INVESTIGATION OF STUDENTS' GRAPHICAL AND NARRATIVE TYPE ADVANCE ORGANIZER USE IN AN UNDERGRADUATE COURSE: A MIXED METHOD STUDY

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submitted by **DENİZ BULUT** in partial fulfillment of the requirements for the degree of **Master of Science** i**n Computer Education and Instructional Technology, Middle East Technical University** by,

Prof. Dr. Halil Kalıpçılar
Dean, Graduate School of **Natural and Applied Sciences** _____

Prof. Dr. Soner Yıldırım
Head of the Department, **Comp. Edu. and Inst. Tech** _____

Prof. Dr. Soner Yıldırm
Supervisor, **Comp. Edu. and Inst. Tech, METU** _____

Examining Committee Members:

Prof. Dr. Soner Yıldırım
Comp. Edu. and Inst. Tech., METU _____

Assist. Prof. Dr. Erkan Er
Comp. Edu. and Inst. Tech., METU _____

Assoc. Prof. Dr. Evren Şumuer
Comp. Edu. and Inst. Tech., Kocaeli University _____

Date: 02.09.2022

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name Last name : Deniz Bulut

Signature :

ABSTRACT

INVESTIGATION OF STUDENTS' GRAPHICAL AND NARRATIVE TYPE ADVANCE ORGANIZER USE IN AN UNDERGRADUATE COURSE: A MIXED METHOD STUDY

Bulut, Deniz
Master of Science, Computer Education and Instructional Technology
Supervisor: Prof. Dr. Soner Yıldırım

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Online learning becomes one of the most common educational methods during Covid-19 pandemic. There occurred too many issues and challenges during online education. The absence of pedagogical approaches caused ineffective courses to facilitate learning of students. While designing lectures, instructors should consider the cognitive load of students. The more increased cognitive load leads to ineffective learning outcomes. There are many ways to reduce cognitive load when designing instructional online courses. Advance organizers are one of the pedagogical tools that are used to reduce cognitive load of students. For a long time, advance organizers are used to help students organize their cognitive architecture by linking students' prior knowledge and new learning material.

In this study, the use of different types of advance organizers which are narrative and graphical advance organizers are investigated. Sequential explanatory design model is used with the 15 undergraduate students who registered the course entitled "Research Methods" in a public university participated to the study. Qualitative

data are collected to get more detail of quantitative data results. In order to reveal students' opinion about different advance organizers, a mixed method research design was conducted. To analyze the results, paired sample t - test was used to test students' performance on the achievement test. T-test results showed that there is no significant difference between two AOs on achievement test scores. In addition, as a follow up, 5 participants were invited to answer open ended questions and interview. The constant comparison method was used to analyze qualitative data.

The quantitative analyze results showed that students take advantage from both types of AO. The results indicated that the mean of graphical AO score (M = 6.87, SD = 2.13) was not significantly different than the mean of narrative type AO score (M = 6.80, SD = 2.04), $t(14) = .096$, $p < .01$. Qualitative analyze helped to get deeper understanding of students' opinions about usage of AO. Students pointed out that graphical AOs are useful to catch key point during course, process learning content and connect concepts.

Keywords: Cognitive Load, Advance Organizer, Online Learning

ÖZ

ÖĞRENCİLERIN LİSANS DÜZEYİNDE BİR DERSTE GRAFİK VE ANLATIM TÜRÜ ÖN DÜZENLEYİCLERİ KULLANIMLARININ İNCELENMESİ: BİR KARMA YÖNTEM ÇALIŞMASI

Bulut, Deniz

Yüksek Lisans, Bilgisayar ve Öğretim Teknolojileri Eğitimi

Tez Yöneticisi: Prof. Dr. Soner Yıldırım

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Çevrimiçi öğrenme, Covid-19 salgını sırasında en yaygın eğitim yöntemlerinden biri haline gelmiştir. Çevrimiçi eğitim sırasında çok fazla sorun ve zorluk yaşanmıştır. Pedagojik yaklaşımların olmaması, derslerin öğrencilerin öğrenmesini kolaylaştırmada etkisiz kalmasına neden olmuştur. Dersleri tasarlarken öğretim elemanları öğrencilerin bilişsel yükünü göz önünde bulundurmalıdır. Daha fazla artan bilişsel yük, etkisiz öğrenme sonuçlarına yol açar. Eğitici çevrimiçi dersler tasarlarken bilişsel yükü azaltmanın birçok yolu vardır. Ön düzenleyiciler, öğrencilerin bilişsel yükünü azaltmak için kullanılan pedagojik araçlardan biridir. Uzun süredir, öğrencilerin ön bilgilerini ve yeni öğrenme materyallerini birbirine bağlayarak öğrencilerin bilişsel mimarilerini düzenlemelerine yardımcı olmak için ön düzenleyiciler kullanılmaktadır.

Bu çalışmada, anlatısal ve grafiksel ön düzenleyiciler olan farklı türde ön düzenleyicilerin kullanımları araştırılmıştır. Araştırmada bir devlet üniversitesinde "Araştırma Yöntemleri" dersine kayıt yaptıran 15 lisans öğrencisi ile sıralı açıklayıcı desen modeli kullanılmıştır. Öğrencilerin farklı ön düzenleyiciler hakkındaki görüşlerini ortaya çıkarmak için karma yöntem araştırma tasarımı yapılmıştır. Sonuçları analiz etmek ederken öğrencilerin başarı puanlarını test

etmek için eşleştirilmiş örneklem t - testi kullanılmıştır. T-testi sonuçları, başarı testi puanlarında iki AO arasında anlamlı bir fark olmadığını gösterdi. Ayrıca takip prosedürü olarak 5 katılımcıya açık uçlu sorular sorulmuş ve röportajlar yapılmıştır. Nitel verilerin sonuçları öğrencilerin röportaj ve açık uçlu sorulara verdikleri cevapların sürekli karşılaştırma yöntemi ile analiz edilmesiyle elde edilmiştir.

Nicel analiz sonuçları, öğrencilerin her iki ön düzenleyici türünden de yararlandığını gösterdiğini ortaya koydu. Sonuçlar, grafiksel AO puanının ortalamasının (Ort. = 6.87, SS = 2.13), anlatı tipi AO puanının ortalamasından (Ort. = 6.80, SS = 2.04) önemli ölçüde farklı olmadığını gösterdi, $t(14) = .096$, $p < .01$. Takip prosedürü, öğrencilerin ön düzenleyici kullanımıyla ilgili görüşlerinin daha derinden anlaşılmasına yardımcı oldu. Öğrenciler, grafiksel ön düzenleyicilerin kurs sırasında kilit noktayı yakalamak, öğrenme içeriğini işlemek ve kavramları birbirine bağlamak için faydalı olduğunu belirtti.

Anahtar Kelimeler: Bilişsel Yük, Ön Düzenleyiciler, Çevrimiçi Eğitim

Dedication

To my family Türkan and Mustafa Bulut…

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CHAPTER 1

INTRODUCTION

Advance organizer (AO) concept is introduced by Ausubel as AOs provide the linkage between new and prior knowledge so that cognitive architecture of learners is constructed (Ausubel, 1963). When the knowledge is constructed properly in cognitive structure, then learners retain that knowledge easily from long-term memory and use it in next content or to solve a problem (Mayer, 1979). Since AOs help learning, there were studies that are constructed to find whether AOs reduce cognitive load or not. Most studies showed that AOs are effective to reduce cognitive load because they provide learners to relate their prior knowledge and new ones. In that way, new knowledge become familiar to learners and hold area on working memory. Advance organizers vary in many properties such as their introduction way like visual, audio, verbal or multimedia, their structure and their form as question, video, story, concept map, games, and etc. The effect of advance organizers can change in different conditions. The learning content, age of learners can require different type of AOs.

Cognitive load theory (CLT) is developed by Sweller. CLT states that working memory is limited. Because of that, learning material should not hold that limited working memory so content can be processed well in working memory (Sweller, 2011). While designing a learning material from textbooks to videos, virtual environments, or video games, reducing cognitive and working memory load is crucial. If working memory is held by extraneous items, then the content that is desired to be learned is not processed. When information is not processed instantly, that information is not translated to long term memory where learning occurs. There are some methods that are used to reduce cognitive load and increase the

effectiveness of educational materials such as signaling modality, weeding (Ibrahim et al., 2012; Mayer & Moreno, 2003; Mayer & Fiorella 2014).

1.1 Problem Statement

Cognitive load is an important element that is needed to be considered during designing an instructional tool. Cognitive load theory takes attention to the process of designing instructional tools by considering cognitive architecture of learners in order to reduce working memory load (Sweller, 2019). Sweller (2011) also states that there is an important feature of working memory which is that capacity and duration of working memory are limited (p. 42). These limitations give rise to some issues while students learn complex contents which are also new for them too. In that situation, learners can have difficulty in placing new information into their cognitive architecture. When learners cannot organize their cognitive architecture since they cannot process the information because of limitations of working memory, then the learning cannot be effective. Sweller (2011) states that there are three types of cognitive loads which are intrinsic cognitive load, germane cognitive load and extrinsic cognitive load. While intrinsic and extrinsic cognitive loads are relevant with learning material and presentation of it, germane cognitive load is about working memory of learners (p. 57). The excessive cognitive load which consists of intrinsic and extrinsic cognitive load causes overload on working memory, so the learning process is affected negatively. There are many pedagogical tools or methods to manage cognitive load. Advance organizers are one of these tools.

Advance organizers are learning materials that are presented in the beginning of the course and help learners make connections between new content and prior knowledge that is located in the cognitive structure of learners (Ausubel, 1963). There are numerous studies about the effect of advance organizers on cognitive load. Some of these studies are conducted by using only one type of advance organizer in different learning environment such as video-based (van der

Meij, 2019), game-based (Vogel-Walcutt, et.al. 2013), content-based (Han-Chin & Hsueh-Hua, 2017) learning. In addition, since there are different types of advance organizers, some studies compare different types of advance organizer according to their effect on cognitive load. There are not studies which compare narrative and graphical type AOs.

The studies investigate advance organizers are effective for reducing cognitive load. However, advance organizers differ according to their presentation (visual, audio, verbal), structure (well-structured, less-structured, Gurlitt, et al., 2011), form (question, video, animation, game, story, and etc., Han-Chin & Hsueh-Hua, 2017, Babaei & Izadpanah, 2019). Although there are studies that compare different types of advance organizers, effectiveness of advance organizers can change based on the learning environment. There is a need for a study that is conducted in an online learning environment that compares the effectiveness of different types of advance organizers regarding to students' opinion since online learning become one of the main tezhing method after Covid-19. Therefore, the purpose of this study is to investigate which type of advance organizer has a better effect on test performance. In that way, exploring which type of AO can be used in online lessons, taking into account the success and opinions of the students. Since the participants of the current study is lower than expected, opinions of students are crucial to investigate effective AO type in online learning. In addition, Methods used for reducing cognitive load parallel with purposes of AO to enhanced meaningful learning. Findings of current study can give an idea about which type of AO can reduce cognitive load of students in online learning.

1.2 Purpose of Study

Because of the Covid-19, online learning has become a common teaching method all around the world. On the other hand, the absence of pedagogical strategies, the

effect of lectures has reduced. Mayer (2008) states that video is an appropriate learning tool since it helps organize cognitive structure by using both audio and visual channels. However, if online learning materials are not designed by considering how these channels can be used to make learning effective, then the cognitive load is increased. There are some methods to reduce cognitive load. Some studies show that AOs can be used to reduce cognitive load if they are chosen according to concept and learners. In addition, there are studies that compare the effectiveness of different types of AOs. However, there is a lack of the studies which are conducted to find whether graphical or narrative type AO is more useful. The purpose of that study is to investigate which type of AO whether narrative or graphical is more effective in learning research method during online learning. Hereby, getting idea for future research which type of AO is more useful to reduce cognitive load.

1.3 Research Questions

1. Is there any significant difference between scores of the students using narrative type of AO and scores of those using graphical type of AO in online undergraduate course?
2. What are the opinions of the students about usefulness of narrative and graphical type of AO in an online undergraduate course?

1.4 Definition of Terms

Advance Organizer (AO): AOs as learning materials that are presenting at the beginning of the course and cover the topic of the course in general. The characteristics of AOs were high level of abstraction, generalization, and inclusiveness (Ausubel, 1968, p. 148).

Narrative Advance Organizers: using stories as advance organizer to help students to connect the new information with their prior knowledge (Allen, 1970).

Graphical Advance Organizers: Advance organizers that are presented as diagram format (Elkin, 1980, p. 23).

Concept Map: Concept map is visual educational tool that shows the connections between the concepts (Stewart, VanKirk, & Rowell, 1979).

Cognitive Load (CL): Cognitive load represent the working memory area that is held by the extraneous and intrinsic sources.

Cognitive Load Theory (CLT): Cognitive load theory is developed based on properties of working memory and long-term memory that shape human cognitive schema (Sweller et al., 2019).

Working Memory (WM): Part of the human cognitive system where information is held to process, organized, combined for a short time (Sweller et al., 2011, p.42).

Achievement: Achievement is defined as giving the correct answers to questions of achievement tests in the present study.

CHAPTER 2

LITERATURE REVIEW

Instructional design process aims to create the most effective learning environment for learners by considering features of both learners and content that is taught. Learners' age, prior knowledge, cognitive skills affect their learning process. Also, the difficulty or familiarity of content change the effort of learners during processing the content. That effort can be determined by the capacity of working memory in human cognitive architecture. Sweller (1994) states that analyzing cognitive schemata of learners can be used to handle with difficulty of content. When learning content holds little capacity compared with extraneous elements in learning material, then the effort is increased, and the learning takes time. Therefore, the goal of instructional design should be making space for learning content rather extraneous elements in working memory (Sweller et al., 2011, p.58). To do that, instructional designers should consider cognitive load theory.

2.1 Advance Organizers

The concept of advance organizer (AO) is introduced by Ausubel (1963). Ausubel (1968, p. 148) explained AOs as learning materials that are presenting at the beginning of the course and cover the topic of the course in general. The characteristics of AOs were high level of abstraction, generalization and inclusiveness. In other words, AOs review ideas that are learned from the course. Ausubel (1963, 1968) states cognitive structure of learners plays vital role for acquisition of new knowledge. Before presenting new information, cognitive

structure of learners must be suitable to organize, retain new information so learning happens effectively. In order to make cognitive structure suitable, AOs are useful learning materials that introduce learning materials and help learners to make connection between new information and prior knowledge.

The first studies about effectiveness of AOs are conducted by Ausubel. In 1960, he showed that all introductory materials cannot serve as advance organizer. His study included experimental and control groups. Experimental group has an introductory material that was designed as advance organizer which helps learners to make connection between new information and prior knowledge. The control group on the other hand, was presented an introductory text which is about the history of the concept and did not relate to cognitive structure of learners. The results showed that AOs are more effective for learning. Moreover, Luiten, Ames and Ackerson (1980) published a meta-analysis that analyzes 170 studies from 1960 to 1979 about effectiveness of AOs. The analysis showed that most studies support the idea that AOs are useful for effective learning.

Beside the supportive studies, there are also studies that claim AOs do not facilitate learning. Barnes and Clawson (1975) review 32 articles which are experimental studies that compare AOs and other methods. Since 20 of the 32 studies do not support the hypothesis that AOs facilitate learning, Barnes and Clawson stated the AOs do not improve learners. However, Mayer (1979) argued that the result of Barnes and Clawson' review is problematic with three issues which are insufficient explanation of AOs, inefficient analysis of the results of studies and wrong experiment and control grouping.

Ausubel introduced two types of AO which are expository and comparative AOs. Expository AOs used when the learning topic is new which means learners are not familiar with the topic. Expository AOs present general structure of the new topic that help learners construct their cognitive structure. On the other hand, comparative AOs are used when the topic is familiar to learners. The major aim of comparative AOs is to differentiate the prior knowledge and the new information

(Ausubel, 1978). Learning context, learners' age and prior knowledge, presentation of AOs also create different type of AOs. According to form, structure, function or presentation styles, AOs can differentiate. One of the examples of the studies that compare different type AOs is conducted by Lawton and Wanska (1979). They designed three AO lessons which are subject organizer, process organizer and includes both to investigate the effect on classification learning of kindergarten students. The study showed that AOs that includes both subject and process concepts are better for classification learning.

Furthermore, Gurlitt, Dummel, Schuster, Nückles (2011) stated the structure of AOs affect the creation of cognitive schemata of learners. Their experimental and control groups are learned with well-structured, well-structured and key-concept emphasizing and less-structured. Well-structured AOs make easier to construct initial schemata for learners. Babaei and Izadpanah (2019) compared the effects of three different type AOs which are key vocabularies, previewing comprehension questions and multimedia annotations on learners' comprehension skills. The results show that key vocabularies and multimedia annotations are effective as AOs while comprehension questions do not facilitate learners. Moreover, Han-Chin and Hsueh-Hua (2017) made a study with high school students to examine the effect of different format of AOs (graphical, audio, text) on understanding of science concepts. They stated that while designing instructional material to teach abstract science concepts, graphical AOs are more effective.

Studies that support the idea of AOs facilitate learning bring a new research area. The question of can AOs reduce cognitive load becomes popular on the field. Working memory load occurs when working memory tried to process, organize, compare unfamiliar complex contents. Reducing working memory load requires repetition of learning content (Sweller, 2011, p.43). By definition, AOs aim to help learners organize their knowledge and introduce them to learning material. Because of that, the hypothesis of AOs can reduce cognitive load is supported many researchers. Cutrer, Castro, Roy & Turner (2011) conducted research with forty-six pediatric residents to investigate the effect of AOs on knowledge organization.

The results showed that using AO has positive effect for organizing and integrating knowledge compare with traditional methods. In their study, Colliot and Jamet (2017) indicated adding AO into learning material has better effect on students' retention and transfer skills. In addition, Moore and his collages (2013) reported that concept maps help students to focus conceptual knowledge rather than procedural information unlike traditional learning materials.

Effect of AOs can change by learners' cognitive structure, prior knowledge, age and etc. Moreover, the content that is taught is also influence the effect of AOs. Because of that according to their form, function, presentation, there are different type of AOs. Although it is known that AOs can be used to reduce cognitive load, there is hypothesis which different type of AOs have different effect on cognitive load. In literature, there are some studies about how different type of AOs influence cognitive load. Lin and Chen (2005) compared question type and descriptive type of AOs on students to investigate which one is more effective for reducing cognitive load of 86 undergraduate EFL students in animation-based learning environment.

2.1.1 Graphical Advance Organizer

Graphical advance organizers are used to show concepts in visual way. Graphical organizers are useful to show connection between concepts and construct ideas. Ausubel (1963) defines graphic organizers as a "bridge" between knowledge that is already known and will be learned. Diagrams, charts, and illustrations, maps are the type of graphical organizers and using them while teaching provides learners to make clear content understanding (Egan, 1999). Graphic organizers give idea students about the main points, structure for the constructing ideas and overview for the topic (Hawk & McLeod, 1985).

The literature shows that graphical type AOs are useful for many different teaching methods such as Willerman and Mac Harg (1991) used concept maps in-class

lessons, Shihusa and Keraro (2009) used with traditional teaching method. In this study, hierarchical concept maps are used as graphical AO since Amadieu and his colleagues found that hierarchical concept maps require less mental effort for learners rather than network concept maps (2009). Graphical type of AOs are implemented the topics which are instrumentation, mean comparison tests and observation-interview. To indicate results, quantitative data with achievement scores and qualitative data with open-ended questions and interview are collected.

Advance Organizers help learners to make connection between knowledges and put them cognitive architecture in the light of hierarchical relations of knowledges. Concept maps which are the type of graphical organizer serves that purpose. Using concept map as an AO is very common in education. Cutrer and his collogues (2011) used concept map as AO to facilitate medical knowledge of doctors. They found that concept maps help learners to structure and combine knowledge and get deeper understanding. Willerman and Mac Harg (1991) used concept map as an AO for eighth grade science students. They designed an experimental study which contains control and experimental groups. Experimental group which concept maps are used get high scores compared with the control group. Shihusa and Keraro (2009) also design a study on biology students. The results showed that concept map as an AO affects positively students' motivation.

2.1.2 Narrative Advance Organizer

Narrative type AOs are all textual concepts such as stories, novels, memories, news etc. Scripts are also used as narrative type AO. Narrative Script AO improves understanding of students in video lecture (Ambard & Ambard, 2012). In similar, short sentences is an example of narrative type AO. Herron (1994) used six short sentences before video part of the lesson. With the help of short sentences, students could catch the key point of the video.

Literature contains studies that show narrative type AOs facilitate learning in different teaching methods. Ollerenshaw (1998) design a study that examine students' science understanding while doing experiments in physics class. Ollerenshaw used storytelling as advance organizer and divide participants in two groups which are control group who was not exposed to story-telling and the experiment group who used advance organizers. In the end, post unit test was conducted. The results indicated that the experiment group get higher scores.

Using stories as an AO can help learners because stories are easy to understand by giving readers to a structure to analyze the actions. Readers are aware of all situations happens for a reason in story, so they pay attention. Also, stories are exciting, make readers curious. In this way stories are memorable (Willingham, 2021). Lawton and Burk (1990) found that using story type AO with preschool students improves social problem-solving skill of students.

2.2 Cognitive Load Theory

Cognitive load theory (CLT) is developed based on properties of working memory and long-term memory that shape human cognitive schema (Sweller et al., 2019). The schema is used for arrangement of the knowledge in cognitive system by their relations (Sweller, 1994). CLT is designed for providing the idea for instructional designers by using the information how human cognitive architecture is constructed with schemas (Pass & van Merriënboer, 2020). When cognitive load is increased then learning becomes ineffective since redundant elements in learning materials hold excessive area in cognitive system (Sweller et al., 2019). To maximize learning, learning material should include less unrelated elements so cognitive load is managed to more relevant materials to process (van Merriënboer et al. 2006).

CLT emphasizes that working memory has narrow time (Peterson & Peterson, 1959) and capacity (e.g., Cowan, 2001; Miller, 1956) to process unfamiliar information which is obtained from environment (Sweller et al., 2011, p.42). Information is held in working memory in a short time. Because of that, if information is not processed immediately, it will be forgotten. Peterson and Peterson (1959) states that information is held in working memory approximately 20 seconds. In addition, the number of items that processed in working memory simultaneously is limited. While Miller (1956) propose that number as seven, Cowan (2001) states that number even less as four. Although the working memory do not store information, the limitations of working memory affect the learning process. In working memory, information is processed by arranging, comparing etc. Since these require more effort, people can process limited numbers of information in time (Sweller et al., 1998).

The information that is processed in working memory is translated to long term memory to be stored in cognitive system. Long term memory is responsible for storage. In contrast to working memory, capacity of long-term memory is not limited. Information that is stored in long term memory enables people to make connections between novel information that is processed in working memory and prior information. In that way, novel information is included to cognitive system (Sweller et al., 1998). Prior knowledge determines the knowledge level of people which cause variation between learners. According to stored knowledge, the working memory of people differs from each other (Sweller, 2016). Differences between working memory and prior knowledge of learners require to consideration during instructional design.

2.2.1 Categories of Cognitive Load

Working memory and long-term memory are main concepts for CLT. Based on characteristics of working memory and long-term memory, the attention of CLT focused on which information should be processed in limited working memory (Sweller et al., 1998). Working memory is able to get all information from environment with human senses. Therefore, chose of which information is processed becomes crucial for instructional designers. CLT aims to reduce cognitive load by reducing working memory load. Sweller and his colleagues (1998) introduced three types of cognitive load.

2.2.1.1 Intrinsic Cognitive Load

The main goal of instructional design is making learners acquire desirable knowledge and get learning objectives. The information that includes learning objectives places load on working memory. The load that is resulted from instructional information is called as intrinsic cognitive load (Sweller et al., 2011, p.57). Intrinsic cognitive load is measured by element interactivity. Element interactivity determines the number of interactivity that the instructional information includes (de Jong, 2009).

Sweller and his colleagues (1998) states that instructional information includes elements which are called as knowledge schemas. Elements are all the piece of knowledge that are requires to be learned by processing in working memory. Complexity of elements also known as element interactivity vary learner to learner based on prior knowledge of learners (Sweller et al., 2019). When an element is related with another element that is already located in long term memory, then those elements can act as an element, so element interactivity is reduced (Sweller, 2019). It is explained by a well-known mathematical equation example (Sweller, 1994; Sweller, van Merriënboer, & Paas, 1998; Sweller, Ayres & Kalyuga, 2011;

Sweller, 2010). The equation of (a + b)/c = d has many elements for a novel learner like a, b, / and more. In order to solve this equation, the novel learner must process all of these elements simultaneously. In that situation, element interactivity is very high because working memory needs to organize, compare and process much more elements at the same time. On the other hand, when the learner is familiar with that equation, the equation will be a single element that is needed to be processed in working memory. In that way, the load will be reduced on working memory.

As Bannert (2002) states learning materials are primary source for intrinsic cognitive load. High element interactivity causes high intrinsic cognitive load. Low element interactivity provides learning in continuum since elements do not need to be process simultaneously (Sweller et al., 1998). While designing an instructional learning material, intrinsic cognitive load should be manage as reducing load.

2.2.1.2 Extraneous Cognitive Load

The instructional design which includes unnecessary knowledge for learning objectives cause extraneous cognitive load (Sweller et al., 2011, p.57). Extraneous cognitive load is related with instructional design rather than instructional information like intrinsic cognitive load. Extraneous cognitive load results from procedures to get knowledge and presentation styles of that knowledge (Sweller et al., 2019). Since working memory has limited in capacity, sources of extraneous cognitive load should be removed form instructional design. Hereby, there will be more area in working memory to process desired knowledge.

Although extraneous cognitive load is not related with instructional knowledge, element interactivity influences also extraneous cognitive load. Presentation of the learning materials can be affected by element interactivity. If a learning material is designed as presenting information without consideration of cognitive schema of learners, then the procedure includes many elements in working memory. The other

way, learning material can present information as learners can get knowledge easily (Sweller et al., 2011, p.56). The total cognitive load which includes intrinsic and extraneous cognitive load affects the processing of working memory. Both extraneous and intrinsic cognitive load is too high, then the learning cannot be effective because of overload on working memory (Sweller et al., 1998). The effective instructional design should manage the total cognitive load as minimum in order to facilitate learning.

2.2.1.3 Germane Cognitive Load

Intrinsic and extraneous cognitive load are related with instructional design. However, germane cognitive load is different from them. Germane cognitive load is defined by Sweller and his colleagues (2011) as the sources of working memory that engage the learning (p. 57). Germane cognitive load is all about the working memory activities that encourage learning. Because of that, Sweller identifies the primary source of germane cognitive load is feature of learners since working memory effort change learner to learner. (2010). In that way intrinsic and germane cognitive load is related with each other. Reducing extraneous cognitive load create more space for intrinsic activities in working memory. In 1998, Sweller attributed germane cognitive load to total cognitive load. Later, germane load is outed of the total cognitive load because although extraneous cognitive load is reduced, since germane cognitive load is increased, total cognitive load is not changed (Sweller, 2019).

While managing cognitive load, germane cognitive load should be increased in order to support learning. On the other hand, too much cognitive load can be harmful to learning. Kalyuga (2007) claims that the working memory has limited capacity. When learning material is design to increase germane cognitive load too much, then the working memory is overloaded which is detrimental situation to facilitate learning. In that situation, germane cognitive load return to extraneous cognitive load. Thus, while designing instructional material, beside the total

cognitive load which includes extraneous and intrinsic cognitive load, germane cognitive load should also be manage carefully.

Germane cognitive load is working memory resources (Sweller et al., 2011, p.57). Instructional designers should consider that learning materials should be designed to engage learners use these resources in or to deal with intrinsic cognitive load rather than extraneous cognitive load. Usage of resources for intrinsic cognitive load provide more effective learning since in working memory intrinsic nature of information is processed (Sweller, 2010).

2.2.2 Principles of Cognitive Load Theory

Cognitive load theory claims that there are two types of knowledge which are biologically primary and secondary knowledge based on the study of Geary (2002). Biologically primary knowledge cannot be teachable, people are evolved to get biologically primary knowledge such as problem solving, learning native language, self-regulation (Sweller, 2019; Newell & Simon, 1972). On the other hand, biologically secondary knowledge can be taught by instructions. The lessons that are taught in schools are the examples of biologically secondary knowledge. People cannot learn them automatically in contrast to biologically primary knowledge (Sweller, 2019). Both biologically primary and secondary knowledge are used during instructional design. Although biologically primary knowledge cannot be taught, they can be used for acquisition of biologically secondary knowledge. For that reason, both biologically and secondary knowledge play crucial role in construction of human cognitive architecture (Sweller et al., 2019).

2.2.2.1 Randomness as Genesis Principle

Problem solving is one of the ways to get novel, secondary information. When people face with a new problem that is unfamiliar to them, they try to solve that problem by testing solutions randomly. Randomness as genesis principle deals with the knowledge that is obtain directly from environment not via guidelines or prior knowledge (Sweller, 2019). The focus of randomness as genesis principle is that problem solving is primary source for new knowledge that is acquired by randomly. The main consideration is the problem must be new that learners do not have prior knowledge to obtain to solve problem. The solution should be tested randomly and the correct one is held in long term memory (Sweller & Sweller, 2006). It is the way that novel information which is transferred to human cognitive architecture. The knowledge that is gained with randomness as genesis principle has the learner own biologically primary characteristic.

2.2.2.2 The Barrowing and Reorganizing Principle

The barrowing and reorganizing principle also deal with novel information that is obtained from environment. The difference with randomness and genesis principle is that the knowledge is presented by a person. The knowledge that is obtained with randomness as genesis principle is transferred with barrowing and reorganizing principle (Sweller, 2019). The barrowing and reorganizing principle provides the tested and organized knowledge by someone. Since the tested and organized knowledge is appropriate for the problem situation, it is stored more efficient in long term memory (Sweller et al., 2011, p. 37). The barrowed information is reorganized with prior knowledge and transferred to learner's own cognitive schema.

2.2.2.3 The Narrow Limits of Change Principle

The previous two principals were about the acquiring information. The narrow limits of change principle is about processing and storing processed information. Before the transfer of novel knowledge to long term memory it is processed in working memory. The narrow limits of change principle focus on limitations of working memory (Sweller, 2019). Working memory is limited both in capacity and duration. Cowan states that working memory can process only four elements at time (2001). Peterson & Peterson claim the duration that working memory can process a content is 20 seconds (1956). Working memory obtained much information from external environment with sensory memory. On the other hand, this information should be limited before transferring long term memory. Thus, the narrow limits of change principal supply that limitation with manner of working memory. In that way, only desired knowledge is transferred to long term memory (Sweller & Sweller, 2006).

2.2.2.4 The Information Storage Principle

The other principle which is related to processing and storage information is the information storage principle. Learning occurs when the knowledge is transferred to long term memory. Learners becomes expert on one content by practice their stored knowledge. The information storage principal claims that the more novel information that is stored in long term memory the more become expert (Sweller, 2019). Learning materials or instruction should encourage learners to practice their knowledge and transfer that knowledge long term memory properly. Because of that storage of the wide information is the main point for information processing system (Sweller & Sweller, 2006).

2.2.2.5 The Information Storage Principle

The environmental organizing and linking principle is about usage of stored information in long term memory. This principle assumes that when people face with familiar situation, they call their prior knowledge that is located in their long-term memory and use that knowledge (Sweller & Sweller, 2006). It is known that working memory is limited while processing novel information. On the other hand, there is no limitation for working memory while processing familiar information that is translated to working memory from long term memory (Sweller, 2019). In short, this principal claims that people link their prior knowledge with the environment and use it in the external world.

2.2.3 Cognitive Load Effects

Cognitive load theory is used for instructional design. In order to reduce cognitive load of the designed learning material, there are some procedures. These procedures are introduced by Sweller and his colleagues (1998) result from many experimental studies that compare traditional learning materials and cognitive load effect included material (Sweller et al., 2011, p.87). In 1998 paper, Sweller introduces seven cognitive load effects which are goal-free, worked example, completion problem, redundancy, modality, variability and split-attention. However, later studies show that there are more effects that are used to reduce cognitive load (Sweller et al., 2019).

The explanations of some cognitive load effects;

- Goal-Free Effect: Sweller and Levine state that when learners do not know what the specific problem is, they solve the problem situation easily (1982). Goal-free problems are lack of the desired goal. There are many unknown of the problems and learners try to solve all the unknowns. Traditional problems may create extraneous cognitive load. In order to reduce that load, goal-free effect can be preferred (Sweller et al., 2011, p.98).

- Worked Example Effect: Sweller and Cooper found that learners spend less time on a problem when they study on worked example before (1985). Worked examples reduce cognitive load for novel learners by engaging them to focus specific problem operators (Sweller et al., 2019).
- Completion Problem Effect: Completion problems are between worked examples and traditional problems (Clark, Nguyen, Sweller & Baddeley, 2006). In order to level up learners' learning working examples cannot be enough. Completion problem effect which makes learners more active during problem solving is introduced by van Merriënboer and Krammer (1987).
- Split-Attention Effect: When the group of information which needs to be processed simultaneously is presented separately, then the working memory is overloaded (Tarmizi & Sweller, 1988).
- Redundancy Effect: Chandler and Sweller (1991) states that the same information is presented in two or more channel at the same time, it causes the overload.
- Modality Effect: To handle with split-attention effect, modality effect provides integrated information that needs to be processed simultaneously, can be presented in multiple channel (Mousavi et al., 1995).
- Variability Effect: Variability effect is different from other effects by increasing cognitive load. It states that when aspects of a problem are increased, then transfer of knowledge is increased since learners are familiar with more than one aspect of a problem (Paas & van Merriënboer 1994).
- Element Interactivity Effect: Element interactivity effect claims that intrinsic cognitive load cannot be changed since the content and the learner are stable. However, element interactivity is one of the reasons of the intrinsic cognitive load so by changing element interactivity also cognitive load can be changed (Sweller 1994).

- Expertise Reversal Effect: When learners become more expertise about the content, the element interactivity will be decreased relevant with the environmental organizing and linking principle (Kalyuga et al. 2003; Sweller et al., 2019).
- Guidance-Fading Effect: Renkl and Atkinson (2003) state that long period of learning requires change in instructions. While at the beginning of the learning period, learners were novel, strategies such as worked example are effective. However, when learners become expert on topic, there will be need for more sophisticated strategies such as traditional problems (Sweller et al., 2019).
- Transient Information Effect: When learning context becomes complex and includes details, then information should be presented in permanent way such as pictures or diagrams rather than transient way like animations where information disappears in time (Leahy and Sweller 2011).
- Self-Management Effect: Self-Management effect claims that learners should be aware of their cognitive load and reorganize the learning material according to their cognitive load (Roodenrys et al. 2012; Sithole et al. 2017).
- Self-Explanation Effect: Self-explanation effect requires working memory resources to learners connect prior knowledge and current elements of content by creating their self-explanation for problems which can be difficult for novel learners (Clark, Nguyen, & Sweller, 2006; Renkl et al., 1998).
- Imagination Effect: Imagination effect for expert learners is facilitate learners since the information is practiced in working memory by imaging the content (Cooper et al. 2001; Sweller et al., 2019).
- Isolated Elements Effect: Complex learning materials that include high element interactivity is harmful for learning. Isolated element effect states that beside presenting all elements and their interaction, presentation first

elements then their interactions will be more appropriate to facilitate learning (Pollock et al. 2002).

- Collective Working Memory Effect: Kirschner et al. (2009; 2011) argues that when learners study collaboratively, their working memories act as a single working memory which means the more working memory resource.
- Human Movement Effect: One way of the people learning is observations. People get biologically primary knowledge by observe and imitate other's movement. Because of that human movement effect assumes that people learn better with animation which includes movements (Paas and Sweller 2012).

2.2.4 Cognitive Load in Multimedia Learning Environments

Reducing extraneous cognitive load is one of the key elements in multimedia learning. There are numerous studies that is conducted to find out how extraneous cognitive load is decreased, and germane cognitive load is increased. Management of cognitive load is the topic of much research. Study of Hughes, Costley & Lange which is made with number of 1701 students showed that variety of media is negatively correlated with extraneous cognitive load (2018). This study is parallel with the Mayer's cognitive theory of multimedia learning (2002). In addition, one of that research is conducted by Costley and his colleagues. They searched to investigate whether video viewing strategies are effective to manage cognitive load. They found that video viewing strategies positively correlated with germane cognitive load which facilitate the learning (2020).

Cognitive load effects are the focus of many research that located in multimedia environments. Singh, Marcus and Ayres (2019) are conducted a study that investigate the transient information effect by comparing two modality channels. Sixty-four 10^{th} grade students were participated to study. They are divided into four groups as reading continuous (N = 15), reading segmented (N = 17), listening continuous (N = 16), or listening segmented (N = 16). When reading continuous

and listening continuous groups are compared, it is seen that reading continuous group has better learning outcomes. Moreover, the comparation between listening continuous and listening segmented groups show that listening continuous group were superior in learning outcomes. These results claim that when information is permanent, the learning is facilitated.

In 2010, Blayney, Kalyuga, and Sweller look for the relationship between isolated elements effect and expertise reversal effect. They conduct a study with 728 students by computer-based learning. The results show that students who were novel about the topic, get advantage from instructions that are design with isolated element effect. However, the more expert students can handle with interactive elements in a productive way. Although split-attention effect is related with extraneous cognitive load, Cierniak, Scheiter, and Gerjets, (2009) investigate that split-attention effect is also related with germane cognitive load. They conducted two experiments with 98 students who are assigned randomly six groups according to 2 x 3 experimental design as instructional format (integrated vs. split-source) and type of secondary task (without vs. perceptual vs. cognitive). They found that provide alternative instructional design that reduce split-attention effect facilitate learning.

Tabbers, Martens and van Merriënboer (2000, 2001, 2004) stated that modality effect does not cause the extraneous cognitive load. System-paced instructions that provide both audio and visual source of information that are integrated are useful to reduce cognitive load. Moreover, in his meta-analysis, Ginns (2005) stated that modality effect is useful when the topic has high element interactivity. The studies that are analyzed in that meta-analysis showed the topics that has low element interactivity do not require modality effect since there are enough area in working memory. On the other hand, while learning high element interactivity topics, there is no need for extraneous cognitive load because the working memory processes the elements and their interactions.

