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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

Evaluation of Geohepta Mobile Application-Based Instructions' Impacts on Affective Behaviors

Geohepta Mobil Uygulamasına Dayalı Öğretimin Duyuşsal Davranışlara Yönelik Etkilerinin İncelenmesi

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Abstract

The purpose of this research is to determine the effect of mobile application-based instruction in distance education period on students' self-efficacy, belief perceptions and attitudes towards technology. The study was carried out with a quasi-experimental research design utilizing a pretest-posttest control group. Students in the seventh grade from a public secondary school in Central Anatolia participated in the study in which the students were given the Self-Efficacy Scale for Geometry, the Belief Scale for Geometry, and the Attitude Scale for Technology. Data obtained from measurement tools were then analyzed with t-tests for independent samples as well as t-tests for dependent samples. The study's findings revealed a substantial difference between the experimental and control groups' students' attitudes toward technology, ideas about geometry, and self-efficacy in said areas. The usage of various mobile applications in the instruction of mathematics has been recommended in light of the results found.

Keywords: affective behaviors, ADDIE design model, distance education, geometry education, mobile learning

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Öz

Bu araştırmanın amacı, uzaktan eğitim döneminde mobil uygulamaya dayalı olarak sağlanan öğretimin öğrencilerin geometriye yönelik öz yeterlik, inanç algılarına ve teknolojiye yönelik tutuma etkisini belirlemektir. Çalışma, ön test son test kontrol gruplu olarak yarı deneysel araştırma deseni ile gerçekleşmiştir. Araştırma İç Anadolu bölgesinde bir devlet ortaokulunda öğrenim gören yedinci sınıf öğrencileri ile sağlanmıştır. Çalışmada öğrencilere Geometriye Yönelik Özyeterlik Ölçeği, Geometriye Yönelik İnanç Ölçeği ve Teknolojiye Yönelik Tutum Ölçeği uygulanmıştır. Ölçme araçlarından elde edilen veriler bağımsız örneklemler için t-testi ve bağımlı örneklemler için t-testi ile analiz edilmiştir. Çalışma sonucunda, deney ve kontrol gruplarındaki öğrencilerin geometriye yönelik öz yeterlik, inançları ve teknolojiye yönelik tutumları arasında deney grubu lehine anlamlı farka ulaşılmıştır. Elde edilen bulgular ışığında matematik öğretiminde farklı mobil uygulamaların kullanımı önerilmiştir.

Anahtar Kelimeler: duyuşsal davranışlar, ADDIE tasarım modeli, uzaktan eğitim, geometri eğitimi, mobil öğrenme

Geniş Özet

Giriş

Geometri doğayı, yaşadığımız evreni anlamak için hayatın içinde yer alan bir alandır. Yaşamın içerisinde bulunan geometriyi anlamak ve öğrenmek için bireylerin geometrinin doğadaki varlığına yönelik dikkatleri sağlanmalıdır. Matematik biliminin, ilk esin kaynakları doğa ve yaşamdır. Geometri öğretim sürecinde çocuklar, gelişimsel olarak insanlığın geometri bağlamında yaşadıklarını yaşayacaktır. Bu durum göz önüne alınarak okullarda öğretim sürecinde çocukların geometriye yönelik ilgi, tutum, öz yeterlik ve diğer duyuşsal davranışlarının artması sağlanarak geometriyi öğrenme istekliklerinin ve başarılarının da olumlu yönde etkilenmesi sağlanmalıdır. Matematik ve geometri öğrenimi-öğretimi sürecinde duyuşsal özelliklerin desteklenmesinin amaçlandığı ve duyuşsal özellikleri bağlamındaki davranışlar arasında bir tutarlılık sağlanması gerektiği belirtilmiştir (Mccoach, 2007), