of invested mental effort into a numerical value” (Paas, 1992).

This rating scale has shown good internal consistency, which is one of the reasons why it is preferred a lot in the field.

Moreover, the concurrent validity of the rating scale is shown by its sensitivity to detect variations in task complexity and intrinsic load during task performance (Paas et al., 1994). For these reasons, since “the mental effort scale can assess overall cognitive load that comprises intrinsic, extraneous, and germane cognitive load” (Brünken et al., 2003), it has been utilized very often.



CHAPTER III

METHODOLOGY

This chapter provides an extensive description of the research design of the study and outlines the rationale for the research methodology followed in the study.

3.1. Introduction

This research aims to determine the effect of an instructional design over the cognitive load and, thereby, the achievement of adult learners of English. An instruction regarding relative clauses was designed and applied to the control and experiment groups to see if the learners' cognitive load was reduced and their achievement in learning the structure increased. The research had a quasi-experimental design, which utilized quantitative data collection tools, namely, an achievement test and the Paas subjective cognitive load scale (also referred as Paas mental effort scale). The results of the research were analyzed utilizing descriptive and inferential statistics.

It is of paramount importance to report that at the design stage, the study was to be conducted as an in-class experimental research. Yet, owing to the pandemic disease, the implementation of the data collection procedures had to be altered. As a result, the experiment was redesigned in line with the newly implemented distance education setting, and then conducted under these circumstances.

3.2. Design of the Study

The study was designed as a quasi-experimental study. Quasi-experimental designs are commonly employed in the evaluation of educational programs when random assignment is not possible or practical (Gribbons and Herman, 1996) and when the efficiency of an intervention is sought for. This study employed a control and an experiment group and a pre-post test administration, a quasi-experimental research design was implemented. The design of the research can be seen in Figure

1.



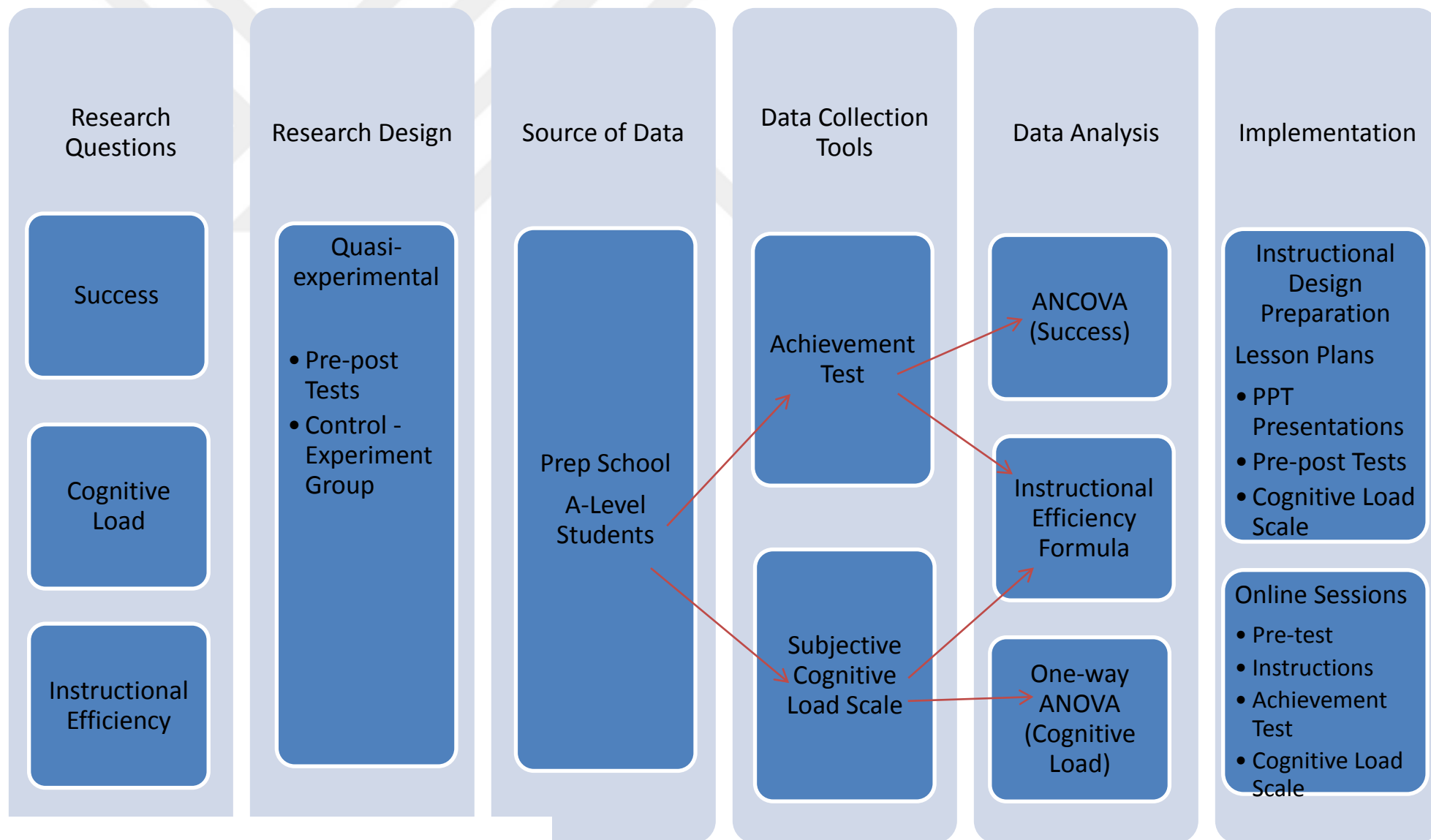


Figure 1 The Research Design

The study consists of four stages as shown in Table 1. At the first stage, a pre-test was conducted in both experiment and control groups, which was subsequently followed by the implementation of a regular instruction in the control group, and a newly designed instruction in the experiment group as the second stage. As for the third stage, a post test was applied as the achievement test of the study. In the final stage, the mental effort scale develop by Paas (1992) was implemented in both groups to receive the necessary data with regards to cognitive load.

Table 1 *Stages of the study*

<i>Stage</i>	<i>Experiment group</i>	<i>Control group</i>
1	Pre-test administration	Pre-test administration
2	Treatment	Regular instruction
3	Post-test administration	Post-test administration
4	Implementation of the mental effort scale	Implementation of the mental effort scale

The research had a quasi-experimental design, the dependent variables of which is the achievement and cognitive load of the students, while the independent variable is the instruction designed accordingly. The data were obtained through implementation of the mental effort scale and administration of an achievement test to the experiment and control groups before and after a treatment which is the designed instruction. Throughout the process, only the subjects in the experiment

group received a treatment through the specifically designed instruction of relative clause unlike the subjects in the control group who received regular instruction. As the inferential statistics, covariance analysis (ANCOVA) was utilized to investigate any difference in the pretest and posttest performance scores of the experiment and control groups. Pretest results were used as the covariate variable to compare the post-test results of the experiment and control group, and to investigate the effect of treatment over the performance of students.

Additionally, the results of the achievement test were used as students' performance scores to identify their achievement. To determine if the cognitive load of the subjects reduced or not, Paas subjective cognitive load scale (1992) was used and analysed through one-way ANOVA. Together with the results that were obtained from the achievement test, these results were also utilized in the Paas and Van Merrienboer formula (1994) to measure the instructional efficiency.

3.3. Subjects

Table 2 *Participants*

	Gender		
	Girls	Boys	Total
Experiment group	16	24	40
Control group	21	18	39
Total	37	42	79

This study was undertaken at an English prep school of a public university in Istanbul in the spring semester of 2019-2020 academic year. English program of this particular university offers around 25 hours of intensive English language courses within a week depending on the starting level. The programme is administered in three different levels: A level (beginner), B level (intermediate), and C level (upper intermediate) in relation with the Common Europeans Framework (CEFR) standards. Learners in this program are the ones who could not succeed in the English language exam administered at the start of each academic year and were placed into the A-level classes according to the exam results. Since the complex structures had not been yet taught to the A level students as they start from scratch, the target of the study focused on this level of the students to receive reliable data.

Since the study was carried out in distance learning environment due to the pandemic, the subjects of the study were not randomly assigned to the groups, instead, they voluntarily signed up to the online sessions themselves as the sampling method of the study. All the subjects had had an opportunity to familiarize themselves with distance learning conditions with their teachers beforehand because the School of the Foreign Languages had already switched to the means of online learning. The ids and passwords of the experiment and control group Zoom sessions were announced to the prep students through mentor teachers of A level classes, and subjects chose their sessions on the basis of their own wishes and constituted the sample of the study. In total, 79 students participated in the study in the spring

semester of 2019-2020 academic year. There were 16 girls and 24 boys in the experiment group (N=40 in total), and 21 girls and 18 boys in the control group (N=39 in total) coming from different departments of the university. All the participating subjects in the research study had Turkish as their first language.

3.4. Data Collection Instruments

In this research, the data were collected through an achievement test developed by the researcher to evaluate the student achievement. Additionally, Paas mental effort scale was utilized to measure the cognitive load of the subjects and to determine the efficiency of instruction so as to test the asserted hypotheses of the research.

3.4.1. Achievement Test

To serve the purpose of the study, an achievement test was prepared by the researcher after a well-documented review of the literature (See Appendix E). As is suggested by Baysal (2001), to increase the reliability and validity of data collection instruments used in language learning area, it is important to include different types of activities. Especially in the assessment of relative clause structure, it is highly recommended that three different data elicitation tasks should be employed (Baysal, 2001). Based on this, activities in the test included three different sections, in which students were to produce relative clause sentences. Below in Table 3 can be seen the distribution of the test items in total.

Table 3 *Distribution of Achievement Test Items*

	Number of items	Content
Section 1	6	Sentence Combining
Section 2	6	Translation (from Turkish to English)
Section 3	4	Picture choosing
Total	16	

As Table 3 reveals, there are six items in each of the first two sections of the test, and four items in the third section. In order to elicit data from the students, a sentence combining task, a translation task and a picture choosing task were preferred in the three sessions of the test. In total, there are 16 items in the achievement test of the study.

Section 1 included a sentence combining activity in which two English sentences were written by the students using a relative clause structure. The purpose of this task was to see if the students were able to produce the correct structure while combining the sentences. In Section 2, students were required to translate six sentences from Turkish to English constructing a relative clause. Finally, in the third section, students were supposed to choose the correct picture among three alternatives in each item according to the given English sentence. Here the purpose was to identify if the students understood the word order of the sentence and chose

the correct picture accordingly. The four sets of pictures were adapted from a study Özçelik (2006) conducted in relation with relative clause structures.

To test the content validity of these items in the achievement test, expert opinion was received from five instructors who held a PhD degree in ELT. They were asked to rate their agreement to the usefulness of the items to be used in the test on a five-point scale ranging from “(1) strongly disagree” to “(5) Strongly agree”. The results per section are shown below in Table 4:

Table 4 *Descriptive Statistics for the Achievement Test Items Section 1*

	N	Minimum	Maximum	Mean	Std. Deviation
item 1	5	5	5	5,00	0,00
item 2	5	5	5	5,00	0,00
item 3	5	4	5	4,20	,45
item 4	5	5	5	5,00	0,00
item 5	5	4	5	4,20	,45
item 6	5	4	5	4,40	,55

Regarding the sentence completion activity, the experts reported that items 1, 2 and 4 were very well designed sentences with an average of 5,00, as is seen in Table 4. The table also reveals that items 3, 5 and 6 were also considered as good items that help measure the relative clause usage as the rest of the items as their average was 4,20 and 4,40 respectively.

Table 5 reveals the descriptive statistics for the items in the second section which deals with translation of Turkish sentences to English using relative clause.

Table 5 *Descriptive Statistics for the Achievement Test Items Section 2*

	N	Minimum	Maximum	Mean	Std. Deviation
item 7	5	4	5	4,20	,45
item 8	5	5	5	5,00	0,00
item 9	5	4	5	4,20	,45
item 10	5	4	5	4,40	,55
item 11	5	4	5	4,20	,45
item 12	5	5	5	5,00	0,00

For the translation task, it was reported by the experts that items 8 and 12 were the most useful ones with a mean of 5,00, which were followed by item 10 with an average of 4,40. According to Table 3, item 7, item 9 and item 11 received an average of 4,20 out of 5,00.

Table 6 reveals the descriptive statistics for the items in the last section of the achievement test, which is picture choosing. This section has four different sets of pictures as the main items. In each item, there are three pictures that require the construction of a relative clause structure. An English sentence which depicts one of the pictures appears on the screen after the pictures are seen. According to what they understand from the given sentence, subjects try to find the correct picture.