2.3 Summary

In online learning, managing cognitive load holds important area while designing learning materials. Extraneous cognitive load leads to decreasing the working memory area that needed for processing instruction. Since learning occurs when the new knowledge is integrated to learners' cognitive architecture, helping learners to construct the new knowledge with their prior knowledge is one of the aims of instructional material design. There are some ways to reduce cognitive load and one of the is using advance organizer at the beginning of the course. AOs help learners to organize their knowledge and in tat ways organizing knowledge at the working memory becomes easy for the learners. Different type of AOs has different effect on the learners' cognitive load.

CHAPTER 3

METHODOLOGY

3.1 The Research Design

The purpose of that study is to investigate which type of AO whether narrative or graphical is more effective in learning research method during online learning. In order to see the difference, a mixed method study is conducted. Mixed method is defined as using combination of quantitative and qualitative data in one study. Mixed method requires using both quantitative and qualitative research method to collect and analyze the data (Creswell, 2014). Creswell (2014) states that both quantitative and qualitative data have weaknesses through getting understanding of data. For that reason, using mixed method helps us to get more stronger results with proper understanding of the data. There are three main types of mixed method which are explanatory design, exploratory design and triangulation design (Fraenkel, et al., 2012). In triangulation design which is also known as convergent parallel design (Edmonds & Kennedy, 2017), the quantitative and qualitative data are collected and analyzed independent from each other. Then the results are compared to see whether they provide same results. While other mixed method designs give priority to quantitative or qualitative data, triangular design does not give priority any type of data, they are equally prior. In the exploratory design, the order of the usage of the methods is first qualitative data are collected then the according to these finding quantitative method is established. Since the priority is on the qualitative data, quantitative data is used to support qualitative data. In explanatory design, quantitative data is collected in the first place. Qualitative data are used to get additional information for quantitative data (Creswell, 2014, Fraenkel, et al., 2012).

In the current study, the sequential explanatory design is used. The sample size of the current study is lower than expected because of that sequential explanatory design is used so get more detail about quantitative findings. The qualitative data are used to get more detail about the result of quantitative data. Firstly, the quantitative data are collected with achievement test then the data are analyzed. Then interview questions are developed. Interviewing with participants helped to collect qualitative data. Finally, the quantitative and qualitative results are combined. The process is done in the light of Ivankova and his friends' sequential explanatory design model (2006).

For the quantitative research part of the study which uses numerical data to make suggestion about the relationship between variables (Watson, 2015), one-group posttest research design is conducted (Cook & Campbell, 1979). In one-group pretest-posttest research design, all participants experience all treatments unlike true experimental research designs that include one control and one experimental group (Fraenkel, et al., 2012).

The experiment took 8 weeks. The participants are 15 students from department of Computer Education and Instructional Design who take Research Methods course. Participants attended six online course which three of courses included narrative type of AO and other three courses included graphical type of AO. Before the treatments, pre-test is applied to measure the prior knowledge of students about the topic.

The data were collected with the achievement test scores. Achievement test includes 24 questions for all topics, and each AO type is measured with 12 questions. Achievement test is implemented after sixth week. The mean of achievement scores were compared. The presentation of the research design is shown below.

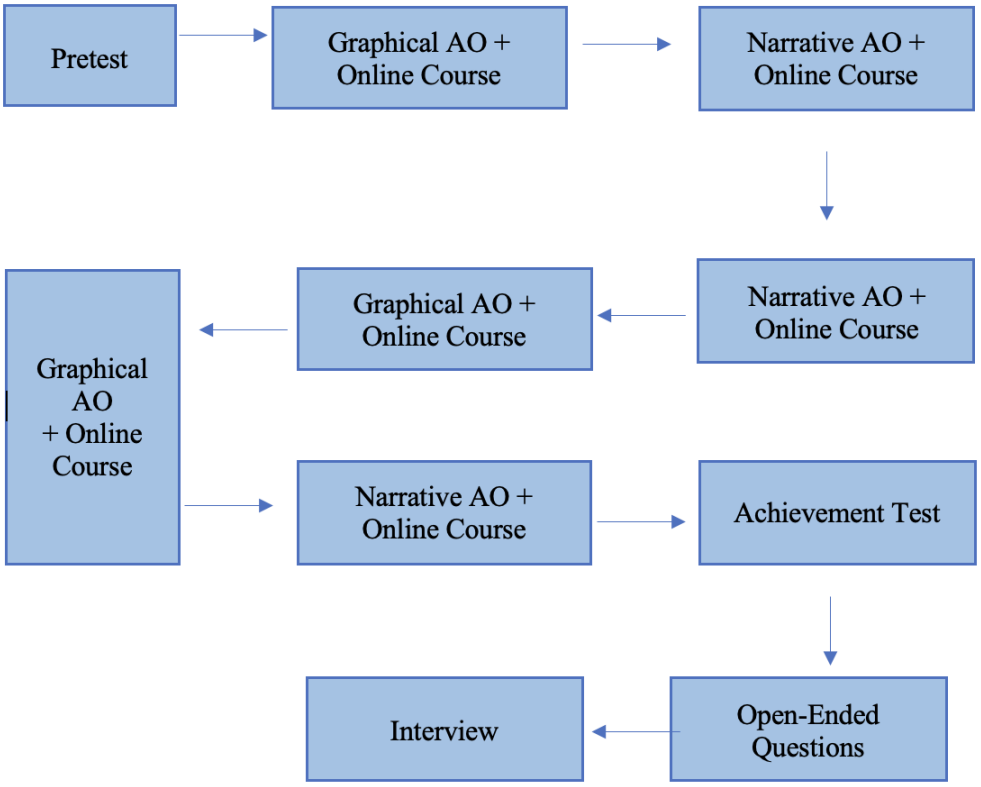

Figure 3.1 Research Design

Research design includes treatments that contain narrative and graphical type of AOs and after that there was achievement test. Finally, open-ended questions and interview part are the last steps of research design.

The qualitative data is collected with the open-ended questionaries and interviews. Interview research method gives an idea to researcher about the opinions of participants (Frankel et al., 2012). Five of the participants are selected according to their achievement test results. Participants that get high, average, and lower points on achievement tests firstly answered open-ended questionaries. Then the interview is done as online that took 5 minutes to get detail information which type of AO was more useful to enhance their learning.

The independent variable of the currents study is the type of AO that used at the beginning of the class. The dependent variable on the other hand is achievement test performance of students.

3.2 The Course

Research Method course from the department of Computer Education and Instructional Technology is a thirteen-week course. The aim of the course is to introduce students with research methods that are used in educational research. The topics of the course were given with the Table 3.1. This course is chosen because the topics are appropriate for both graphical and narrative type of AO. In this course one of the week topics are not reliable with next one.

Table 3.1 Topics of The Course

Week	Topic
1	Introduction to the course & Educational Research
2	Introduction to educational research
3	Instrumentation in Educational Research
4	Validity & Reliability
5	Literature Review & Correlational Analysis Workshop
6	Mean Score Comparison Analysis Workshop
7	Qualitative Research in Education
8	Interview & Observation
9	Qualitative Data Analysis
10	Reporting Educational Technology Research
11	Midterm - Review
12	Midterm
13	Portfolio Presentations

3.3 The Participants

In a class includes 15 students from the department of Computer Education and Instructional Technology. Students who take the Research Method course learn concepts, methods, and theories of educational research. Within group designed requires all participants attend all treatment conditions.

The participants for this research study is chosen by convenience sampling method which is using available participants who are voluntary for the attend the study (Frankel et al., 2012). Since prior knowledge is crucial for this study, the sample is chosen from Research Method course because the students of this course are not familiar with the topics of course and the course is not required prerequisite course.

The participants of the study are student of the course of Research Method. The age of participant was between 19 and 23. While 11 of participants were male, 4 of participants were female. The participants of the course are from Computer Education and Instructional Technology department. They would not get similar or pre-requested course of the course. Because of that, the potential prior knowledge of learners will occur from their daily life experiences.

3.4 The Instruments

3.4.1 Pre-Knowledge Test

AOs help learners to construct the new knowledge with their prior knowledge. When the new concept is more familiar to learner their cognitive load will be less. Because of that prior knowledge of learners is effective while measuring the effect of advance organizer on cognitive load. In order to balance the learners' prior knowledge, pre-knowledge test that measures the prior knowledge of learners was

applied. The pre-test includes multiple choice questions. There are six questions in pretest. One question for all topics. Questions are comprehensive which means they are not focus on the one point of the topic. Mean of pre-test scores is examined. According to pre-test scores, with the instructions, learners' prior knowledge would be tried to make equal.

3.4.2 Achievement Test

Observation of cognitive load cannot be done directly. There is need for instruments that help measurement of cognitive load. Brunken, Plass and Leutner (2003) classify measurement tools into two extend which are objectivity and casual relation. While objectivity explains the data were used objectively or subjectively, the casual relation type measurements set on according to relation type as direct or indirect. In short, there are four type measurement of cognitive load indirect subjective, indirect objective, direct subjective and direct objective measurements.

In the present study, indirect objective type measurement is used. Indirect objective measurements look over the participants' performance. In that type measurements, the more the amount of information that learners get from the materials is interpreted as the more intrinsic cognitive load. Beside the performance, behavioral and psychological outputs of learners are also analyzed in that type measurements (Brunken, Plass, & Leutner 2003). Learners' learning outcome from the achievement test and pre-test scores are analyzed. There was one achievement test that cover the objectives of the courses. Achievement test consists of 24 questions which are multiple choices that include four choices. There were four questions for all topics. The questions measured the content knowledge of the students. Achievement test is prepared with one instructor who is giving this course.

3.4.3 Open-Ended and Interview Questions

In the qualitative part of the study, open ended questions and interview are designed. The aim of the qualitative part was to validate the findings from the quantitative part. The questions are type of opinion questions. Opinion questions concern participants' thoughts (Frankel et al., 2012). Opinion based questions are asked to five participants who participate qualitative part voluntarily. The current study contains seven open-ended questions and five interview questions. Since open-ended questions were not enough to get deeper understanding, participants are asked five interview questions later.

3.5 The Procedures Followed

There are two types of AOs each of which was presented for three weeks. The study was conducted in the department of Computer Education and Instructional Technology. The study started at the third week of the 2021-2022 fall semester. The participants of the study were student of the course of Research Method.

There was one group that is exposed to all treatments. Each treatments includes different type of advance organizers. These treatments are exposed to participants for 6 weeks. Since difference in prior knowledge of learners can affects the results of the study, before the treatment conditions to detect learners' prior knowledge, the pre-test was applied. According to results of the prior knowledge test, there would a class that involves necessary instructions to balance prior knowledge of learners. In that way, their cognitive load will not be affected by their cognitive architecture.

The second week of the course, pre-knowledge test is given to students. After one week off, treatment conditions were started at the third week of the course. Type of AOs which are presented through course are listed in Table 3.2. It was decided that which type of AO would be used for which week, according to the suitability of the course topics with the pre-editor who is instructor of the course.

Table 3.2 Advance Organizer Types Through Weeks

Week	Topic	Advance Organize Type
3	Instrumentation in Educational Research	Graphical
4	Validity & Reliability	Narrative
5	Literature Review	Narrative
6	Mean Score Comparison Analysis	Graphical
7	Qualitative Research in Education	Narrative
8	Interview and Observation	Graphical

AOs were presented at the beginning of the course and their duration was approximately three minutes. After presentation of AOs, the lesson was taught by the instructor. At the end, mean scores of students' achievement test were compared to investigate which type of AO is more effective.

Achievement test was given after one week of the sixth week treatment. Extra time to students for preparing the achievement tests was not given since when students repeat the content, they can remember the contents because of the repetition instead of AOs.

Achievement test was designed as online at the same time for all students in Classtime web 2.0 tool. To avoidance cheating, there was limited time for each question and students cannot back previous questions again. In addition, the alignment of the questions was different for all students.

For qualitative part of the study, as a first step, questionaries that includes five questions to get opinion of students about using which type of AO was more

efficient for them is given by e-mail. Students are chosen according to their achievement test results. Five students who get highest, lowest, and average score answered open ended questions. Then, interviews are done with these students as online. Interviews were recorded by informing students. Interviewer was the researcher of the current study who did not know participants earlier.

3.6 Internal Validity

Internal validity requires that the relationship between variables causes from the treatments not from some other effects such as gender, age, date and etc. (Frankel et al., 2012). Possible internal validities for that study are location, data collector characteristics, data collector bias and implementation. In this chapter, all internal validity threats will be discussed.

Location. Internal validity threat that occurs when the location causes the different result for the study. Students' personal computers can be effective in that internal validity. On the other hand, the materials that is used in study do not require extreme properties. The materials can be reachable for all computers so that location threat is tried to eliminate for that study.

Implementation. Implementation threats occurs when participants think participating study will be get advantage to them. In order to eliminate this threat, participants were informed at the beginning, they will not get extra point for participating.

Instrumentation. The instrumentation threat can occur for this study. Pre-knowledge test and achievement test do not contain same number of questions. While pre-knowledge test includes six questions, achievement test includes twenty-four questions.

Testing Decay Effect. Covid-19 pandemic causes missing courses because of that achievement test could not done more than once. There was only one achievement test. This situation may cause misleading results.

In addition to these internal validity threats, for the present study, the difficulty level of the contents is another point that is needed to consider because when they will not equal in difficulty, the scores of students for achievement test will be affected from these difficulty level instead of AOs. The equal topics will be chosen with experts who are the instructors of the course.

3.7 Data Analysis Methods

In the present study, for quantitative part, data analysis is done with statistical method of paired sample t-test in SPSS program. While the means of pre-knowledge test scores are presented in descriptive forms, the means of achievement test scores are compared by using paired sample t-test.

In qualitative part, 5 students who get high, average, and low scores from achievement test are chosen for interview. Firstly, they answered five open-ended questions then they were interviewed. The data are analyzed with constant comparison method. Firstly, the coded words list was prepared and codes which are look like similar were categorized. Finally, categories are classified under themes.

CHAPTER 4

RESULTS

In this chapter, the results of quantitative and qualitative data analysis are presented. This chapter aims to provide data analysis to get idea about the effect of narrative and graphical type AOs on students' test performance.

4.1 Analysis of Quantitative Data

The quantitative data is obtained from students' pre-knowledge test and achievement test scores. The data are analyzed with Statistical++ Package for the Social Sciences (SPSS) version 27.0. Descriptive Statistic is used for analyzing students' pre-knowledge test scores. Paired sample t test is used to compare achievement test scores of students as a result of normality test result which helps to decide using parametric or non-parametric statistical test. Paired sample t test has done to find out which type of AO is more effective for online learning in the case of facilitate their learning performance.

4.1.1 Pre-Knowledge Test Scores

The purpose of pre-knowledge test was to determine the knowledge level of students about the concepts at the beginning of the study. Prior knowledge is one of the key elements for cognitive load since it affects process of knowledge in working memory. Participants are asked six questions in pre-knowledge test that each questions represents one topic. Table 4.1 shows descriptive results of pre-knowledge test.

Table 4.1 Descriptive Statistics

	N	Max Score	Mean	Std. Deviation	Std. Error Mean
Pre-Knowledge Test Scores	15	6	2.0667	1.57963	.40786

The pre-knowledge test scores shows that students correctly answered 2 questions out of six questions. It can be interpreted that students do have prior knowledge for topics but not much.

4.1.2 Achievement Test Scores

Participants took achievement test that contains twenty-four questions. Each AO type is represented by twelve questions. To understand which AO type is more effective, means of participants' scores for AO types are compared with paired sample t-test. The normality of scores is checked. Based on the results of Shapiro Wilk's test, the achievement test scores of students (N=15) were normally distributed ($p > .05$). Achievement test scores of participants with skewness of .185 (SE = .597) and kurtosis of -.782 (SE = 1.154). Normality test results are shown in Table 4.2 and 4.3. Normal Q-Q plot of the students' scores in Achievement Test is shown in Figure 4.1. Then paired sample t-test is conducted. Table 4.5 and Table 4.6 show the result of paired sample t-test.

Table 4.2 Shapiro Wilk Results of Achievement Test Scores

	Shapiro Wilk		
	Statistic	df	Sig.
Achievement Test Scores	.951	14	.569

Table 4.3 Swness and Kurtosis Results of achievement Test

	N	Skewness	Kurtosis
Achievement Test Scores	15	.185	-.782

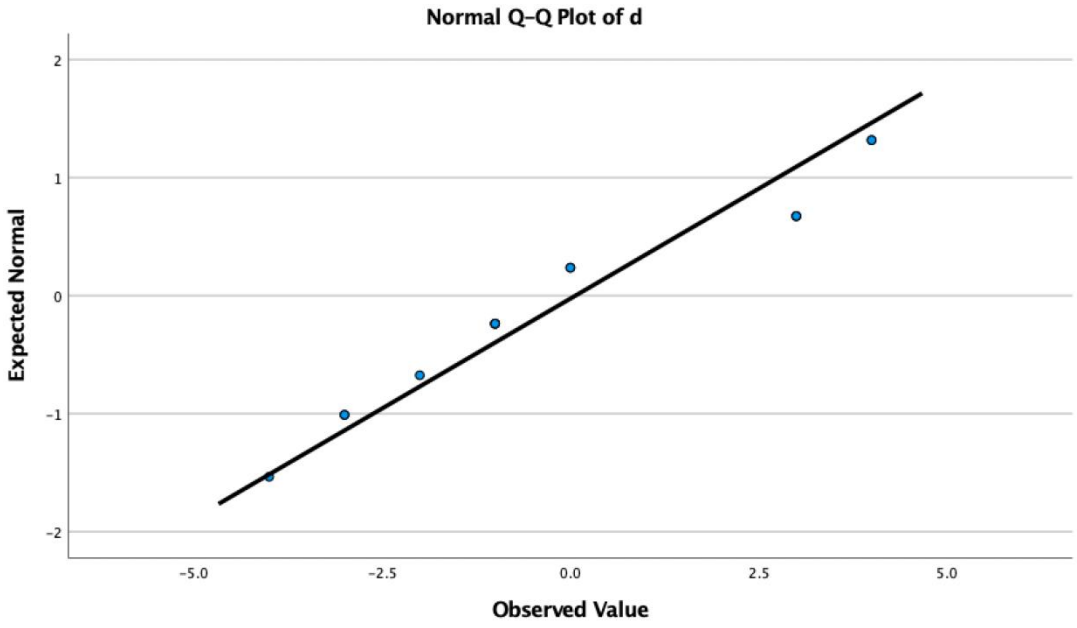

Figure 4.1 Normal Q-Q plot of the students' scores in Achievement Test

Table 4.4 Descriptive Statistics of Achievement Test

		N	Mean	Max Scores
Graphical Scores	AO	15	6.87	12
Narrative Scores	AO	15	6.80	12

Table 4.5 T-Test Statistics Compariong Graphical and Narrative AOs on Achievement Test Scores

		N	Mean	Std. Deviation	Std. Error Mean
Graphical Scores	AO	15	6.87	2.134	.551
Narrative Scores	AO	15	6.80	2.042	.527

Table 4.6 T-Test Results Compariong Graphical and Narrative AOs on Achievement Test Scores

	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Scores	.067	2.685	.693	-1.420	1.554	.096	14	.925

A paired-samples t test was conducted to evaluate whether participant learn more effectively with graphical or narrative type AO. The results indicated that the mean of graphical AO score (M = 6.87, SD = 2.13) was not significantly different than the mean of narrative type AO score (M = 6.80, SD = 2.04), $t(14) = .096$, $p < .01$. The 95 % confidence interval for the mean difference between the two ratings was -1.42 to 1.55. Since learners took advantages from both type AOs, there is no significant difference between achievement test scores.

4.2 Analysis of Qualitative Data

The qualitative data of this study were collected through interviews and open-ended questions from five participants who are given after achievement test. The aim of open-ended questions and interview is to get idea about participants' opinions about which AO is better for them in the manner of cognitive load. While open-ended questions aim to get more general idea of participants, interview questions look deeper of participants' experiences and feelings.

4.2.1 Open-Ended Questions

The current study looks for the better advance organizer type for college students. To understand participants' experiences and opinions, six open-ended questions are asked to participants. These questions are asked to get an idea what type advance organizer had better effect on participants' learning. Open-ended questions are sent via e-mail to participants. Participants answered questions as written and sent them back via e-mail.

The written answers of the participants were analyzed, and themes are determined at the end. The themes are emerged as starting lesson with story type advance organizer, starting lesson with concept map type advance organizer.

4.2.1.1 Starting Lesson with Story Type Advance Organizer

Four of the participants mentioned that stories are useful as a beginning activity. It helps to remember subjects since it focusses on important parts. Stories highlight key concepts of the topic in a fiction world. Also, participants think that stories give comfort to them since stories connect the topic with the real life. Real life examples enable participants to remember their experiences and prior knowledge. Therefore, prejudice of the participants about the topic is broken and they get more attention:

"[…] Useful for understanding and keeping in the mind the subject thought in the lesson. It also helps to draw attention to important issues (S3, Open-Ended Questions, 09.02.2022)."

"Starting with a story gives comfort to learners. […] it represents daily life problems/examples (S1, Open-Ended Questions, 07.02.2022)."

Although participants have positive opinion for story type advance organizer, only two of them think story type is better than concept map:

"I think it is the best method for me. I personally like stories therefore story type advance organizer helps me focusing the lesson […] (S4, Open-Ended Questions, 09.02.2022)."

"I think it is great to start lesson with story type advance organizer which enlightens us what will be covered in the lesson (S5, Open-Ended Questions, 17.02.2022)."

From the participants' statements, it can be said that stories are helpful to students for engaging them and making them more focus on topic. On the other hand, most of participants did not mention the effect of stories on their learning process.

4.2.1.2 Starting Lesson with Concept Map Type Advance Organizer

Four of the participants claim that concept maps at the beginning of the class are effective for learning. All of them mentioned that concept maps are helpful to make connections between concepts. Also, it is asserted that concept maps help to structure prior knowledge about the topic. Making connections is important since it relates with learning process of participants. Making connections has effect on cognitive load positively. Statements of participants show that they have positive view about effect of concept map on learning:

"[…] learners have a chance to see connections between subtopics and also have a chance to record the topic on visual memory (S1, Open-Ended Questions, 07.02.2022)."

"[…] it is effective to use them at the beginning because it shows you what you are going to learn. I think it makes learning process easier (S2, Open-Ended Questions, 08.02.2022)."

"Knowing how the course works and its order relaxes me. Making connections between concepts becomes easier […] (S3, Open-Ended Questions, 09.02.2022)."

"Starting lesson with concept map help me structure what I already know about the topic. Since it is not so funny, I rarely participate to the activity (S5, Open-Ended Questions, 17.02.2022)."

"Although concept maps are helpful to constructure cognitive architecture, some learners do not feel comfortable with them. One of the participants states that I think it is a little bit confusing to get main topic […] (S4, Open-Ended Questions, 09.02.2022)."

4.2.2 Interviews

Open-ended questions look for the general idea for participants' opinion about both type of advance organizer. Since there occurred only two theme from open-ended questions, participants are also asked interview questions after open-ended questions through web conference. The aim of interview questions is getting deeper idea about participants' experiences with advance organizers. Participants are asked to compare advance organizer in different points. Since cognitive load is about the learning process, making connections and progress the knowledge, participants are asked about these concepts. Interviews are done as online with Zoom which is video conferencing tool.

Like the open-ended question data, interview questions are also analyzed with content compared method. Firstly, participants' spoken answers are written by researcher. Then, from the coded data, themes are emerged. Themes are catching key points, easier to process, making connections between concepts and learning style.

4.2.2.1 Catching Up Key Points

Catching key points during the lesson with concept map is easier compared to stories is claimed by most of the participants. Concept maps show key concepts directly and learners focus only the concepts not the other words. In that way, concept maps are helpful to catch key point during lesson and their connections. All the participants state that analyzing a concept map before the lesson is more useful to realize and remember the concepts during the lesson.

"[…] Concept maps targeted key points […] (S5, Interview, 17.02.2022)."

"Since the concept map is a one-dimensional thing, it is easier to connect with the lesson because it only provides the map and contains only the keywords […] (S4, Interview, 09.02.2022)."

"Examining the concepts before the lesson with concept maps helps me to catch the keywords more during the lesson […] (S2, Interview, 08.02.2022)."

"Compared with stories, concepts maps were more helpful to catch key points (S1, Interview, 07.02.2022)."

These statements show that examine advance organizer and connect it with the lesson is meaningful when concept maps are used. Thus, concept maps can be useful video-based learning since they get attention of learners then they become aware of key points.

4.2.2.2 Easier to Process

During interviews, it is asked which advance organizer type was easier to process. Most of the participants claim that concepts maps were easier process and understand at the beginning of the lesson:

"Concept maps were more effective to process because they showed connections between concepts and were visual (S3, Interview, 09.02.2022)."

"[…] Reading a passage does not effective for my learning. Therefore, concept maps are more helpful for me (S2, Interview, 08.02.2022)."

"[…] Concept maps include abstract information compared to stories (S4, Interview, 09.02.2022)."

"Concept map was easier to process (S1, Interview, 07.02.2022)."

These opinions asset that concept maps reduce cognitive load by make easy processing the information. Participants related that with concepts maps using relations between subtopics. In that way, participants see overview of the class clearly.