Table 6 *Descriptive Statistics for the Achievement Test Items Section 3*

	N	Minimum	Maximum	Mean	Std. Deviation
item 13	5	5	5	5,00	0,00
Item 14	5	5	5	5,00	0,00
item 15	5	5	5	5,00	0,00
item 16	5	5	5	5,00	0,00

When Table 6 is examined, it can be seen that this section itself received the highest average when compared with the other sections of the test. All the items of the picture choosing activity were considered very useful by the experts as they received an average of 5,00 out of 5,00.

To assess the inter-rater reliability of agreement, Fleiss Kappa statistics was administered across the achievement test items. Fleiss Kappa statistics is used to analyse the inter-rater reliability when there are two or more raters and categories for nominal and ordinal data as it provides “the highest flexibility of the available reliability measures among the raters for such data” (Zapf, et. al., 2016).

Since the study involved ordinal data and five experts rating the achievement test items, the Fleiss Kappa statistics was applied (Zapf, et. al., 2016). Fleiss' kappa was found to be $(\kappa)=.79$, $p=.00$, which represents a good strength of agreement with a 95% confidence interval from .63 to .94.

Table 7 *Results for the Achievement Test Inter-rater Reliability*

Overall Kappa						
	Kappa	Asymptotic Standard Error	Z	P Value	Lower 95% Asymptotic CI Bound	Upper 95% Asymptotic CI Bound
Overall	,79	,079	9,98	,00	,63	,94

Examining the results of the statistical analyses, it can be concluded that the achievement test items could measure the students comprehension of relative clause word order. Therefore the content validity and the reliability of the test purports that the items are at highly acceptable levels.

A pilot study was also implemented with twenty nine students to check the internal consistency reliability of the achievement test items; and to see if the instructions were applicable. For this reason, the Kuder–Richardson Formula 20 (K-R 20) was applied to the responses to identify the reliability of the achievement test items which had dichotomous choices as true and false. The Kuder–Richardson reliability coefficient of the students’ responses in the pilot study was found to be 0.77, at first. Items 4 and 5 in Section 1, and items 7 and 10 in section 2 were deleted from the original items list because of the time concerns in online lessons. When these items were deleted from the list, the K-R 20 reliability of the test increased to 0.80. The breakdown of the responses of the students can be seen in Table 8 below.

Table 8 *Breakdown of the Responses to Pilot study*

	Incorrect answers	Correct answers	Total
item 1	4	25	29
item 2	8	21	29
item 3	4	25	29
item 4	17	12	29
item 5	15	14	29
item 6	10	19	29
item 7	12	17	29
item 8	8	21	29
item 9	6	23	29
item 10	11	18	29
item 11	4	25	29
item 12	9	20	29
item 13	5	24	29
item 14	1	28	29
item 15	3	26	29
item 16	3	26	29
item 17	1	28	29
item 18	1	28	29
item 19	6	23	29
item 20	1	28	29

The main study was, then, initiated; however, the administration of the data collection process was interrupted due to the pandemic disease. After receiving consent form the thesis jury and the school administration, the study was started again and the necessary changes were made in the way the instructions were to be conducted. Both the instructions and data collection materials were transferred to the distance learning education environment from the actual class environment. As a result, another pilot study had to be conducted with eleven students to see if the instructions and data collection tools were also *applicable* in an online class environment. The data collection procedure was, then, completed accordingly.

3.4.2. Subjective Cognitive Load Scale

Subjective scales are mostly preferred methods that are used in the measurement of cognitive load in instructional design research. There is a variety of uni-dimensional and multidimensional scales, that have been developed and utilized to assess cognitive load. Yet, such scales were applied randomly utilized to find possible differences amongst the three cognitive load types. However it has been proved by previous research that subjective ratings have a better potential to differentiate between three cognitive load types when compared to task based ratings.

To measure the cognitive load of the students during the instruction of relative clause structures, the nine-point Likert scale developed by Paas (1992) was utilized (See Appendix F). Although it is a subjective scale based on subjects' own

judgments, the mental effort spent by learners is accepted as a valid and reliable estimate of cognitive load by the experts (Paas and Van Merriënboer, 1994). For this reason, the subjects were asked to rate how much mental effort they thought they spent while doing the exercises during the instruction. They selected one of the nine options upon the completion of the study: “ (1)very very low mental effort, (2)very low mental effort, (3)low mental effort, (4)rather low mental effort,(5) neither low nor high mental effort, (6)rather high mental effort, (7)high mental effort, (8)very high mental effort, and (9)very, very high mental effort” (Pass, 1992). The mental effort rating ranging from 1 to 9 was, therefore, collected from each participant.

3.5. Data Collection Procedure

The data collection procedure of this study can be divided into two main stages: preparation of the materials; and implementation process as is seen in Table 9 below.

Table 9 *Stages of the Study*

Stage	Activities
1	Preparation
	Preparation of the instruction, activities, achievement test materials and mental effort scale
	Preparation of the PowerPoint slides of instructions
	Pilot study of the instruction and the achievement test materials and mental effort scale
2	Implementation
	Scheduling zoom sessions and distribution of the meeting ids and passwords
	Implementation of the treatment and regular instruction
	Administration of the pre-test and post-test and the mental effort scale

At the preparation stage, learning and testing materials were developed for the study. The items of the achievement test, and the mental effort scale were prepared and checked by five instructors with a PhD degree in ELT field. Upon their feedback, and validity and reliability analyses, the achievement test items were rearranged accordingly. The practicality of the mental effort scale was also checked through a pilot study during this stage. Additionally, an instruction was designed for the experiment group and was transformed into PowerPoint presentation in order to reach the same standards across classes/sessions during implementation. Another instruction was designed for the control group with the guidelines and materials provided by the Curriculum Committee of the prep school. It was also transformed

into a PowerPoint presentation. Both instructions were submitted to the approval of two English instructors teaching at the prep school.

A pilot study of the achievement test and the mental effort scale was also conducted with twenty nine students in an actual classroom environment in order to remove irrelevant questions and vague wording in the achievement test as well as to see the applicability of the instruction. After it was assured that the achievement test, the instruction and their related activities were ready together with the mental effort scale, it was preceded to the next stage.

As seen in Table 10, the implementation stage of the data collection procedure can be examined in three sub-stages. First of all, before the instructions were conducted, another pilot study with 11 students was carried out to see if the instructions were also applicable in an online class environment. Then, the Zoom sessions were scheduled and announced to the A-level class teachers who were requested to share the meeting id and the passwords with their students. The students joined the instructions at the appointed times on a voluntary basis.

In the meanwhile, two different instructors agreed to conduct one experiment and one control group instruction in order to avoid researcher influence over the study. A separate Zoom session was practiced with them related to the administration of the achievement test, instruction, its activities and the application of the mental effort scale. Finally, two of the sessions in each group were conducted by the researcher herself while one of the sessions in each group was carried out by

a different instructor to eliminate the possible bias in the process that may arise because of the researcher being the instructor at the same time. The instructions were conducted six times in total within the same week, three for the experiment group and three for the control group. The steps taken during the implementation stage are provided in Table 10 below.

Table 10 *Stages of the Implementation*

Stages	Activity
1	Application of Pre-test to both groups
2	Implementation of the treatment with the experiment group Traditional instruction with the control group
3	Application of Post-test to both groups
4	Application of Mental Effort Scale

Data obtained from the achievement test were collected at the beginning and the end of the zoom sessions during which the designed instructions were conducted. The Zoom sessions were started after the subjects joined the session. They were informed that they were participating in a PhD study and that their answers would be used for this research and be kept confidential. The subjects were also acknowledged that the session was being recorded and that they were allowed to leave the session if they were not content with the conditions before the process started. What the subjects were expected to do, and the outline of the lesson plan was explained before the instruction began.

After receiving the consent of the subjects, the instructions started with the presentation of the pretest slides which were followed by the instruction of relative clause sentences and related activities in both groups. The sessions were designed as four 40-minutes-lessons, at the end of which the post test was presented. The students were asked to note their answers at the pretest and posttest stages, and send their answers simultaneously to the e-mail account of the instructor as a photo. At the same time, the instructor was able to check whether the participant could send the photos of the answers to the pretest and post test questions. Finally, three groups of Zoom sessions (6 groups of Zoom sessions in total) for experiment and control groups were conducted to obtain data.

In order to obtain data regarding the mental effort the subjects made, the Paas scale was presented to the subjects as the final stage of the study. They were asked to indicate how much effort they thought they spent while answering the achievement test questions. Their ratings were also included in the photos sent to the instructor.

Student responses were evaluated by two instructors from the prep school who are familiar with the process according to a detailed answer key (See Appendix G). Errors such as wrong article usage or spelling mistakes were not taken into consideration as long as they did not affect the relative clause structures syntactically during the process of evaluation of the answers received. For each test

item answered correctly, subjects were assigned one point, whereas zero point was given in case of a wrong answer. The student answers were double checked.

3.5.1.Treatment

In both groups, a lesson plan was prepared, and the instruction was carried out using PowerPoint slides in a Zoom session as a means of distance learning. The content of the materials having been prepared for each group changed as the essence of the study focused on the efficiency of the instruction carried out throughout the process. Yet, the reinforcement activities that were presented to the students at the end of each instruction were the same types of activities and exercises in both groups so as to eliminate any extraneous variables. In so doing, it was also aimed to obtain equality between the control and the experiment groups in terms of practice opportunities. In other words, to better understand how efficient the instruction was, and to decrease the possibility of giving privilege to any group through practices with specially designed activities, the students in both groups were provided with the same methods of teaching and sets of exercises after the instruction was completed.

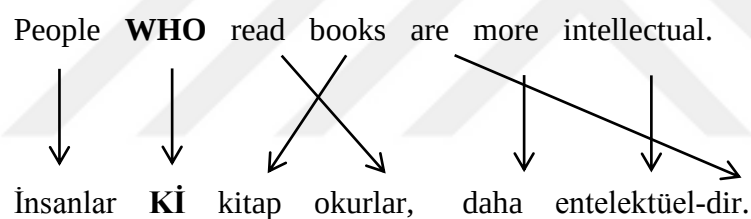
Both the lesson plans and the presentations were checked by two different instructors who work in the English prep school of the university for more than 20 years. It was made sure that the plans and the presentations were suitable with the levels of the students of the prep school before the process started.

Experiment Group: One of the most important aspects of this study is the instruction that was designed to scrutinize any changes in the learners' cognitive load and to determine their performance in learning English. With this purpose in mind, the instruction was designed in a way that required learners to construct complex cognitive structures that are non-corresponding in their native language such as relative clauses, and hereby simulate similar syntactical structures in the target language. So that it was aimed to identify if the instruction was effective on the achievement of the learners and could reduce their cognitive load during second language learning. A lesson plan (See Appendix A) was prepared and its content was presented via PowerPoint presentation (See Appendix C).

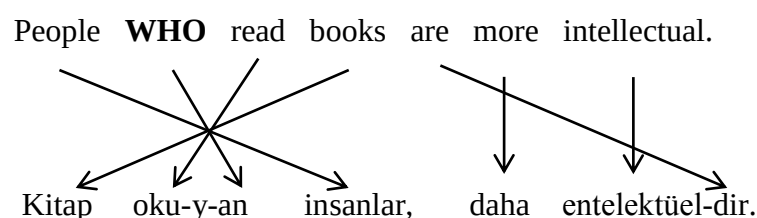
According to the lesson plan of the experiment group, the instruction started with a brain storming activity that helped students to increase their awareness about the fact that their native language and the target language belong to different language families (See Appendix A). By emphasizing the word orders and structural differences, the instructor gave examples in Turkish and asked students to make sentences. The aim here was to increase students' awareness that relative clause structures are not used in Turkish as they are used in the English language. Hence, the first step was to prepare the students for the construction of a new cognitive structure by using the structures that were available in the native language of the students. In other words, the instructor tried to help students get used to making sentences in Turkish first, so that they would understand in what kind of situations

relative clause structures are used in Turkish first, and then they would be able apply this in constructing English relative clause sentences.

In order to help students familiarize themselves with the structure of the target language, the most similar syntactical unit, namely *-Kİ-* structure in Turkish relative clause, was preferred. Although this usage is not morphologically sufficient and not commonly used in Turkish, it syntactically corresponds to English relative clause structures. In order to activate the schemata in the Turkish learners' mind and construct the new cognitive structure, examples of this usage are presented to the students. One example from the lesson plan is given below:



As can be seen in the example, the word order is the most similar when the relative clause is started with *-Kİ-* structure. However, it is mostly taught as in the example below:



When the relative clause is presented in the traditional way, it becomes even more complex due to the word order, therefore, the lesson plan was designed accordingly and the instructor presented the relative clause structures by giving such examples in the PowerPoint slides (See Appendix A and C).

Control Group: The materials of the control group included a lesson plan and PowerPoint slide presentations (See Appendix B and D), which were prepared by the researcher and checked by two more instructors. The lesson plan and its content were designed as was suggested by the Curriculum Committee of the School of Foreign Languages. At the beginning of each term, the committee prepares the materials using different sources and provides the instructors with the plan and the materials. Then depending on the dynamics of their classes, instructors prepare their own daily plans with materials given by the committee. In this case, the instruction of the control group was designed in line with the traditionally adapted curriculum and samples were extracted from the sources that had been offered. The outline and the examples chosen were approved by two instructors of the Prep School. The content of the lessons plans for both groups are provided in Table 11.

Table 11 *Content of the Lesson Plans*

Outline	Experiment Group Lesson Plan	Control Group Lesson Plan
Lesson 1	Pre Test	Pre Test
	Lead in	Lead in
	Introduction	Introduction
	Summary	Summary
Lesson 2	Activity 1 Sentence Combining	Activity 1 Sentence Combining
	Activity 2 Picture Choosing	Activity 2 Picture Choosing
	Wrap up	Wrap up
	Evaluation	Evaluation
Lesson 3	Achievement Test	Achievement Test
	Mental Effort Scale	Mental Effort Scale
	Answer Check	Answer Check

Table 11 shows the breakdown of the lesson plans of the experiment and control groups. Here it is important to note that although the instruction changed in content, the activity types and method of instruction in the plan were the same as well as the application processes in both groups. Moreover, the subjects were given the practice sheets which included further exercises right after the instruction, and these activities also had exactly the same exercises so as not to bring any biased effects to the forefront (See Appendix A and B).

3.6. Data Analysis

This research study employed quantitative data collection instruments, namely an achievement test and a mental effort scale. Descriptive analyses were made for all responses of the subjects and processed through SPSS (version 22). Inferential analyses, namely ANCOVA, was conducted to determine if there was a meaningful difference between the achievement test scores of the subjects in control and experiment groups with regards to their achievement in learning the relative clause structures. In order to investigate the cognitive load of the students after the treatment, the subjective cognitive load scale was utilized and the results were computed through one-way ANOVA.

To gauge the instructional efficiency, a computational approach that was developed by Paas and Van Merriënboer (1994) was utilized. The formula “combines measures of mental effort with task performance to compare the mental efficiency of instructional conditions” (Paas and Van Merriënboer, 1993). The formula of instructional efficiency is then:

$$E = (P - R) / \sqrt{2}$$

(E) represents the relative instructional efficiency of a condition, while (P) is the performance measure that come from the achievement test scores of the students, and (R) is the mental effort scores that are obtained from the Paas mental effort scale. The important point here is that the performance and the mental effort measures should be converted into as z-scores to be able to calculate the

instructional efficiency. The result obtained from this formula identifies the efficiency of instructions carried out in each group and helps us compare their efficiency over the academic performance and achievement of students.

3.7. Reliability and Validity of the Research

Reliability and validity are by far the most fundamental test attributes.

Reliability refers to how consistent test scores are from one to another (Bachman et.al., 1996). Validity, on the other hand is often characterized as the degree to which a test measures what it aims to measure. Prior to all subsequent analyses for the research questions, a series of statistical operations were conducted to maintain reliability and validity of the main research instrument. Figure 2 shows the statistical analyses performed for the achievement test utilized in this study.

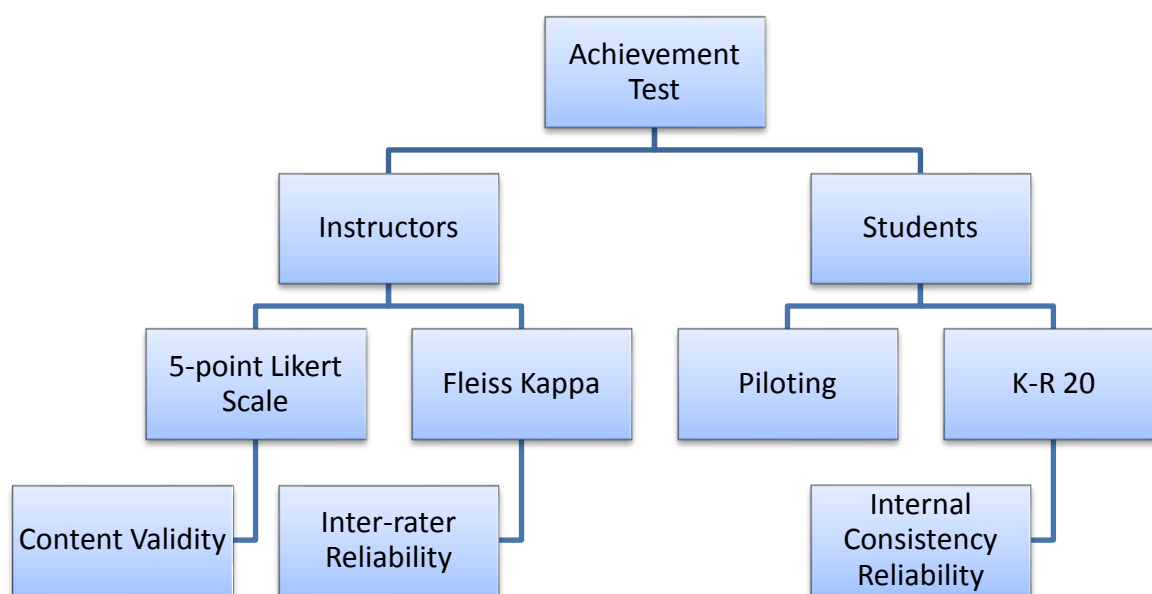


Figure 2 Reliability and Validity Operations for the Achievement Test

To test the content validity of these items in the achievement test, expert opinion was received from five instructors who held a PhD degree in ELT. They were asked to rate their agreement to the usefulness of the items to be used in the test on a five-point scale ranging from “(1) strongly disagree to (5) Strongly agree”. All the items (N=16) of the achievement test were accepted as *very useful and applicable* by the experts as their averages ranged between 4.20 and 5.00.

Reliability estimates were also calculated for the achievement test. The data obtained from the instructors was quantitatively analyzed performing Fleiss Kappa through SPSS 22. The inter-reliability of the test was found to be $(\kappa)=.79$, $p=.00$. Besides, a pilot study was implemented with twenty nine students to check the internal consistency reliability of the achievement test items. The data obtained from the piloting study was analysed with Kuder–Richardson Formula 20 (K-R 20) to further observe the relationships among the items measuring the constructs targeted in the achievement test. The reliability coefficient of the students’ responses in the pilot study was found to be strong with a K-R 20= 0.80. As the results show, it can be said that the main research instrument maintained its validity and reliability.

CHAPTER IV

RESULTS

This chapter presents the findings of the study discussing the three research questions this research set out to examine in relation to the possible effects of instructional design on academic achievement and cognitive load of the subjects, and their interaction during second language instruction.

4.1. Outline of the Study Design and Procedure

The purpose of this experimental study is to explore the impact of first language usage over the instruction of relative clause structures to see if this intervention decreases learner cognitive load and leads to successful acquisition of this specific part of speech. In order to identify any differences between the experiment and control groups in terms of achievement, an achievement test was used in the study. It was administered to the A-level students of a prep school of a public university through online lessons. The results obtained from the test were computed through covariance analysis (ANCOVA). Additionally, to collect data about the cognitive load of the students in the experiment and control group, Paas subjective rating scale was administered before and after the instruction. The results received from the ratings were used to gauge if the designed instruction caused any decrease in the learners' cognitive load. To examine if the instruction that was designed with this purpose yielded any increase in the achievement of these learners while they are studying relative clauses used to determine if the instruction was

efficient on student learning. To calculate this, the results were replaced into the formula of instructional efficiency.

4.2. The Results for Research Question 1

This research question aimed to reveal if the designed instruction yield to any achievement in students' academic performance during the second language learning process. The research question was:

‘Does the instructional design efficiently yield to success of learners in learning complex structures through construction of new cognitive structures in their native language during second language education?’

To see if there was a significant difference between the achievement scores of the experiment and control groups and that the treatment had a positive effect over student achievement, a covariant analysis was conducted. First of all, it was checked if the assumptions regarding the sample were met. It was seen that the groups were normally distributed and homogeneity of regression was statistically non-significant, which meant that ANCOVA could be conducted. Table 12 shows the ANCOVA results of the post test scores of the experiment and control groups according to the corrected pre-test scores of the students.

Table 12 *ANCOVA Results of the Achievement Test Scores*

Source	Type III Sum of Squares	df	Mean Square	F	p	η^2
Pretest	473,43	1	473,43	89,18	,00	,54
GROUP	52,91	1	52,91	9,97	,00	,12
Error	403,45	76	5,31			
Corrected Total	933,47	78				

The pre test scores were considered as the shared variable, and post test scores were the dependent variable. As the statistics indicate, there was a statistically significant difference ($F_{(1,76)} = 9.97$ $p < .05$.) between the post test scores of the students in the experiment and control group in favor of the experiment group. In other words, the results of the covariant analysis revealed that the experiment group was more successful in learning the target structures when compared with the control group.

4.3. The Results for Research Question 2

The second research question of this study focused on the identification of any reduction on the cognitive load of students who received an instruction which benefitted from the syntactical correspondence between the two languages in its design. With this purpose in mind, the second research question was designed as follows:

‘Does the instructional design significantly affect the cognitive load of learners in learning complex structures through construction of new cognitive structures in their native language during second language education?’

It was hypothesized that by constructing new cognitive structures in the first language usage, students would require the least mental effort to process the complex structures while learning a second language. To examine if the cognitive load which is reduced through the instruction designed, one-way ANOVA was conducted, the results of which can be seen in table 13.

Table 13 *One Way ANOVA Results of the Cognitive Load Scale*

		Sum of Squares	df	Mean Square	F	Sig.
Cognitive Load Scale	Between	142,91	15	9,53	5,56	,00
	Within	107,94	63	1,71		
	Total	250,86	78			

When the data from subjective rating scale were analyzed, the results produced statistically significant differences between the two instructional formats used in the experiment and control groups, as $F_{(15,63)}=5.56$, $p=.00$. According to Table 13, the p-value obtained indicated that students in the experiment group spent less mental effort in the learning of complex structures in English when compared to the students who received regular instruction in the control group.

This finding supported another hypothesis of this research. Establishing syntactical similarity between the native and the target languages that belong to different language families required significantly less mental effort than learning through the traditional instruction. In other words, construction of a new cognitive

structure, namely *-Ki-* in Turkish, allows students to spend less mental effort and learn English relative clause better. This finding is consistent with previous research which showed that by decreasing extraneous cognitive load, students can learn by using their all available cognitive forces and capacity during second language instruction.

As a result, the results obtained indicated that students who spent less mental effort by means of the designed instruction, significantly outperformed the students in the control group who received regular instruction.

4.4. The Results for Research Question 3

The main aim of research question 3 was to identify the instructional efficiency of the program and the interaction between the cognitive load of the students and their academic success. Therefore, the third research question was designed as:

‘Do cognitive load and success of students interact with each other to yield to efficient instruction?’

Although the covariant analysis (ANCOVA) proved that the treatment administered in the experiment group was statistically significant, another analysis using the efficiency formula was conducted to further identify if reduced cognitive load also played an important factor together with the performance on the efficiency of instruction.

To measure the instructional efficiency, the efficiency formula that was developed by Paas and Van Merriënboer (1994) was utilized. As was stated earlier, this very formula “combines measures of mental effort with task performance to compare the mental efficiency of instructional conditions” (Paas and Van Merriënboer, 1993). The formula of instructional efficiency is as follows:

$$E = (P - R) / \sqrt{2}$$

In order to find out the efficiency of the instruction, cognitive load ratings (R) and performance (P) scores are converted into z-scores and then calculated. This formula allows us to eliminate any threat which might be posed by self-confidence or subjective comfort levels of the students rather than their cognitive load. As Kalyuga et al., (1998) explain, “if learners rate the mental effort of a task as low, but perform well on the test (high efficiency), it means that they are rating cognitive load, not just self-confidence” (as cited in Kablan and Erden, 2008). When the data obtained from the cognitive load scale and the post-test scores as the performance of the students were placed in the formula, the results for the experiment and control groups are as follow as shown in Table 14.