4.2.2.3 Make Connections Between Concepts

Participants are asked which advance organizer help to make connections between concepts. Participants' answers are supportive for concept maps:

"Since all the concepts were given together, it was both simple, understandable, and easy (S1, Interview, 07.02.2022)."

"It is easier to connect concepts with concept maps because they directly impose keywords on us. Therefore, it is easier to connect concepts with each other and to provide transitions between concepts (S5, Interview, 17.02.2022).""

"Concept maps establish a connection between concepts. It gives an idea about the order and relationship of the subjects (S3, Interview, 09.02.2022)."

Concept maps present a prepared schema for learners. In this way, students do not have difficulty in transferring the subjects to their own cognitive schemes. Instead of processing the subjects one by one and placing them in their cognitive schemes, they can consider all of the subjects as a single element thanks to the connections in the concept maps.

4.2.2.4 Individual Differences of Students

Learners sometimes feel more comfortable with some specific learning materials. While two of the participants state that stories are more effective for them because they enjoy stories, two of them vote for concept maps since they think they have visual memory.

"[…] I can keep visual materials in my mind more easily. While stories are effective for short-term learning, concept maps have a long-term impact. […] I still remember the concept maps we used at the beginning of the term (S3, Interview, 09.02.2022)."

"Concept map was better for me as my visual memory is better (S1, Interview, 07.02.2022)."

"Regarding my own learning style, it made it easier for me to understand the stories as they sounded like sections from real life in terms of reconciling them with real life […] (S5, Interview, 17.02.2022)."

"[…] The story type AO was more effective as it was a lesson start activity. I can immerse myself in stories because it is more enjoyable to listen or read stories. […] While remembering the concept map only visually, it is easier to keep the story in my mind longer (S4, Interview, 09.02.2022)."

Learners who attend this study have different cognitive and intellectual skills. In the light of their statements, it can be said that learners' cognitive backgrounds can be effective through learners' choice of learning material.

Table 4.7 Frequencies of Qualitative Data

Themes	Graphical AO Frequency	Narrative AO Frequency
Catching Up Key Points	5	0
Easier to Process	4	1
Make Connection Between Concepts	3	2
Individual Differences	2	2

4.3 Summary of Findings

Quantitative and qualitative data are analyzed to find out whether narrative or graphical type AO is effective to students' achievement test scores. Quantitative data are collected with achievement test scores and show that there is no significant

difference between usage of graphical and narrative type of AO in the context of achievement test scores, so students took advantages from both type AO. In order to get deeper understanding, five of participants were asked open-ended questions via e-mail. As a results of open-ended questions, students' answers gave only two theme which are starting lesson with graphical type AO and starting lesson with narrative type AO. Students' answers showed that they think starting lesson with both type AO is useful. Since there occurs only two theme five participants were also asked interview questions. The results showed that participants prefer graphical type AO in many perspectives such as catching up key points, easier to process and make connection between concepts. Participants' responses are summarized in Table 4.5.

CHAPTER 5

DISCUSSION AND CONCLUSION

During online learning, attention span of students can decrease. In that case, there emerge a need for new pedagogical tools that will increase the attention span of students for use in online lessons. The purpose of this study is look for effectiveness of narrative and graphical type advance organizers on students' test performance so explore more effective advance organizer type in the case of cognitive load. For this reason, both quantitative and qualitative data are collected and analyzed. Quantitative data are collected via pre knowledge test scores and achievement test scores of students. Furthermore, open-ended questions and interview are used to collect qualitative data. In this chapter, findings of the study will be discussed in the case of research questions.

5.1 Narrative Type Advance Organizer

In this study, although there is no significant difference of students' success between topics where used graphical ad narrative type of AO, four of the five students who participate open-ended questions and interview section state that narrative AO is a good way to start lesson because it is effective to remember concepts. Students also point at that narrative type AOs more useful to make connections with daily life. In this way, they understand and remember concepts more efficiently. Moreover, since get attention is a crucial issue for online learning as students' limited attention span, narrative AOs were helpful to students give more attention to the lesson since they aware of the general idea of the course. Literature serves studies that support that finding. Ambard & Ambard (2012) compare three groups in the case of usage narrative AO in video-based learning. In one group, students used narrative AO collaboratively while the other group used

individually. The control group did not use narrative AO before watching the video. Then all participants took achievement test. The results of that study show that two groups that used narrative AO got higher scores compared to control group.

Cognitive load theory (CLT) claims that working memory has limited capacity for processing new information. For this reason, instructional materials should include less extraneous elements that hold working memory. Instructional materials should highlight learning content so working memory process learning material. Since stories which are narrative type AO introduce learning content to learners before the class, students recognize the learning content and focus it rather than extraneous elements. Furthermore, Sweller (1994) indicates cognitive schema as a property of CLT. Cognitive schema represents hierarchy of knowledge of learners. When novel information is connected with the previous knowledge in cognitive schema of the learner, then learning occurs. At that point, stories as AO help students to make the connection with novel and prior knowledge. Hereby, cognitive schema of learners is structured. In addition, cognitive load effects which are presented to reduce cognitive load while designing instructional material can be another reason for narrative AOs reduce cognitive load. Worked example effect states when learners are familiar with the problem, they analyze and solve new problem situations easily. In this study, stories include daily-life problem situations about the topic. One of the participants states that stories give comfort and presents real-life examples for them. In this manner, students examine similar situations and problems with stories before the class.

To conclusion, narrative type AO is useful to reduce cognitive load of students by making learning effective in online learning. Students claim that narrative AOs help them to remember concepts much longer. The reasons of this results can be stories create space for learning material in working memory, they help students to structure their cognitive schema and stories act as worked example.

5.2 Graphical Type Advance Organizer

Students' achievement test scores on instrumentation, mean comparison tests and observation-interview topics are compared with narrative type AO topics. Mean of the achievement test scores indicates that there is no significant difference. To get deeper understanding about the results, participants' answers of open-ended questions and interview questions are analyzed. Open-ended question responses show that participants think starting lesson with concept map make learning meaningful for them by showing connections between concepts. Moreover, participants mentioned that they took advantage of concept maps for constructing prior and new information. Interview questions aim to find in which aspect participants think use of concept map is beneficial. According to participants' answers, there occur three main reason which are concepts maps make easy to catch key point during course, process learning content and connect concepts.

Working memory has limited capacity. Therefore, learning material should not hold extraneous elements instead of learning concepts. When working memory is hold by extraneous items, then the content is not processed properly. Concept maps enable learners to process concepts one by one. Learners can put content in pieces. In that way, limited capacity of working memory will not be challenge for learners. Advance organizers ensure that the material to be learned is familiar to students. Thus, when learners face with similar subjects again in the lesson, they can work on them more because working memory is limited only for novel information. When processing familiar concepts, the limitation of working memory disappears.

Working memory classify and compare new information to operate and transfer it to long-term memory. As element interactivity effect of cognitive load states, brain tries to group concepts and learn them as one concept by making relation between them. In that way, concepts have related each other and constructed with prior knowledge of learners. As the barrowing and reorganizing principle of cognitive load theory states, learning occurs when new information is placed in cognitive schema of learners (Sweller et al., 2011, p. 37). Concept maps help learners at that

point because they show relations between concepts, and they present information as schema so working memory arrange new information easily. Concept maps are effective tools to recall prior knowledge of learners and manage cognitive resources of learners (Zheng & Dahl, 2010). Concept maps provide key relationships to learners before the lesson. Hereby, learners become familiar, and they can develop deep understanding about concepts during the lesson. Trochim (1989) claims that concept maps stimulate cognitive schema of learners by make them organize all knowledge and make clear relationships of concepts.

Split-attention effect, one of the cognitive load effect, states that should presented together served separately, there occur working memory load. Concept maps prevent split-attention effect by presenting key concepts as verbal and their relationships by visual at ones. Mayer and Anderson (1991) claimed that when information is presented in only one channel, there occur a possibility for cognitive load. Concept maps are helpful for this issue by presenting information both in visual and verbal channels. The other cognitive load effect is element interactivity that can be used to explain effect of concept maps on cognitive load. Concept maps reduce element interactivity by giving explanation of relations of concepts. In that manner, concepts become connected and during lecture, students The less element interactivity the less intrinsic cognitive load. One of the participants S5 claims that it is easier to connect concepts with concept maps because they directly impose keywords on us. Therefore, it is easier to connect concepts with each other and to provide transitions between concepts. Another participant S3 states concept maps establish a connection between concepts. It gives an idea about the order and relationship of the subjects.

While Mayer (2017) presents some principle to accomplish issues for designing multimedia learning environment in the light of CTML which is a theory based on cognitive load, it can be seen that, some principles are fit with concept maps. Mayer (2017) states signaling, and spatial contiguity principles are useful to reduce cognitive load during multimedia learning. Signaling offers highlighting important parts of content and spatial contiguity states learning materials are more

effective when texts are integrated into graphics. Moreover, Mayer (2017) also serves pre-training principle which claims defining and explaining unfamiliar elements to learners before to avoid processing issue. In that manner, graphical AOs serve this purpose. Also, narrative type AOs can be used for signaling and pre-training. However, as participants point out, concept maps are more helpful since they show and highlight key points directly as seen in participants' responds. Concept maps targeted key points […] (S5, Interview, 17.02.2022).Since the concept map is a one-dimensional thing, it is easier to connect with the lesson because it only provides the map and contains only the keywords […] (S4, Interview, 09.02.2022).Examining the concepts before the lesson with concept maps helps me to catch the keywords more during the lesson […] (S2, Interview, 08.02.2022). Compared with stories, concepts maps were more helpful to catch key points (S1, Interview, 07.02.2022).

5.3 Conclusion

This study paid attention to compare effectiveness of graphical and narrative AOs in relation to students' performance to ensure understanding about usage of AOs by students' responses. Working memory perceive unlimited information from environment with sensory motors. Because of that make learners give attention to learning material is important to enhance learning. Besides, since students have limited attention span during online learning, there occurs a need to pedagogical tool to help them to process information by reducing cognitive load. This current study put AOs as pedagogical tool through six weeks.

As a first step, prior knowledge is crucial issue for construction of students' cognitive architecture which affect the result. For this reason, the prior knowledge test is applied. If participants' prior knowledge would be higher than expected, then there will be training week to balance participants' prior knowledge. Analysis of

pre-knowledge test scores show that there was no need to training course. The results show both type of AO were useful for students for Research Method course. Achievement score comparison of topics for narrative and graphical AOs indicates that there is no difference in students' success between topics of narrative and graphical AOs different from expected.

Secondly, participants are asked open-ended and interview questions. Answers to open-ended questions were more general. Participants' answers were in favor both narrative and graphical AOs. They claim that it was more beneficial for them to use either one than to use no educational tools. Interview aims to get deeper idea of participants' response to comparison of these two type AO. Most of the participants think that concept maps are better than stories in the relation with themes which are catching key points, easier to process, making connection between concepts. It was not surprise because concept maps represent a schema of the concepts and indicate relationships of the contents. Therefore, learners make less effort to construct their cognitive schema. In addition, since they highlight the concepts, learners can pay attention the contents instead of extraneous materials.

Stories can also be used in training, although they are not as effective as concept maps. Some of participants indicate that stories help to memorize since they related with real-life issues. One of the reason stories are not found effective can be they require learners to make connection between concepts. Stories do not show relations directly and this can be problem in online learning which learners' attention span is less than twenty minutes. Moreover, beside the key points, stories include other elements such as storyline, characters etc. It could be beneficial for courses which include less content. In addition, stories are effective when they affect students emotionally. The stories of the study cannot do this job. Interests of students plays a curial role in that. Stories may be more effective with younger learner group.

This current study made contributions about usable pedagogical tools for reducing cognitive load. The results indicate that for adult learners graphical AOs are more effective for reducing cognitive load.

5.4 Implementations for Practice

This study showed that students get advantages from graphical AOs during online learning. Concept maps help students to see relations between concepts. Graphical AOs can be used for novel students to help structure the cognitive schema of learners since they give idea about the order and relationships of the concepts (S3, 2022). It can be inferred from the students' responses; graphical AOs are more useful to facilitate learning since they are not encouraged by reading a passage. One of the participants states that graphical AOs include abstract knowledge compared to stories (S4). Another participant also agrees with this opinion by telling graphical organizers serve all the concepts together which makes simple, understandable and easy the concepts (S1, 2022). Graphical AOS are one-dimensional so focus only key points (S4, 2022), this helps to target key points during class. Instructors can use graphical AOs for classes which have many concepts to show connections between concepts. In that way, students become familiar with the concepts and during the class, they can focus all aspects of the class.