Table 14 *Instructional Efficiency Results*

Efficiency	Formula	Result
Experimental group	$\frac{0,24 - (-0,19)}{\sqrt{2}}$	0,31
Control group	$\frac{(-0,25) - 0,18}{\sqrt{2}}$	-0,31

As shown in Table 14, when the necessary data were calculated, efficiency for the experiment group was found to be $E = 0,31$ for the experiment group, while the efficiency was $E = -0,31$ for the control group. This meant that “when the performance z-score is higher than the rating z-score, then instructional efficiency is positive, and when the performance z-score is lower than the rating z-score, then instructional efficiency is negative” (Kalyuga et al., 1998, as cited in Kablan and Erden, 2008). The results were demonstrated in Figure 1.

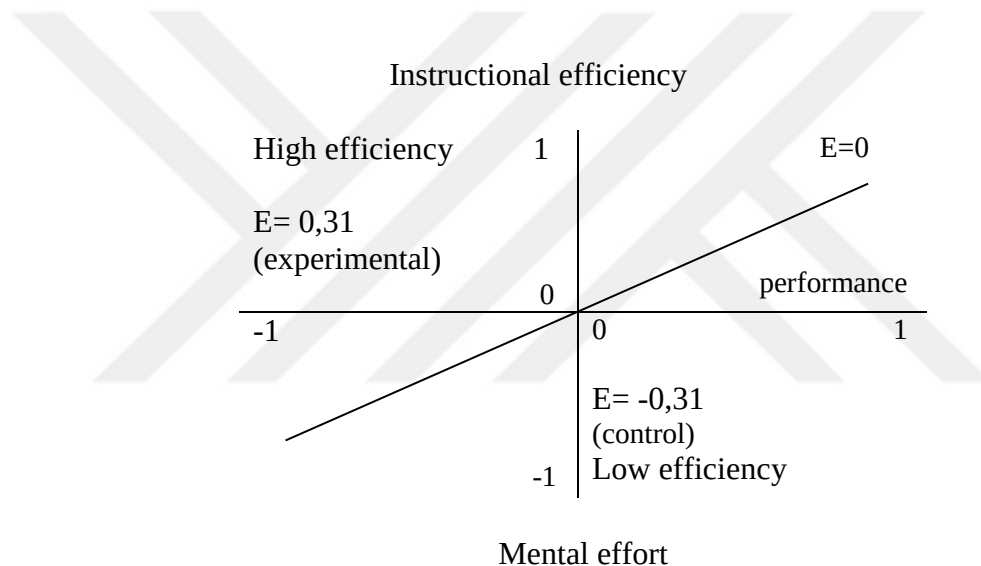


Figure 3 Instructional Efficiency for the Experiment and Control Group

Figure 3 presents the result of instructional efficiency measurements in accordance with mental effort and test performance scores of the students in the groups. Based on the results, the experiment group is located in the high-efficiency region which means that it has relatively lower cognitive load and higher performance. Unlike the experiment group, the result for the control group is located in the low-efficiency region with more cognitive load and lower performance.

As a result, it can be concluded that the instructional design utilized as the treatment of this study is found to be efficient on the achievement of the students in their learning. The efficiency of the instruction could also be associated with reduced cognitive according to the results. So, the study reveals that when the students are presented with an instruction that deliberately tries to reduce their cognitive load by reconstructing the available cognitive structures in their minds through native language, then, the students' performance could outweigh the performance of those who receive traditional instruction for a complex structure, namely the relative clause.

CHAPTER V

DISCUSSION AND CONCLUSION

This research had two aims; to design an instruction that help the learners reduce their cognitive load through already existing schemata in their minds as native language constructions; and to examine if the very same instruction yielded any increase in the academic achievement of these learners while they are studying relative clauses. Therefore, an instruction was designed using the subjects' native language in the teaching of relative clauses as the treatment of the study. It was aimed to use the previously organized material in the long-term memory; and to construct a new cognitive structure in working memory of the learners in the experiment group to process the relative clauses during the instruction. In the control group, the regular instruction for the relative clauses was applied in a way that the curriculum of the School of Foreign Language provided. The lesson content of both groups were prepared visually using PowerPoint format in order to maintain equality between the groups (See Appendix A and B for the lesson plans).

To analyze the performance of the learners, an achievement test was designed by the researcher and expert opinion was received. As for the instructional efficiency over the cognitive load of the students, a mental effort scale developed by Paas (1992) was utilized. The results obtained from the achievement test and the

Paas mental effort scale were statistically analysed to investigate any effects of the instructional design over the success and cognitive load of the learners.

5.1. Conclusions

This research study was based on a main research motivation that has been hotly debated in the second language education field: Adults have a harder time learning a new language than children, and most learners never achieve native level competency in another language (Ellis and Sagarra, 2011), but why is this the case?

As the studies in the field imply, it could be the learners' *inter-language* to be blamed which is defined as “the intermediate status of the learner’s language system between his first and second language” as Selinker (1974) puts forward; or there can be *subjective*, “learner-related—or (intra) individual—difficulties” in learning complex structures during the Second Language acquisition (Housen and Simoens, 2016). Yet, some language characteristics are cognitively more demanding than the learner characteristics which represent objective difficulty known as the *notion of structural complexity* (Housen and Simoens, 2016). This was considered as the starting point of this study through which the main conclusions were drawn depending on the results.

The first research question of this study, therefore, focused on the success of the students. It was shown that when an instruction is designed to eliminate the structural differences between the native and target languages through construction of new cognitive structures, this instructional design can help increase the student

achievement in return. Based on the results of the study, it was seen that when the subjects in the experiment group were taught the complex structures of the second language in such a way, they become more successful when compared to the subjects in the control group. Additionally, as students in the control group received a traditional instruction, it was observed that they still had *structural complexities* related to the target language. These results are in line with the studies in the field. When the Second Language learners are instructed the “grammar rules describing or explaining the linguistic features different from their first language, then the complexity of the target language structure increases as the complexity of its corresponding pedagogical rules are not the same” (Housen and Simoens, 2016). With this in mind, it should be concluded that an instructional design that aims to create cognitive structures in the native language similar to the ones in the target language plays an important role over the academic success of the students.

The second research question focused on another aspect of the instruction that was designed in this study. According to the hypothesis of the study, the cognitive load of learners can be reduced while learning complex structures of a second language through construction of new cognitive structures in their native language. According to the results of the study, when the instruction is designed in a way to reduce the cognate load of the students, they require less mental effort to process the complex structures in the second language. As suggested in the literature, working memory is limited when there is no *executive* that decides how to use or organize the

new information (Sweller, 1999). Therefore, when there is available *prior knowledge* that can act as an executive, it should be included “in the instruction in order to involve student participation” (Sweller, 1999). In other words, having to learn a complex structure in a second language that belongs to a different language family from the learner’s own language causes cognitive overload, which, in return, results in inefficient learning. For this reason, the instruction was deliberately designed to deal with the cognitive overload, and an alternative structure, namely *-Kİ-* structure, was suggested to reduce the load which affected the overall performance of the subjects. As the results imply the instruction designed in this study proved to be successful in controlling the high cognitive load consequently.

In this study, the *-Kİ-* structure that is already available in the mother tongue of the learners was used as the *prior knowledge* or *the executive*. As a matter of fact, this structure is not included in the regular relative clause instructions as it does not morphologically give a perfect exemplification of the structure. However, it was found out in the study that that it syntactically corresponded very well to RC in the target language. It was obvious from the results that through activating the *-Kİ-* structure in their learning schemata in Turkish, students had a chance to familiarize themselves with how and where the very same structure is used in the target language. Based on the results of this study, when cognitive load is lowered via this type of RC instruction, learners could have more cognitive capacity left which could be invested in processes contributing to their learning.

When the test scores of the subjects who received the instruction designed in line with the principles of CLT were contrasted with those of the students who received traditional RC instruction, the results were also verified by the central tenet of CLT which asserts that “instruction needs to be organised in a manner that reduces unnecessary working memory load” (Kirschner et al, 2006). We can reach the same conclusion when look at the results of this study. If the mental effort scores of the experiment and control groups are compared, it can be seen that the students in the control group reported investing higher mental effort as was indicated in the literature. At this point, it can be concluded that when the cognitive structures are constructed and reconstructed especially when the target language is a member of a different language family, it becomes possible to decrease the extraneous, (also known as external and secondary) and increase germane cognitive load that leads to higher performance.

The third research question tried to identify if cognitive load and success of students interact with each other to yield to efficient instruction. It was ensured with the results of the study that lowering the mental effort spent through actively constructing coherent mental representations leads to an increase in the student achievement, which shows the efficiency of the instruction over successful learning. The results of the study could prove that “if an instruction does not provide enough guidance that shows a learner the structures and processes that support them to process language items”, then learners end up with exerting irrelevant or

meaningless structures which charge extraneous cognitive load on learners' working memory (Brünken et al. 2003). It was found out that the more existing schemata is activated in the instruction, the lower the amount of cognitive load gets and the more successful students become in learning the complex structures of a target language which belongs to a different language family.

Consequently, the main conclusions of this study could be drawn as follows:

- When we design an instruction that help learners create similar cognitive structures in their native language by activating their available cognitive forces, then, they academically become more successful in learning complex structures in the target language.
- When we manage the high cognitive load caused by complexity of structures by tailoring our instruction as was administered in this study, then the mental effort that is spent by the learners can be reduced. This also affects the students' academic achievement in a positive way.
- When the instruction is designed in alignment with learners' cognitive architecture, then the learners have lower cognitive load and higher performance in language learning. This also proves the efficiency of tailored instruction.
- Such an instruction can also be administered in distance learning environments and become successfully efficient as long as the instruction is designed in a way that aims to reduce the cognitive load

of learners through construction of cognitive structures in native language while learning complex structures; and to increase academic performance in processing of relative clauses.

5.2. Implications of the Research

Based on the results of the study, it was concluded that instructional strategies that help “reduce extraneous cognitive load and increase germane cognitive load” should be employed into second language education if we want to increase the performance of our students (Paas, 2003; Sweller 1999; Van Merriënboer and Sweller, 2005). In second language education, this implies that:

- Teachers should “explicitly present the grammar and vocabulary of the second language rather than expecting learners to induce the information themselves” (Kirschner et al., 2006).
- Second language learning necessitates “conscious effort by learners and explicit teaching by instructors” (Sweller, 2017) which helps reduce the cognitive load of the learners, and yields to better academic performance.
- Instructors should keep in mind that syntactically corresponding structures between the native and the target languages that belong to different language families influence the instructional efficiency by lowering the load and increasing the academic performance of the students.

- When the language curriculum is to be designed, the dimensions of cognitive load theory must be definitely taken into consideration.
- Not only the relative clause structures but also some other structures that are considered complex in language learning can be taught by creating cognitive structures in the native language and activating the already existing schemata.

However, when we look at the problems in Turkey with regards to language instruction, the problems encountered are never about the role that cognitive load plays in learning. Looking at the studies carried out in Turkish settings, not much research can be found related to the cognitive perspective of instruction design in English relative clause acquisition of Turkish learners. Besides, we cannot find any claims that try to explain the failure with a cognitivist perspective. According Çetintaş (2010) the problems are mostly about:

- institutions
- instructions
- socio-economic problems
- lack of well-trained teachers
- absence of realistic objectives
- lack of sustainability from the primary school to secondary education
- the issue of technological utilities

- time spent on grammar
- materials and course books used in ESL

In such a case, it might be deduced that we are looking at the wrong places to identify the problems we have in language teaching. As a consequence, we should be aware of the facts that:

- Where grammatical structures are almost in a reverse order due to belonging to different language families, the instructors should change their ways of tracing the problems in the instruction of the second language.
- That's why it is also advisable to identify the problems in second language education, and include the cognitive aspects of the problems we encounter in our experiences in the field.
- We should underline the importance of reducing the cognitive load which might impede learning by taking the advantage of syntactical correspondences between the distinct languages to yield to success.
- The awareness of the teachers should be increased on how important and effective it is to take into consideration the role of cognitive load in our teaching of complex structures.

- Even in distance learning environment, implementation of new cognitive structures to lower the load of the learners effectively help students succeed in the acquisition of complex structures.

Additionally, it should also be noted that this study does not try to emphasize the first language usage in order to explain grammatical issues. Rather, the results of this study may provide an insight to the teachers as well as the curriculum designers whose major consideration should be providing meaningful learning of complex structures when designing instruction, and benefitting from prior knowledge to reduce cognitive load and hereby increase the academic achievement.

The study would have been strengthened by the inclusion of interventions suggested below. Hence, for further research, it would be a good idea

- to investigate if the students with higher or lower proficiency levels respond in the same way to the designed instruction that had a similar purpose if not the same structure of RC.
- to administer the mental effort scale in a longitudinal study and compare the results of the control and the experiment groups to identify any differences over the academic performance of the students while they are increasing their level of proficiency at school.
- to add the motivation aspect suggested by Paas (2016) as one of the perspectives this study suggests. This would not only give learners and

their teachers, a more accurate picture of learners' individual progress, but might also be more motivating for learners to be able to see development.

- to ask students to reflect on the process and report the experience with their own words which would help them gain an insight about how they succeeded in the acquisition of RC structures.

- to work on different language constructions that are considered as complex structures such as passive voice or conditionals, or structures that are not available in the native language such as perfect tenses.

Following the same path, new instructions might be designed in the teaching of a second language that belongs to a different language family.

In short, this research study could contribute to future directions in research and practice in the field by helping teachers, administrators and curriculum designers increase their awareness about how the principles of cognitive load theory are invaluable in the way that lead the learners to the desired outcomes of the learning processes in a successful way. So, as the study implies, through activities that are developed to emphasize correspondences in both language and thereby activate the prior knowledge, we could provide students with a room to balance their cognitive capacity, and help not only the students to increase their academic

achievement but also the instructors in the instruction of complex structures in the target language.



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APPENDICES

APPENDIX A

LESSON PLAN FOR THE EXPERIMENTAL GROUP

COURSE: ENGLISH SUBJECT: RELATIVE CLAUSE	Time allocated: 2 lessons (40+40)
Class: A2	Methods: group discussion, pair works, question-answer, using visuals, discovery learning
Aims and Objectives:	Aim 1: The knowledge of combining two sentences which have the same subject. Outcomes: At the end of the lesson, students will be able to state the rules for combining two sentences which have the same subject in common. Aim 2: The understanding of relative clauses with subject position. Outcomes: At the end of the lesson, students will be able to make sentences by combining two sentences which have the same subject. Aim 3: The understanding of the difference between the usage of relative pronouns <i>who</i> and <i>which</i>. Outcomes: At the end of the lesson, students will be able to use the correct relative pronouns within the correct context.
Materials:	➤ Board, power point presentation, handouts, visuals such as pictures and colourful charts ➤ Worksheets
LESSON 1 (40’) *First lesson starts right after the pre-test of the study is applied. Lead in (10’): They are going to have a grammar lesson and learn how to combine two sentences and give extra information in English, which is called Relative Clause. But before they start, the teacher explains that some structures such as perfect tenses and relative clauses do not have equivalent structures in Turkish since these languages belong to different language families.	

In addition, the teacher says that 'we do not actually use the relative clause structures as they are used in the English language. For this very reason we should first get used to making sentences in our language, Turkish, in order to understand the gist of using this structure and then learn how to use it in English'. Therefore she starts with an example sentence by writing on the board:

- Dün bir öğrenciyle konuştum. O Mert'ti.
Dün konuştuğum öğrenci Mert'ti.
- Tayfun anahtarları bir kişiye verdi. O Ayşe'ydi.
Tayfun'un anahtarları verdiği kişi Ayşe'ydi.
- Adam tedirgin görünüyordu. Konuşmayı yaptı.
Konuşmayı yapan adam tedirgin görünüyordu.
- Hırsız kolyeyi çaldı. Kolye kasadaydı.
Hırsız, kasada duran kolyeyi çaldı.
- Yan bahçede yaşayan bir köpek var. Çok havlıyor.
Yan bahçede yaşayan köpek çok havlıyor.
- Eylül'ün arabası bozuldu. Onu geçen ay aldı.
Eylül'ün geçen ay aldığı arabası bozuldu.

After elaborating on these sentences, the teacher shows the students the picture from the power point slide saying that they are going to make sentences in TURKISH by looking at the picture. S/he asks questions regarding the objects or the people on the picture then writes the sentences elicited from the students on the board (See Appendix A for the picture used)

The teacher asks how many sentences students can make looking at the picture on the board and wants them to combine these sentences in TURKISH eliciting answers. Then using the students' answers written on the board, the teacher shows how 2 sentences are combined by making one sentence out of two, again in TURKISH.

Introduction (25'): The teacher starts the power point slide show and continues the lesson via slides, stopping at necessary point underlined in the slides emphasizing different usages shown and making sure students follow the slides (See Appendix D for the power point slides).

Summary (5’): The teacher summarizes the lesson asking what they learnt so far, gives feedback after eliciting the correct answers from the students.

Possible questions to be used are suggested below:

Questions about meaning

- What do we use **who** for?
- What do we use **which** for?

Questions about the form

- What does **who** replace?
- What does **which** replace?
- Which part gives us extra information?
- Which part gives us main information?

Questions about the function

- Why do we use **who** and **which**?

LESSON 2 (40’)

The teacher starts the lesson saying ‘**It’s time to practice. Are you ready for it?**’ and tells students that they will work in pairs for the first activity.

1.ACTIVITY (15’): Sentence combining - small group work activity

Teacher says that they will continue with another activity in which the students are supposed to combine eight sentences using relative pronouns and make any necessary changes. Before they start the teacher makes groups of three and then distributes the handouts (See Appendix C). Students are allowed to work with groups The time is set for 5 minutes. After going over the instructions and example, the teacher starts the time.

Example: *She is an accountant. She runs her own business.*
 She is an accountant who runs her own business.

When the activity finishes pair check is done and answers are elicited from the students giving feedback.

2. ACTIVITY (10’): Picture choosing

Teacher says that the last activity is a matching activity. S/he distributes the hand-outs to the class (See Appendix C) and reads the instruction together with them (*Match the*

correct picture with the corresponding sentence). In this activity the students are supposed to choose the correct picture according to the given sentences. Alternatively, this can be done as a station activity in small classes by distributing the sentences to the students and asking them to come to the board and stick the given sentence over the correct picture. Time is set for 5 minutes, and activity is carried out. If any extra time is left then students make ask questions regarding the pictures and or ask students to make/write/say more sentences by looking at the two pictures.

Necessary feedback is given at the end of the activity.

WRAP-UP: (10')

Teacher wants everybody to write one thing they have learnt in this lesson on a piece of paper and stick it on the board so that they can see we have learnt throughout the lesson.

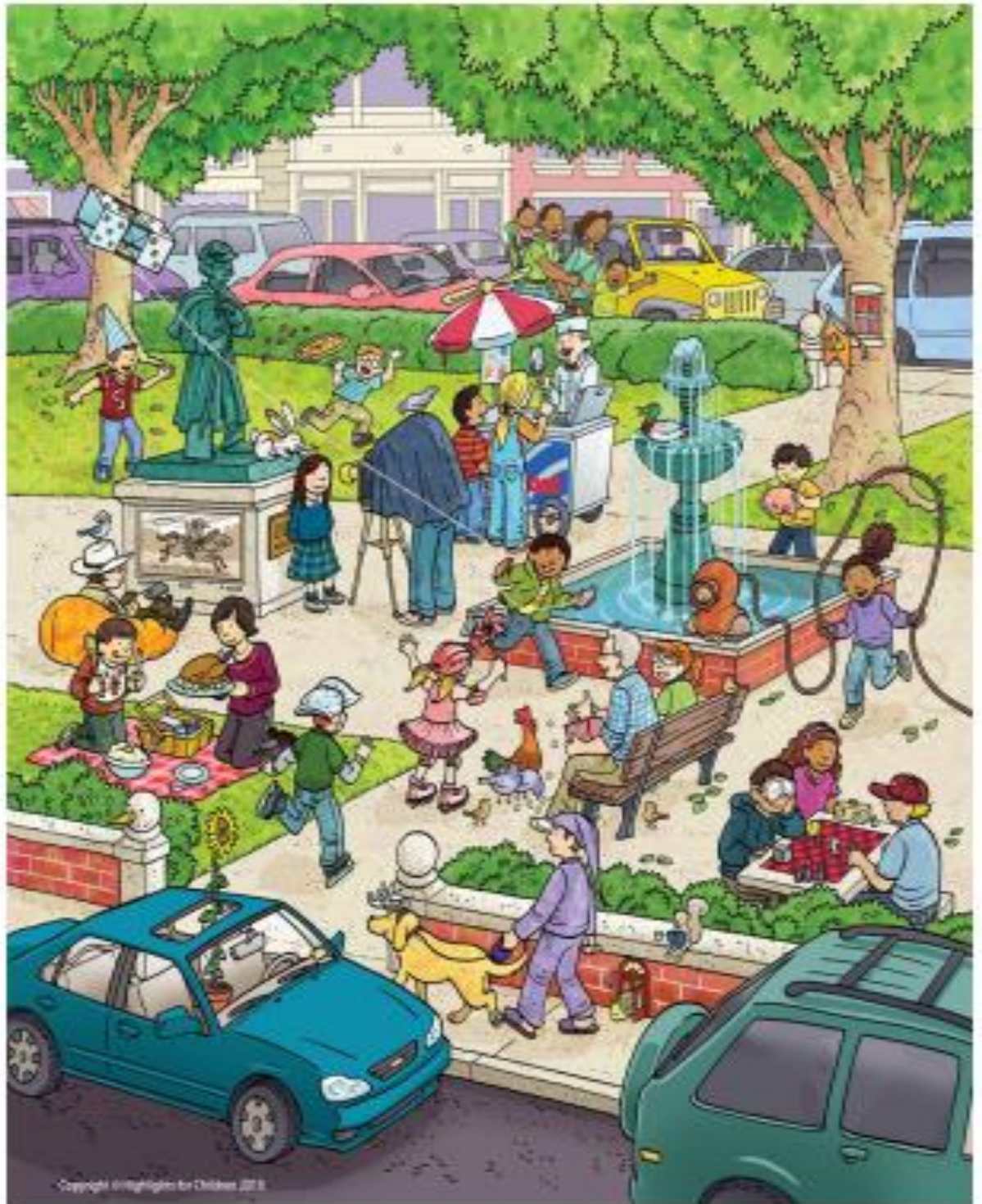
Additionally, the teacher gives homework 'At home think about that you are given a chance to change the town your live in and write about what part/buildings you would change first and why?'

Evaluation and Assessment (5')

Question and Answer, Oral Summary, Written Summary, Feedback from the Activities.

***Post-test of the study is applied after the evaluation of the lesson.**

WARM UP PICTURE (ANY ANSWERS ACCEPTED)



ACTIVITY HANDOUTS (TEACHER VERSION with KEY)

ACTIVITY 1.SENTENCE COMBINING

Combine the following sentences using relative pronouns. Make any necessary changes.

Example: *She is an accountant. She runs her own business.*
 She is an accountant who runs her own business.

1. Dave bought a new CD-player. It was made in Thailand.
 Dave bought a new CD-player WHICH was made in Thailand.

2. The castle is above the town. It was built long ago.
 The castle is above the town WHICH was built long ago.

3. A woman saw the robbery. She talked to the police.
 The woman WHO saw the robbery talked to the police.

4. A factory produces cars. It is in danger of closing.
 The factory WHICH produces cars is in danger of closing.

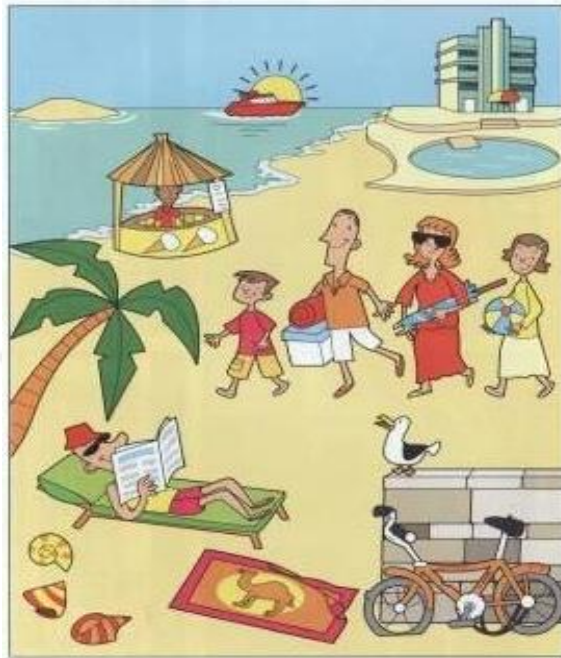
5. The buildings were very old. We photographed them.
 The buildings WHICH we photographed were very old.

6. Sydney is not the capital of Australia. It held the 2000 Olympics.
 Sydney WHICH held the 2000 Olympics is not the capital of Australia.