5.5 Implementations for Future Research

Because of the pandemic, the study is not conducted as planned. Based on the number of students taking the course in previous years, the number of participants was expected to be around 40. The shortage of participants affected the results and analysis. If number of participants were enough, then the quantitative results of the study may indicate significant difference. Pandemic also affect the attendance of

participants to the experiments. Some of them cannot attend all courses since they infected Covid-19 virus. This situation played crucial role their achievement test scores. Secondly, during pre-knowledge test and achievements test, participants' effort may not be same. Some participants may answer randomly for these tests. Thirdly, at the beginning, the study is planned as including two achievement tests in order to avoid testing decay effect. On the other hand, pandemic causes missing courses because of that there occurs timing issue to complete course. This situation may cause misleading results.

Future research should measure students' achievement with more than one achievement test instead of measuring all AO types at ones. Furthermore, this study can be conducted with true experimental research method. In this way comparing control and experiment groups will give clearer understanding. The sample size of this study is 15. The larger sample group may give more proper results. Also, this research is limited with adult learners. Further research examines the effect of narrative and graphical AOs with different age groups. Finally, this study used concept map as graphical AO and story as narrative AO. However, there are different kind of narrative and graphical type AO. Further research can investigate different type narrative type AO such as news, sentences, list and graphical type AO like pictures, infographic.

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APPENDICES

A. Prior Knowledge Test

1) What should be considered in the choice of an instrument to be used in a research investigation?

A) Validity
B) Reliability
C) Usability
D) All of these

2) Which one of the following does best describe the purpose of interviewing?

A) the purpose of the interviewing is to discover the behavior patterns of someone else.
B) the purpose of interviewing is to find out what is in and on someone else's mind.
C) the purpose of interviewing is to understand universal realities of reasons which can be acted by someone else.
D) the purpose of interviewing is to compare and contrast someone else's behaviors, feelings and beliefs.

3)

I. Is there a relationship between age and monthly income?
II. Is there a difference between female and male students related to fear of missing out behaviors?
III. Does the level of cyberloafing behaviors of university students differ by gender?
IV. Is age associated with students' problematic mobile phone usage?

3) Which one of the following provides appropriate quantitative data analysis methods to answer the research questions given above?

	Correlation	t-test
A)	II,III	I, IV
B)	I, IV	II,III
C)	I,II	III, IV
D)	II,IV	I,III

4) Which of the following is not a main data collection technique in a qualitative study?

A. Questionnaire
B. Interview
C. Observation
D. Document analysis

5) What does mean the level of consistency of an instrument and the degree to which the same results are obtained when the instrument is used repeatedly with the same individuals or group?

A) Reliability
B) Validity
C) Stability
D) Objectivity

6) Which one is the example of primary sources for literature review?

A) Textbooks
B) Diaries
C) Biographies
D) Journals

B. Achievement Test

1) In order to collect data for his research, Tony prepare a questionary. However, he realizes that instructions of the questionary are not clear. What is the feature the instrument does not have?

A) Objectivity
B) Validity
C) Reliability
D) Usability

2) Rachel writes a document about her instrument for research. She pointed where will be data collected, who will collect the data and how often they will be collected. Which one is not considered while the data collection procedure?

A) Frequency
B) Location
C) Time
D) Administration

3) Which one is not the research completed instruments?

A) Flowcharts
B) Performance Checklist
C) Observation Forms
D) Questionaries

4) If a researcher wants to participants to determine or to confirm their own performance which instrument, he should use?

A) Achievement Test
B) Self – Checklist
C) Performance Test
D) Attitude Scale

5) Eric conducts a study whether educational games affect students' attitude about the class. In order to evaluate whether there is a significant difference about attitude of students between before and after the game, which mean comparison test he should use?

A) Paired-Sample T-Test
B) One-sample T-Test
C) Independent Sample T-Test
D) ANOVA

6) Claire makes research to find out what do affect more volleyball players' performance. She analyzes sleep hours, eating habits and practice time of volleyball players. What are the dependent and independent variables for this study?

	Dependent variables	Independent Variables
A)	Sleep hours	Practice time
B)	Eating habits	Performance of players
C)	Performance of players	Eating habits
D)	Practice Time	Performance of players

7) While conducting an independent sample t-test, which assumptions about the variance is not necessary?

A) The variance should be normal
B) The variance should be objective
C) The variance should be equal
D) The variance should be independent

8) Dependent and independent variables are used in

A) Independent sample t-test and ANOVA
B) Paired-sample t-test and one-sample t-test
C) Independent sample t-test and one-sample t-test
D) Paired-sample t-test and ANOVA

9) Kate conducts a study about how does affect usage of short videos before the lesson motivation of students. She makes interviews with students and one of the interview questions, she asks how students feels about the lesson after watching the short video. Which type of question she used in interview?

A) Knowledge
B) Follow-up
C) Comparison
D) Feeling

10) A researcher who wants to make a research about Bulgarian Turks makes interview with people who migrated from Bulgaria to Turkey. Which type of interview did this researcher conduct?

A) Structural
B) Informal
C) Retrospective
D) Key-actor

11) Which situation cannot be named as observer effect?

A) When a teacher looks for the effectiveness of her class, she asks some questions to students whether they enjoy the class.
B) Since a teacher know the topic of the study, he uses more material in his class.
C) During the research about the measuring IQ of participants, the researcher takes a place as participant.
D) When the happiness survey of the employers at the end of the year is made by human resources of the company.

12) Tom collects data from different school principles. He gives some situations to schools' principles and asks them what they would do in these situations. Which type of observation he does?

A) Simulation
B) Naturalistic
C) Participant
D) Non-participant

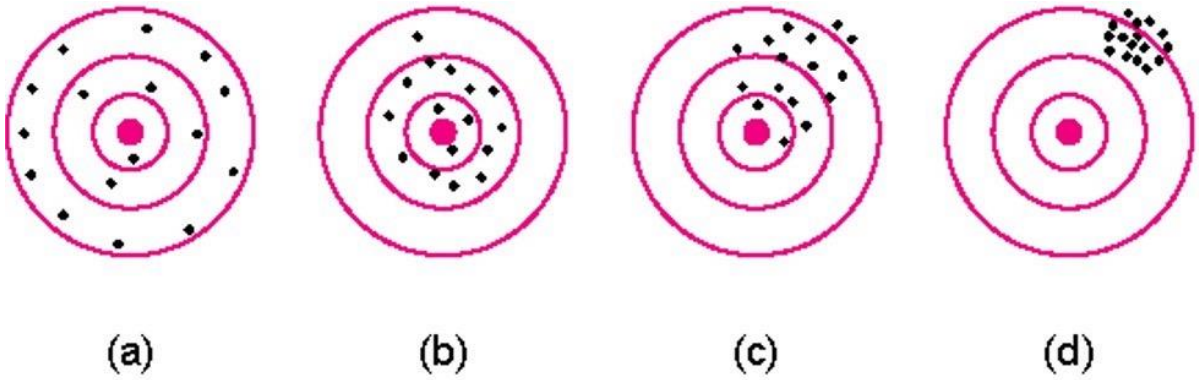
13) A physicist wants to measure voltage of the electrical circuit which he designed for his experiments. When he looked the result, he saw that the voltmeter measure different values although voltage of the circuit did not change. In that situation, what can be said for the voltmeter?

A) Voltmeter is not valid.
B) Voltmeter is not reliable.
C) Voltmeter works properly.
D) Voltmeter is not objective.

14) What can make an instrument more valid?

A) Getting feedback from an expert about the questions
B) Piloting the survey before the experiment
C) Making interviews with the pilot group about the questions
D) Adding more questions to instrument

15) Which one is the best example of the reliability?



A) A
B) B
C) C
D) D

16) Which one is not the evidence of validity?

A) Content-related evidence of validity
B) Criterion-related evidence of validity
C) Correctness-related evidence of validity
D) Content-related evidence of validity

17) Which one is the example of secondary sources for literature review?

A) Diaries
B) Interview
C) Publications
D) Analysis of an article

18) After a researcher define a research problem, what does she should firstly?

A) She should determine key words
B) She should look secondary sources
C) She should look primary sources
D) She should note and summarize key points

19) Which one is not the purpose of the literature review?

A) Make a summary of the studies has been done
B) Get an idea about the area that needed to conduct more research
C) See results of similar studies
D) Construct research question better

20) Which one can be better research question?

A) Which educational methods should be used in science education?
B) How are students affected by using technology?
C) Does using quizzes at the end of the lesson increase success of math students?
D) How can a teacher become more effective?

21) Which one is not the characteristic of qualitative research?

A) Attention for participants thought
B) Collection is in the form of words or picture
C) Researchers are concerned with how things occur
D) Focus on the outcome

22) Which one is the example of qualitative research question?

A) How does the lockdown affect the average usage time of social media?
B) Do online courses increase students' learning?
C) What are the experiences of people while they working from home?
D) Does drinking coffee at the morning affect their blood pressure?

23) What is the first step of qualitative research?

A) Collect data
B) Identification of the case to study
C) Conduct the hypothesis
D) Determine participants

24) Which one is not the approaches to qualitative research?

A) Correlational Study
B) Grounded Theory Study
C) Biographical Study
D) Phenomenological Study

C. Open-Ended Questions

1. What do you think about starting lesson with story type of Advance Organizer?

2. What do you think about starting lesson with concept map type of Advance Organizer?

3. Were they helpful to memorize the topic?

4. Which type of AO was more helpful to memorize?

5. Did you use them while studying later? / How did you use

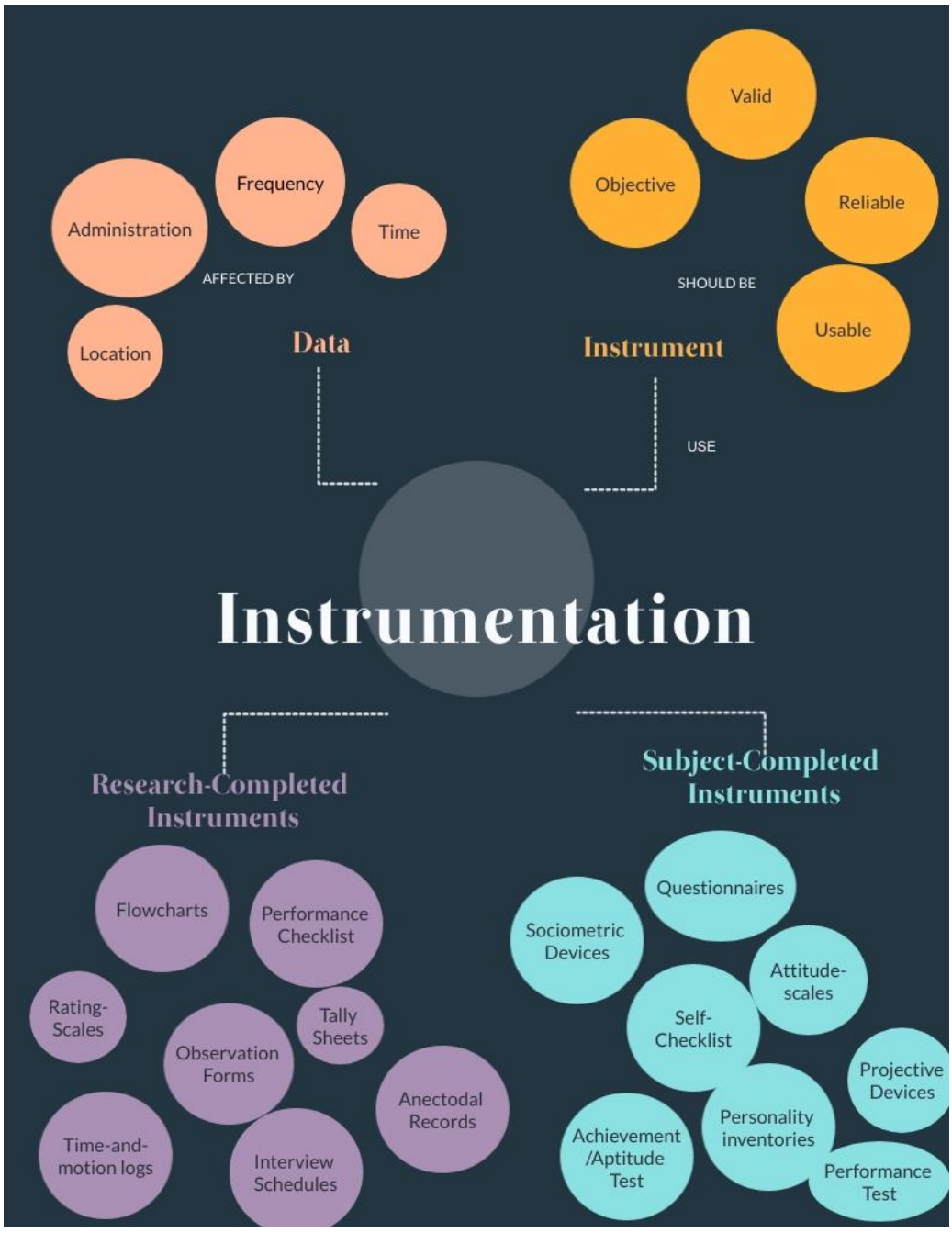
6. How did story type AO affect your attention during lesson?