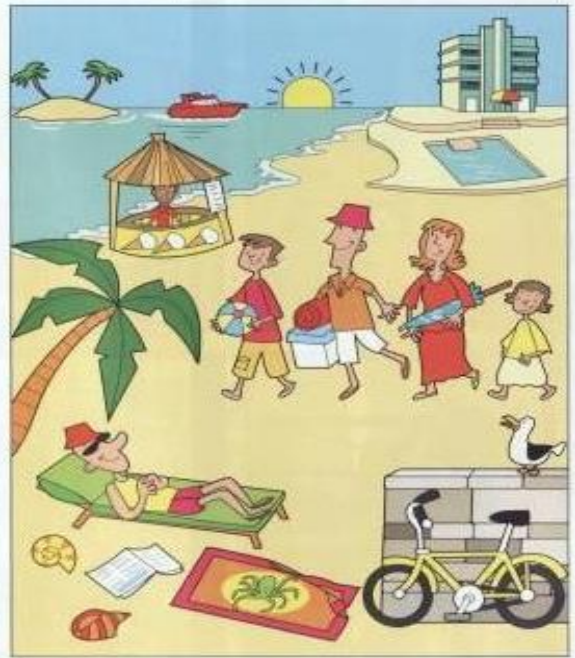
ACTIVITY 2. PICTURE CHOOSING

Match the correct picture with the corresponding sentence.

PICTURE A



PICTURE B



PICTURE

1. The man who is reading a newspaper is wearing a red short. **A**
2. The girl who is holding a ball is walking next to her mum. **A**
3. The bike which is standing behind the wall is painted yellow. **B**
4. The woman who is wearing sunglasses is carrying an umbrella. **A**
5. The boat which is coming from the island is passing before the sun. **A**
6. The man who is smiling has a red hat but he doesn't have sunglasses. **B**

APPENDIX B

LESSON PLAN FOR THE CONTROL GROUP

COURSE: ENGLISH SUBJECT: RELATIVE CLAUSE	Time allocated: 2 lessons (40+40)
Class: A2	Methods: group discussion, pair works, question-answer, using visuals, discovery learning
Aims and Objectives:	Aim 1: The knowledge of combining two sentences which have the same subject. Outcomes: At the end of the lesson, students will be able to state the rules for combining two sentences which have the same subject in common. Aim 2: The understanding of relative clauses with subject position. Outcomes: At the end of the lesson, students will be able to make sentences by combining two sentences which have the same subject. Aim 3: The understanding of the difference between the usage of relative pronouns who and which. Outcomes: At the end of the lesson, students will be able to use the correct relative pronouns within the correct context.
Materials:	➤ Board, power point presentation, handouts, visuals such as pictures and colourful charts ➤ Worksheets
LESSON 1 (40’) *First lesson starts right after the pre-test of the study is applied. Lead-in (5’): The teacher shows the students the picture from the power point slide saying that they are going to make sentences by looking at the picture. S/he asks questions regarding the objects or the people on the picture then writes the sentences elicited from the students	

on the board (See Appendix A for the picture used)

The teacher asks how many sentences students can make looking at the picture on the board and wants them to combine these sentences in English eliciting answers. Then using the students' answers written on the board, the teacher shows how 2 sentences are combined by making one sentence out of two.

Introduction (30'): The teacher explains that they are going to have a grammar lesson and learn how to combine two sentences and give extra information in English, which is called Relative Clause.

At that point the teacher starts the power point slide show and continues the lesson via slides, stopping at necessary point underlined in the slides emphasizing different usages shown and making sure students follow the slides (See Appendix B for the power point slides).

Summary (5'): The teacher summarizes the lesson asking what they learnt so far, gives feedback after eliciting the correct answers from the students.

Possible questions to be used are suggested below:

Questions about meaning

- What do we use **who** for?
- What do we use **which** for?

Questions about the form

- What does **who** replace?
- What does **which** replace?
- Which part gives us extra information?
- Which part gives us main information?

Questions about the function

- Why do we use **who** and **which**?

LESSON 2 (40')

The teacher starts the lesson saying '**It's time to practice. Are you ready for it?**' and tells students that they will work in pairs for the first activity.

1.ACTIVITY (15'): Sentence combining - small group work activity

Teacher starts with an activity in which the students are supposed to combine eight

sentences using relative pronouns and make any necessary changes. Before they start the teacher makes groups of three and then distributes the handouts (See Appendix C). Students are allowed to work with groups. The time is set for 5 minutes. After going over the instructions and example, the teacher starts the time.

Example: *She is an accountant. She runs her own business.*
 She is an accountant who runs her own business.

When the activity finishes pair check is done and answers are elicited from the students giving feedback.

2. ACTIVITY (10'): Picture choosing

Teacher says that the last activity is a matching activity. S/he distributes the hand-outs to the class (See Appendix C) and reads the instruction together with them (*Match the correct picture with the corresponding sentence*). In this activity the students are supposed to choose the correct picture according to the given sentences. Alternatively, this can be done as a station activity in small classes by distributing the sentences to the students and asking them to come to the board and stick the given sentence over the correct picture. Time is set for 5 minutes, and activity is carried out. If any extra time is left then students make ask questions regarding the pictures and or ask students to make/write/say more sentences by looking at the two pictures.

Necessary feedback is given at the end of the activity.

WRAP-UP: (10')

Teacher wants everybody to write one thing they have learnt in this lesson on a piece of paper and stick it on the board so that they can see we have learnt throughout the lesson.

Additionally, the teacher gives homework 'At home think about that you are given a chance to change the town your live in and write about what part/buildings you would change first and why?'

Evaluation and Assessment (5')

Question and Answer, Oral Summary, Written Summary, Feedback from the Activities.

***Post-test of the study is applied after the evaluation of the lesson.**

ACTIVITY HANDOUTS (TEACHER VERSION with KEY)

ACTIVITY 1.SENTENCE COMBINING

Combine the following sentences using relative pronouns. Make any necessary changes.

Example: *She is an accountant. She runs her own business.*

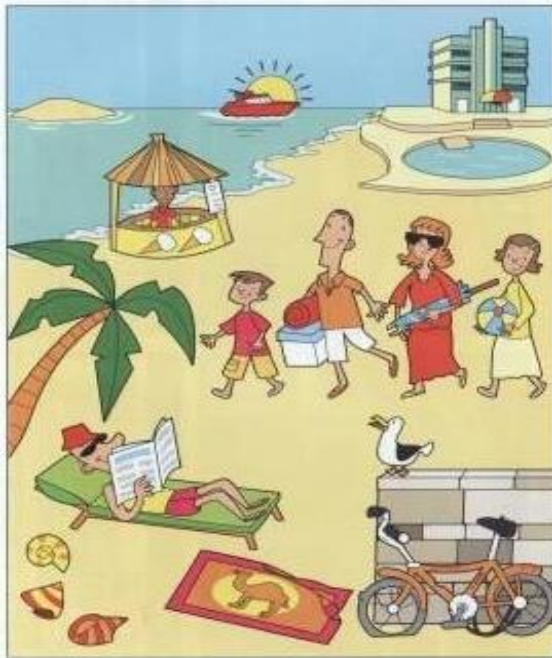
She is an accountant who runs her own business.

1. Dave bought a new CD-player. It was made in Thailand.
Dave bought a new CD-player WHICH was made in Thailand.
2. The castle is above the town. It was built long ago.
The castle is above the town WHICH was built long ago.
3. A woman saw the robbery. She talked to the police.
The woman WHO saw the robbery talked to the police.
4. A factory produces cars. It is in danger of closing.
The factory WHICH produces cars is in danger of closing.
5. The buildings were very old. We photographed them.
The buildings WHICH we photographed were very old.
6. Sydney is not the capital of Australia. It held the 2000 Olympics.
Sydney WHICH held the 2000 Olympics is not the capital of Australia.

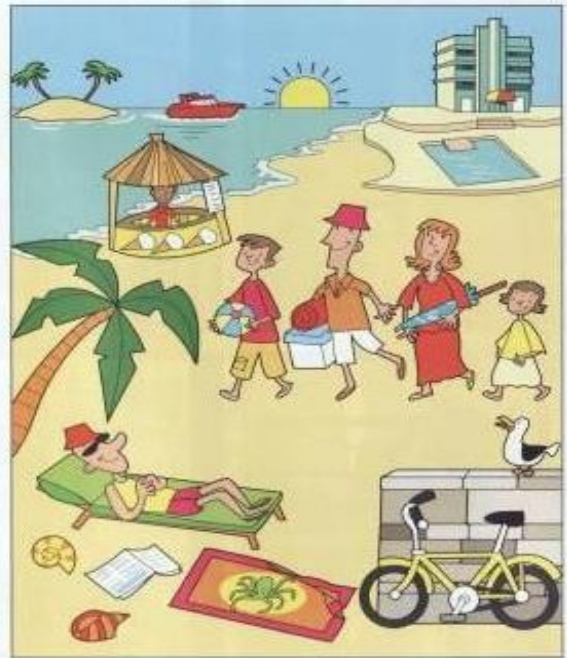
ACTIVITY 2. PICTURE CHOOSING

Match the correct picture with the corresponding sentence.

PICTURE A



PICTURE B



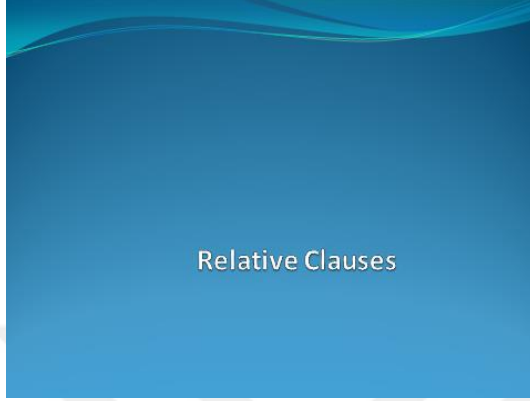
PICTURE

- | | |
|--|----------|
| 7. The man who is reading a newspaper is wearing a red short. | A |
| 8. The girl who is holding a ball is walking next to her mum. | A |
| 9. The bike which is standing behind the wall is painted yellow. | B |
| 10. The woman who is wearing sunglasses is carrying an umbrella. | A |
| 11. The boat which is coming from the island is passing before the sun. | A |
| 12. The man who is smiling has a red hat but he doesn't have sunglasses. | B |

APPENDIX C

POWER POINT PRESENTATION USED FOR INSTRUCTIONS

(EXPERIMENT GROUP)



- Dün bir öğrenciyle konuştum. O Mert'ti.
Dün konuştuğum öğrenci Mert'ti.
- Tayfun anahtarları bir kişiye verdi. O Ayşe'ydi.
Tayfun'un anahtarları verdiği kişi Ayşe'ydi.
- Adam tedirgin görünüyordu. Konuşmayı yaptı.
Konuşmayı yapan adam tedirgin görünüyordu.
- Hırsız kolyeyi çaldı. Kolye kasadaydı.
Hırsız, kasada duran kolyeyi çaldı.

Ne yapacağız?

Bu çalışmada ANLAM değil, CÜMLE DİZİLİŞİ (syntax) önemlidir.
NEDEN???

Farklı dil aileleri & cümle dizimi
İNGİLİZCE → S+V+O
TÜRKÇE → S+O+V

WHO/WHICH → Kİ

Relative Clause (sıfat cümlecği)

- bir isimle ilgili cümleciktir
- ismi tanımlar
- hakkında açıklayıcı bilgi verir
- bir ismi niteler

• Cümleleri bağlarken

WHO

WHICH

gibi PRONOUN / bağlaçlar kullanılır.

Who
the girl, the man, somebody, a person, the people
gibi insanlarla ilgili isimlerden sonra → WHO

Who yerine that kullanılabilir ve anlam ayırdır.

People **WHO** read books are more intellectual.
İnsanlar **Kİ** kitap okurlar, daha entellektüeldir.

Doctors **WHO** normally work hard are even busier nowadays.
Doktorlar **Kİ** normalde de çok çalışırlar, bugünlerde daha da meşguller.

Which:

the thing, a device, the idea, something, the film, the trees, the animals gibi nesne veya hayvanlarla ilgili kelimelerden sonra → WHICH

Which yerine that kullanılabilir ve anlam aynıdır.

Clothes **WHICH** are made of cotton are healthy.
Elbiseler **Kİ** pamuktan yapılır, sağlıklıdır.

This is the painting **which** costs £ 10,000.
Bu tablodur **Kİ** 10,000 Euro tutar.

Relative clause yapılıması

- Relative clause, ilgili olduğu isimden sonra getirilir. İsmi açıklayan cümle bu ismin hemen ardından gelmelidir.
- Açıklanan isme göre, **who** (insanlar için) veya **which** (nesneler için) ile başlanır. (Who ve which yerine that kullanılabilir.)
- Açıklanan isme ait he / him / she/her / it/ they/them zamirleri kalkar. **Who** ve **which** bu zamirlerin yerini tutar.