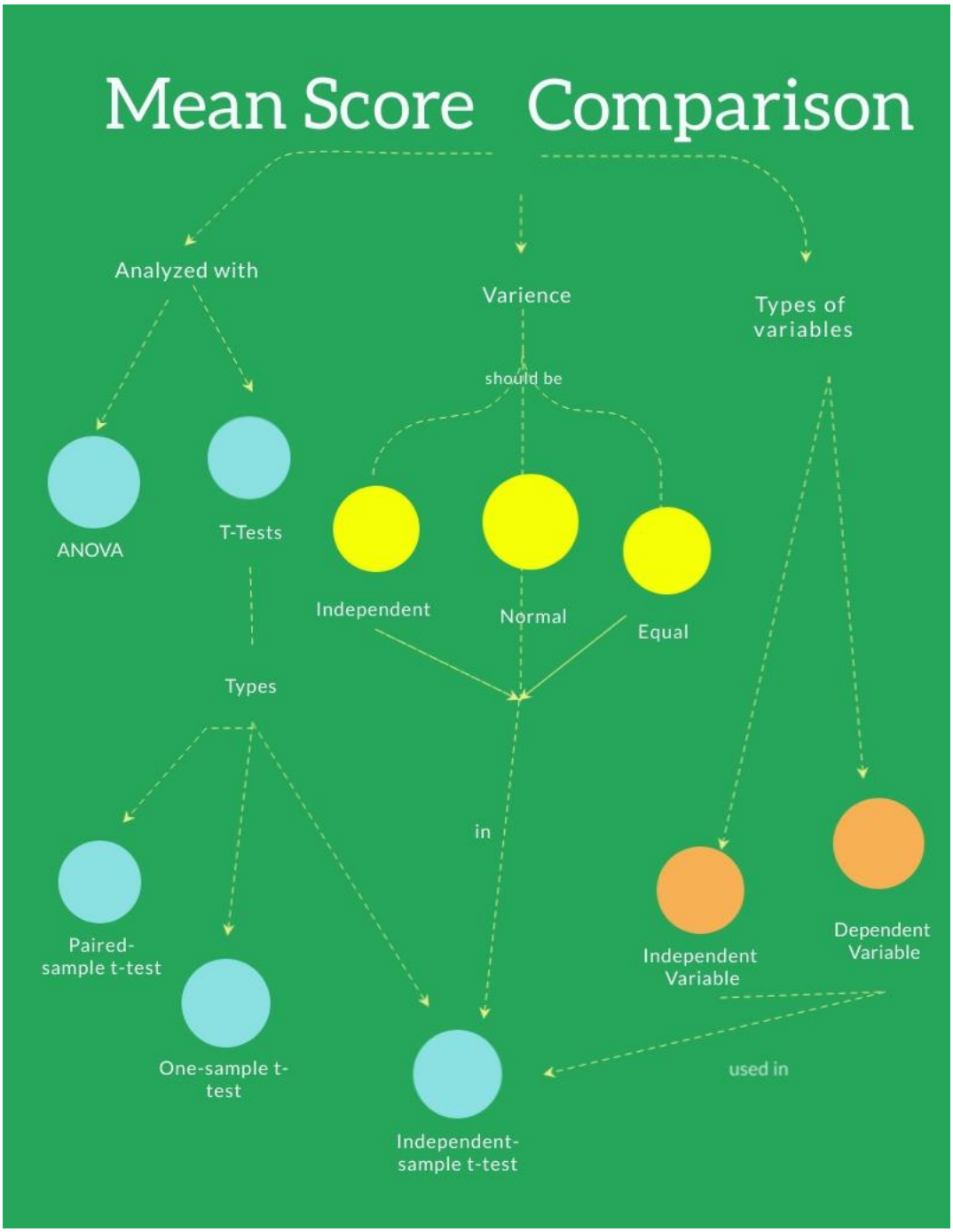
7. How did concept map type AO affect your attention during lesson?

D. Interview Questions

1. Which type of AO was easier to process? Why?
2. How was story helpful to catch key points during lesson?
3. How was concept map helpful to catch key points during lesson?
4. Which one was more helpful?
5. Did story helpful to make connections between concepts? How?
6. Did concept map helpful to make connections between concepts? How?

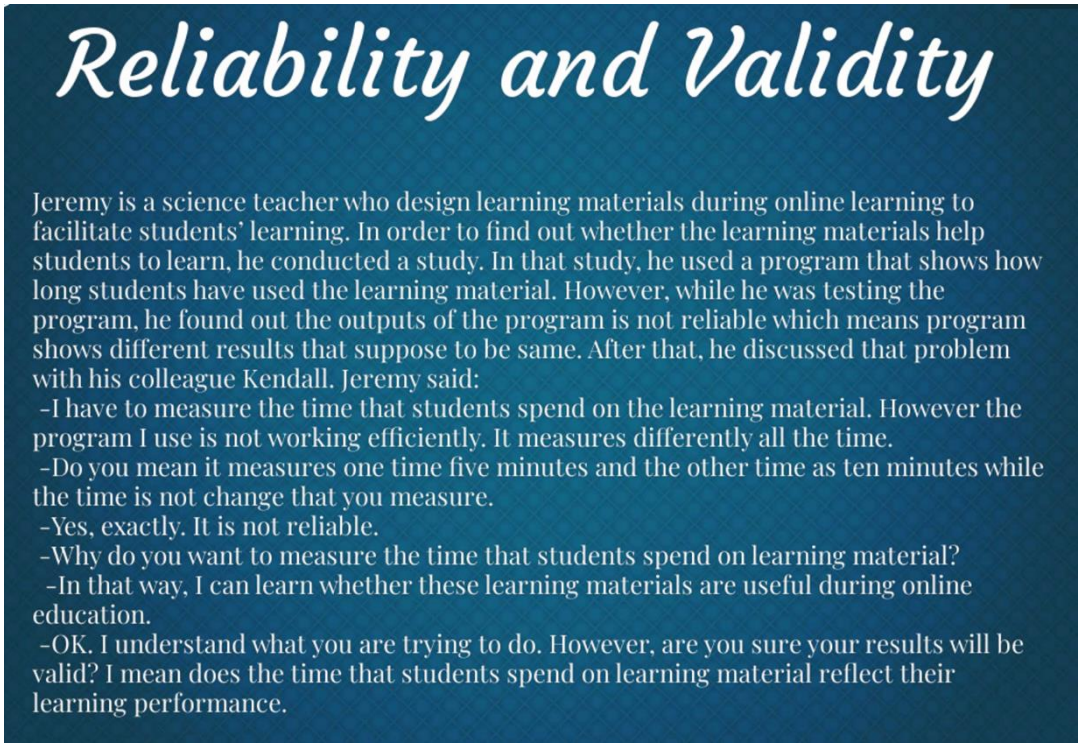
E. Concept Maps




Mean Score Comparison
Analyzed with
Varience
Types of variables
should be
ANOVA
T-Tests
Independent
Normal
Equal
Types
in
Paired-sample t-test
One-sample t-test
Independent-sample t-test
Independent Variable
Dependent Variable
used in


Feeling
Comparison
Knowledge
Retrospective
Informal
Background
Key-actor
Follow-up
Experience
Structured
Interview Types
Interview Question Types
Opinion
Interview Observation
consider
Observation Types
Simulation
Observer Bias
Non-participant
Naturalistic
Participant
Observer Effect

F. Stories


Reliability and Validity
Jeremy is a science teacher who design learning materials during online learning to facilitate students' learning. In order to find out whether the learning materials help students to learn, he conducted a study. In that study, he used a program that shows how long students have used the learning material. However, while he was testing the program, he found out the outputs of the program is not reliable which means program shows different results that suppose to be same. After that, he discussed that problem with his colleague Kendall. Jeremy said:
-I have to measure the time that students spend on the learning material. However the program I use is not working efficiently. It measures differently all the time.
-Do you mean it measures one time five minutes and the other time as ten minutes while the time is not change that you measure.
-Yes, exactly. It is not reliable.
-Why do you want to measure the time that students spend on learning material?
-In that way, I can learn whether these learning materials are useful during online education.
-OK. I understand what you are trying to do. However, are you sure your results will be valid? I mean does the time that students spend on learning material reflect their learning performance.

Literature Review

Emma wants to conduct research to find out how using video games affect adult learners, so she searched for relevant studies. After defining research problem, she looked for relevant textbooks that overview other studies about usage of video games for adult learners. Then she determined the key words as game-based learning, adult learners and video games that help her to find more relevant studies. While she was reading textbooks, she saw some journals' titles where studies are published. She thought make search on these journals by using the keywords would be more beneficial to find more research. She entered the Journal of Education, Review of Educational Research Journal and looked for articles about her research problem. She took notes and summarized key points of the articles to use them in her literature review.

Qualitative Research

John and his friends are taking research method course. They learn qualitative and quantitative research. However, John is little confused about the differences of these two. He asked his friends why there is not only one type research. They start to discuss about qualitative research.

- Through qualitative research, researchers do not collect only numeric data, also pictures, words are the data for qualitative research.
- In addition, data collection process is important for researchers. Because of that, generally, researchers do not conduct their hypothesis before data collection.
- I guess, rather than “what is” questions, “how is” questions are answered with qualitative research.
- Exactly. That is why process is also important as much as product during data collection.

G. Consent Form

ARAŞTIRMAYA GÖNÜLLÜ KATILIM FORMU

Bu araştırma, ODTÜ Bilgisayar ve Öğretim Teknolojileri Bölümü Yüksek Lisans öğrencisi Deniz Bulut tarafından Prof. Dr. Soner Yıldırım danışmanlığındaki yüksek lisans tezi kapsamında yürütülmektedir. Bu form sizi araştırma koşulları hakkında bilgilendirmek için hazırlanmıştır.

Çalışmanın Amacı Nedir?

Çevrimiçi veya video tabanlı dersler için doğru pedagojik araç kullanmak hayati önem taşır. Bu araştırmanın amacı, öğretim elemanlarının dersleri için kullanabilecekleri bir pedagojik araç olan ön düzenleyicilerden etkili olan türü seçmelerine yardımcı olmaktır.

Bize Nasıl Yardımcı Olmanızı İsteyeceğiz?

Araştırmaya katılmayı kabul ederseniz, sizden Araştırma Yöntemleri dersinde 6 hafta boyunca gösterilecek öyküleyici ve görsel türündeki ön düzenleyicileri incelemeniz beklenmektedir. Yaklaşık olarak 5 dakika sürmesi beklenen bu bölümde sizlere o hafta işlenecek ders konusu ile ilgili bir ön düzenleyici gösterilecektir. Daha sonra ders sonrası testlerde derste işlenen konuyla ilgili çoktan seçmeli soruları cevaplamanız beklenmektedir.

Sizden Topladığımız Bilgileri Nasıl Kullanacağız?

Araştırmaya katılımınız tamamen gönüllülük temelinde olmalıdır. Çalışmada sizden kimlik veya kurum belirleyici hiçbir bilgi istenmemektedir. Cevaplarınız tamamıyla gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir. Katılımcılardan elde edilecek bilgiler toplu halde değerlendirilecek ve bilimsel yayımlarda kullanılacaktır.

Katılımınızla ilgili bilmeniz gerekenler:

Çalışma, genel olarak kişisel rahatsızlık verecek sorular veya uygulamalar içermemektedir. Ancak, katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz yarıda bırakıp çıkmakta serbestsiniz. Böyle bir durumda çalışmayı uygulayan kişiye çalışmadan çıkmak istediğinizi söylemek yeterli olacaktır.

Araştırmayla ilgili daha fazla bilgi almak isterseniz:

Bu çalışmaya katıldığınız için şimdiden teşekkür ederiz. Çalışma hakkında daha fazla bilgi almak için Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü öğretim üyelerinden Prof. Dr. Soner Yıldırım (E-posta: soner@metu.edu.tr) ya da yüksek lisans öğrencisi Deniz Bulut (E-posta: deniz.bulut@metu.edu.tr) ile iletişim kurabilirsiniz.

Yukarıdaki bilgileri okudum ve bu çalışmaya tamamen gönüllü olarak katılıyorum.

(Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyad Tarih İmza

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H. Ethical Form

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI 06800
ÇANKAYA ANKARA/TURKEY
T: +90 312 210 22 91
F: +90 312 210 79 59
ueam@metu.edu.tr
www.ueam.metu.edu.tr

Sayı: 28620816 / 374

29 EYLÜL 2021

Konu : Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi : İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Soner YILDIRIM

Danışmanlığını yürüttüğünüz Deniz BULUT'un "Öyküleyici ve görsel ön düzenleyicilerin öğrencilerin bilişsel yüklerine etkileri" başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **374-ODTU-2021** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

Dr.Öğretim Üyesi Ali Emre TURGUT
İAEK Başkan Vekili