Örnek olarak aşağıdaki cümleyi birleştirelim:

The girl is very happy. **She is playing there.**
(Kız çok mutlu. O orada oynuyor.)

- İkinci cümlede she, the girl kelimesinin yerini tutuyor. Bu cümle the girl kelimesini açıklıyor. Bu cümleyi adım adım relative clause yapalım:

1- İkinci cümle «the girl» kelimesini açıkladığı için bundan sonra getirilir:

The girl **She is playing there** is very happy.

2 - The girl insan olduğu için who ile başlanır. The girl yerini tutan she zamirini kaldırılır:

The girl **who she is playing there** is very happy.

3. The girl **who is playing there** is very happy.

↓
(Kız **Kİ** orada oynuyor, çok mutlu.)

EXAMPLES

I like people. They help others.
İnsanları severim. Diğerlerine yardım ederler.

İnsanları severim ki diğerlerine yardım ederler.

↓
I like people **who help others.**

The vase was sold. It was made of gold.
Vazo satıldı. Altından yapılmıştı.

Vazo **Kİ** altından yapılmıştı satıldı.

↓
The vase **which was made of gold** was sold.

Aşağıdaki örneklerde who/which/that relative clause'da object (yani fiilin veya edatın nesnesi) konumundadır.

The film was quite good. We watched **it** last night.
(Film oldukça iyiydi. Onu dün gece izledik.)

The film **which** we watched last night was quite good.
↓
(Film **Kİ** dün gece izledik, oldukça iyiydi.)

People are happier. They have a lot of children.
İnsanlar Kİ Çok çocuğa sahiptir, daha mutludur.

↓
People **who have a lot of children** are happier.

Jill lives in a house. It has got a pool.
Jill bir evde yaşar Kİ havuza sahiptir.

↓
Jill lives in a house **which** has got a pool.

The book is very interesting. It is about life.
Kitap Kİ hayat hakkındadır, çok ilginçtir.

↓
The book **which is about life** is very interesting.

The dress is 7,000 liras. The princess is wearing **it**.
Elbise 7,000 liradır. Prenses onu giyiyor.

The dress **which** the princess is wearing is 7,000 liras.
↓
Elbise Kİ prenses giyiyor, 7,000 liradır.

- The cheese was delicious. We ate it at breakfast.
- The cheese **which we ate at breakfast** was delicious.

↓
(Peynir **Kİ** kahvaltıda yedik, lezzetliydi.)

- The bag was sold. You wanted to buy it.
- The bag **which you wanted to buy** was sold.

↓
(Çanta **Kİ** almak istedin, satıldı.)

- The girl was clever. I spoke to her yesterday.
- The girl **who I spoke to yesterday** was clever.

↓
(Kız **Kİ** dün konuştum, zeki idi.)

Who, which, that; object konumundaysa kaldırılabilir.
Yani relative clause'daki fiilin öznesi varsa kaldırılabilir.

The match **which we watched last night** was good.
The match we watched last night was good.

(Maç **Kİ** dün akşam seyrettik, iyiydi.)

The book **that she** gave me was very interesting.
The book she gave me was very interesting.
Kitap **ki o bana verdi** çok ilginçti.

The school **which my sister** attends has a big garden.
The school my sister attends has a big garden.
Okul **ki kız kardeşim gider** büyük bir bahçeye sahip.

More exercises (First Turkish → then English!!!)

- I loved the dress. It was in Mango.
- **Elbiseyi sevdim ki Mangodaydı.**
- **I loved the dress which was in Mango.**
- The house was in pink. We rented it.
- **Ev ki biz kiraladık pembeydi.**
- **The house which we rented was in pink.**
- Merve is an English teacher. She lives in İstanbul.
- **Merve ki İstanbul'da yaşar bir İngilizce öğretmenidir.**
- **Merve who lives in İstanbul is an English teacher.**

- The White House is an impressive building. It is in Washington.
- **Beyaz Saray ki Washington'dadır, etkileyici bir binadır.**
- **The White House, which is in Washington, is an impressive building.**
- The vase got broken. My mother gave me the vase.
- **Vazo ki annem verdi kırıldı.**
- **The vase which my mother gave me got broken.**
- My friend Jane is a lawyer. You met her yesterday.
- **Arkadaşım Jane ki sen dün tanıştın bir avukattır.**
- **My friend Jane who you met yesterday is a lawyer.**

Now Just English!!!

- My friend Alex works very long hours. He is a doctor.
- My friend Alex who is a doctor works very long hours.
- That person is my teacher. He phoned me last night.
- That person who phoned me last night is my teacher.
- I bought some tomatoes. They were still green.
- I bought some tomatoes which were still green.

- The coffee was cold. She drank it.
- The coffee she drank was cold.
- The game was very difficult. They were playing it.
- The game they were playing was very difficult.
- The exam will be very easy. They will take it tomorrow.
- The exam they will take tomorrow will be very easy.

- Defining / non defining clauses
 - The earth ,which goes around the world, is dealing with a serious pandemic nowadays.
 - The earth which goes around the world also travels around the sun.
- Commas
- No omission of relative clauses
- No usage of that

ACTIVITIES

ACTIVITY 1.SENTENCE COMBINING

Combine the following sentences using relative pronouns. Make any necessary changes.

Example:

She is an accountant. She runs her own business.

She is an accountant who runs her own business.

Dave bought a new CD-player. It was made in Thailand.

Dave bought a new CD-player WHICH was made in Thailand.

The castle is above the town. It was built long ago.

The castle WHICH was built long ago is above the town.

A woman saw the robbery. She phoned the police.

The woman WHO phoned the police saw the robbery.

A factory produces cars. It is in danger of closing.

The factory WHICH is in danger of closing produces cars.

The buildings were very old. We photographed them.

The buildings **WHICH** we photographed were very old.

Sydney is not the capital of Australia. It held the 2000 Olympics.

Sydney **WHICH** held the 2000 Olympics is not the capital of Australia.

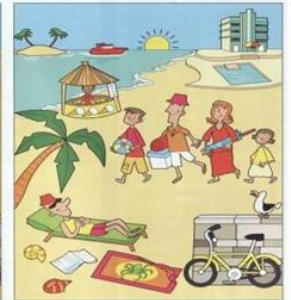
ACTIVITY 2. PICTURE CHOOSING

Match the correct picture with the corresponding sentence.

PICTURE A



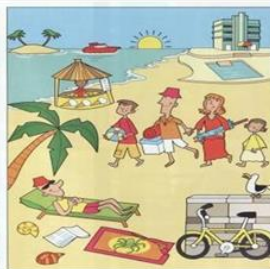
PICTURE B



PICTURE A

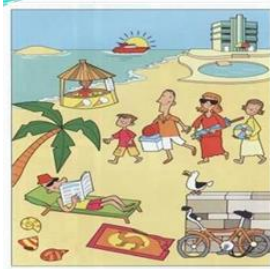


PICTURE B



- The man who is reading a newspaper is wearing a red short.

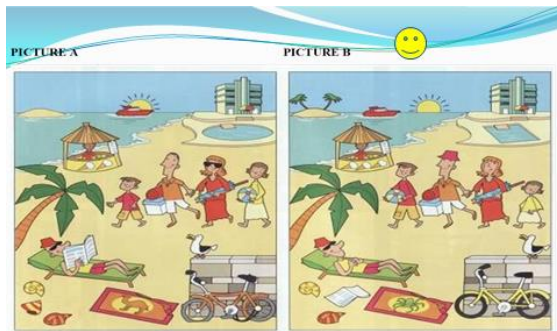
PICTURE A



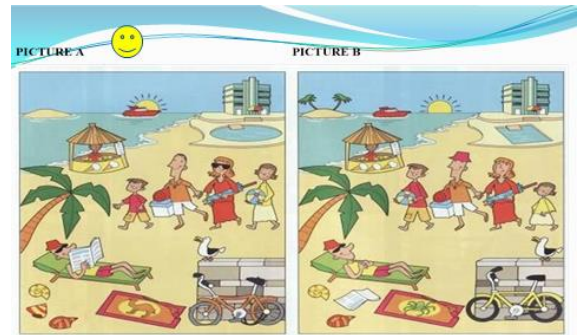
PICTURE B



- The woman who is wearing sunglasses is carrying an umbrella.



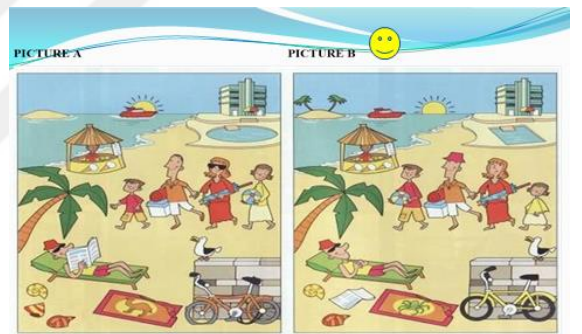
- The bike which is standing behind the wall is painted yellow.



- The girl who is holding a ball is walking next to her mum.



- The boat which is coming from the island is passing before the sun.

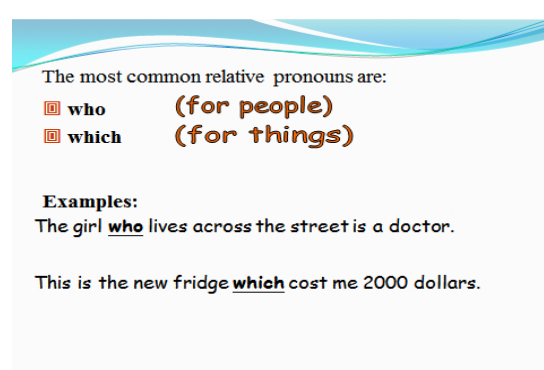
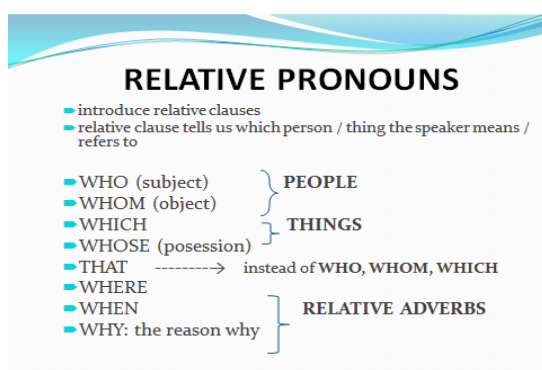
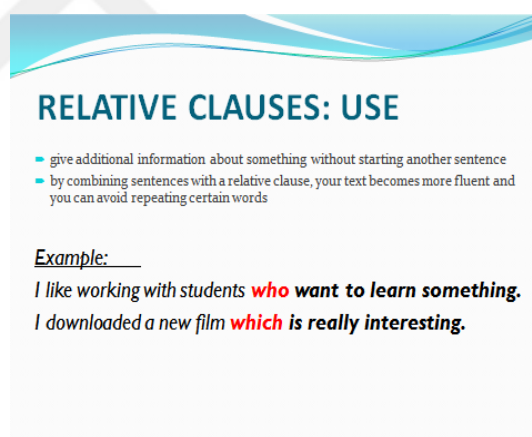
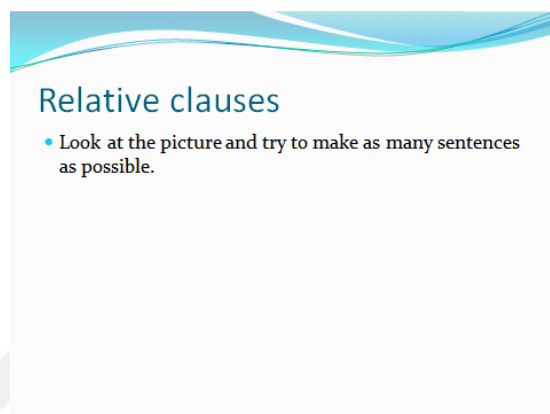
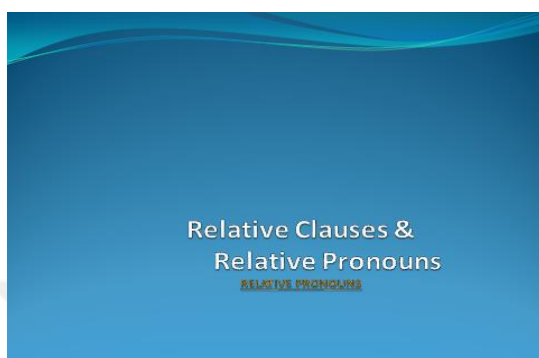


- The man who is smiling is wearing a red hat but doesn't have sunglasses.

APPENDIX D

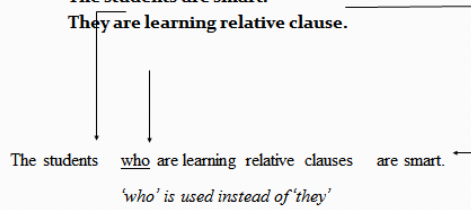
POWER POINT PRESENTATION USED FOR INSTRUCTIONS

(CONTROL GROUP)



HOW TO MAKE IT:

The students are smart.
They are learning relative clause.



Another example:

- to identify the subject or object of the sentence

E.g. Miss Wong is very beautiful.

She teaches us English.

=> Miss Wong who teaches us English is very beautiful.

Relative
pronoun

Adjective clause

Remember:

- the pronoun refers to the same thing as the relative pronoun

e.g. The girl is my sister. You saw her yesterday.

A: The girl who you saw ~~her~~ yesterday is my sister.

→ The girl who you saw yesterday is my sister.

Exercises:

Fill in the blanks with **who** and **which**.

- ⓐ The tree which fell down during the hurricane was over 100 years old.
- ⓐ This is the woman who I told you about.
- ⓐ She wrote an article which explained the reasons of unemployment in the world.
- ⓐ The boy who went out the shop is my cousin.

RELATIVE CLAUSES

SUBJECT	- The person who phoned me last night is my teacher. - The person that phoned me last night is my teacher.	"that" is preferable
	- The car which hit me was yellow. - The car that hit me was yellow.	"that" is preferable

When the relative pronouns **which** and **who** are followed by only a verb, they **cannot** be omitted.

Example:

This is the new dress **which** cost me \$ 500.

↓ (verb only) ✗

This is the new car cost me \$ 500.

DEFINING RELATIVE CLAUSES

OBJECT	- The person whom I phoned last night is my teacher. - The people who I phoned last night are my teachers. - The person that I phoned last night is my teacher. - The person I phoned last night is my teacher.	"whom" is correct but formal relative pronoun is optional
	- The car which I drive is old. - The car that I drive is old. - The car I drive is old.	"that" is preferable to "which" relative pronoun is optional

When the relative pronouns **which** and **who** are followed by a sentence (subject and verb), they can be omitted.

Example:

This is the new dress **which** I bought yesterday.

↓ (subject + verb)

This is the new dress I bought yesterday. ✓

More examples!

1- She was dancing with a student. He had a slight limp.

She was dancing with a student who had a slight limp.

2- The bed has no mattress. I sleep on this bed.

The bed which I sleep on has no mattress.

3- I am looking after some children. They are terribly spoilt.

I am looking after some children who are terribly spoilt.

4- There wasn't any directory in the telephone box. I was phoning from this box.

There wasn't any directory in the telephone box which I was phoning from.

5- I was sitting in a chair. It suddenly collapsed.

I was sitting in a chair which suddenly collapsed.

6- The man was sitting at the desk. I had come to see this man.

The man who I had come to see was sitting at the desk.

7- His girlfriend turned out to be an enemy spy. He trusted her absolutely.

His girlfriend who He trusted absolutely turned out to be an enemy spy.

ACTIVITIES

ACTIVITY 1.SENTENCE COMBINING

Combine the following sentences using relative pronouns. Make any necessary changes.

Example:

She is an accountant. She runs her own business.

She is an accountant who runs her own business.

The buildings were very old. We photographed them.

The buildings WHICH we photographed were very old.

Sydney is not the capital of Australia. It held the 2000 Olympics.

Sydney WHICH held the 2000 Olympics is not the capital of Australia.

Dave bought a new CD-player. It was made in Thailand.

Dave bought a new CD-player WHICH was made in Thailand.

The castle is above the town. It was built long ago.

The castle WHICH was built long ago is above the town.

A woman saw the robbery. She phoned the police.

The woman WHO phoned the police saw the robbery.

A factory produces cars. It is in danger of closing.

The factory WHICH is in danger of closing produces cars.

Dave bought a new CD-player. It was made in Thailand.

Dave bought a new CD-player WHICH was made in Thailand.

The castle is above the town. It was built long ago.

The castle WHICH was built long ago is above the town.

A woman saw the robbery. She phoned the police.

The woman WHO phoned the police saw the robbery.

A factory produces cars. It is in danger of closing.

The factory WHICH is in danger of closing produces cars.

The buildings were very old. We photographed them.

The buildings **WHICH** we photographed were very old.

Sydney is not the capital of Australia. It held the 2000 Olympics.

Sydney **WHICH** held the 2000 Olympics is not the capital of Australia.

ACTIVITY 2. PICTURE CHOOSING

Match the correct picture with the corresponding sentence.

PICTURE A

PICTURE B



PICTURE A



PICTURE B



- The boat which is coming from the island is passing before the sun.

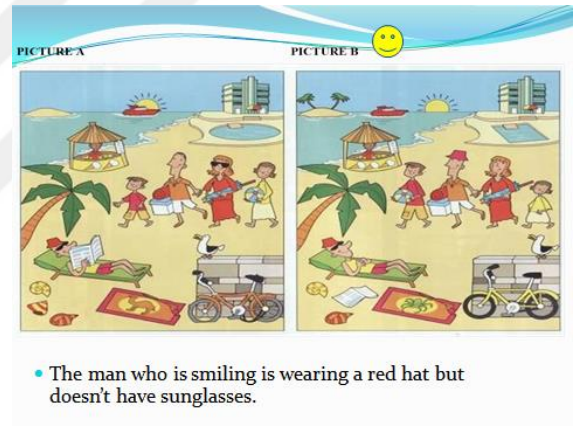
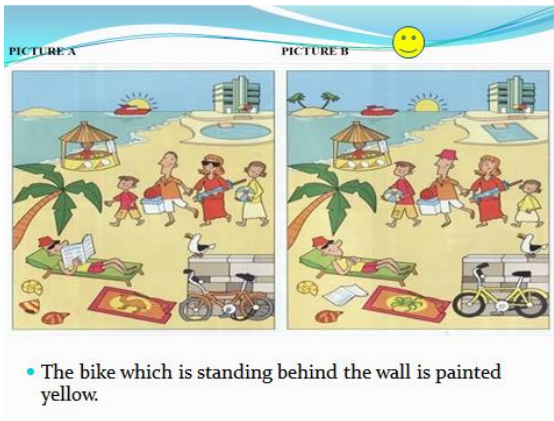
PICTURE A



PICTURE B



- The girl who is holding a ball is walking next to her mum.



APPENDIX E

ACHIEVEMENT TEST

Sentence Combining Task

Please combine the following pair of sentences using who and which.

1. The man couldn't enter the house. He forgot his keys.

2. The book was the bestseller last year. Mary read it.

3. I know the woman. He gave some flowers to the woman.

4. The idea was very good. My father suggested it.

5. Everyone loves the headmaster. You saw the headmaster.

6. John's friend has left quite early. He was at the meeting.

Translation Task

Please translate the following sentences into English by using a relative clause. (Use who and which)

1. İşten ayrılan arkadaşım Antalya'ya taşındı.

2. Kitabı verdiğim kızı bu sabah gördüm.

3. Aniden ağlamaya başlayan kadın sandalyeye oturdu.

4. İçine telefonumu koyduğum çanta masanın üstünde.

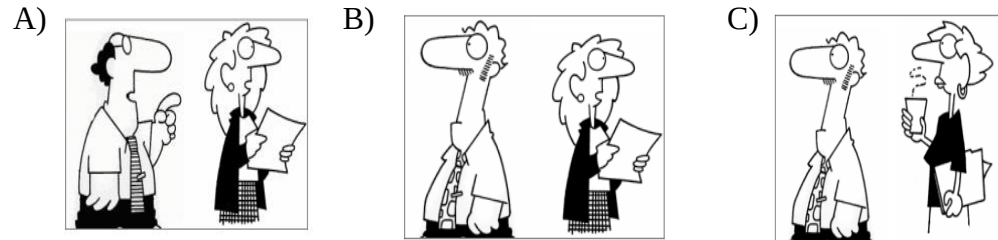
5. Amcamın satın aldığı yeni evi gördüm.

6. Arkadaşımın dün verdiği kitabı kaybettim.

Picture Choosing

Please mark the correct choice in 3 different pictures according to the sentences.

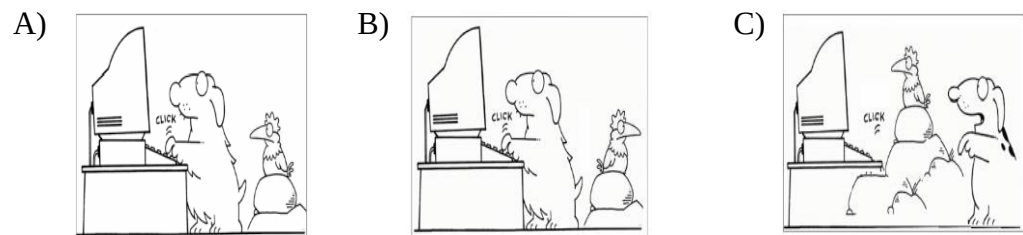
1. Mark the woman that sees the man!



2. Mark the man that chases the woman!



3. Mark the bird that the dog watches!



4. Mark the cow that carries the lion!



APPENDIX F

PLEASE CIRCLE THE NUMBER BELOW ACCORDING TO HOW MUCH MENTAL EFFORT YOU THINK YOU SPENT WHILE DOING THE EXERCISES.

1-----	2-----	3-----	4-----	5-----	6-----	7-----	8-----	9-----
very	very	low	rather	neither	rather	high	very	very
very	low	mental	low	low nor	high	mental	high	very
low	mental	effort	mental	high	mental	effort	mental	high
mental	effort		effort	mental	effort		effort	mental
effort				effort				effort

APPENDIX G

ANSWER KEY FOR THE ACHIEVEMENT TEST

Sentence Combining Task

Please combine the following pair of sentences using **who** and **which**.

Grading Criteria:

- ➔ Omission of the words in brackets are ignored.
- ➔ Spelling mistakes are ignored.
- ➔ Singular/plural mistakes are ignored.
- ➔ Tense-related mistakes are ignored (underlined words).
- ➔ Omission of relative pronouns who/which are NOT given credit.
- ➔ Wrong word/sentence order is NOT given credit.

1. The man couldn't enter the house. He forgot his keys.

(The) man who forgot (his) keys couldn't enter (the) house.

2. The book was the bestseller last year. Mary read it.

(The) book which Mary read was (the) (a) bestseller (last) (year).

➔ it should be excluded, if it's there, no credit is given.

3. I know the woman. He gave some flowers to the woman.

I know (the) woman who he gave (some) flowers (to).

➔ he should not be excluded, if it is, the no credit is given.

➔ second the woman should be omitted.

4. The idea was very good. My father suggested it.

(The) idea (my) father suggested was (very) good.

➔ it should be excluded, if it's there, no credit is given.

5. Everyone loves the headmaster. You saw the headmaster.

Everyone loves (the) headmaster who you saw.

→second headmaster should be omitted.

6. John's friend has left quite early. He was at the meeting.

John's friend who was at (the) meeting has left (quite) (early).

Translation Task

Please translate the following sentences into English by using a relative clause.

(Use who and which)

Grading Criteria:

- omission/wrong usage of possessive adjectives is ignored.**
- omission/wrong usage of prepositions is ignored.**
- words that could not be translated into English and left in Turkish can be accepted as long as they are in the correct place in the sentence (underlined words).**
- Tense-related mistakes are ignored.**
- Omission of relative pronouns who/which are NOT given credit.**
- Wrong word/sentence order is NOT given credit.**
- Spelling mistakes are ignored.**
- Singular/plural mistakes are ignored.**

7. İşten ayrılan arkadaşım Antalya'ya taşındı.

(My) friend who quitted (his) job moved (to) Antalya.

8. Kitabı verdiğim kız bu sabah gördüm.

I saw (the) girl who I gave (the) book.

9. Aniden ağlamaya başlayan kadın sandalyeye oturdu.

(The) woman who (suddenly) started crying sat (on) (the) chair.

10. İçine telefonumu koyduğum çanta masanın üstünde.

(The) bag which I put (my) phone (in) is (on) (the) table.

11. Amcamın satın aldığı yeni evi gördüm.

I saw (the) (new) house which (my) uncle bought.

12. Arkadaşımın dün verdiği kitabı kaybettim.

I lost (the) book which (my) friend gave (me) (yesterday).

Picture Choosing

Please mark the correct choice in 3 different pictures according to the sentences.

1. C Mark the woman that sees the man!
2. A Mark the man that chases the woman!
3. C Mark the bird that the dog watches!
4. A Mark the cow that carries the lion!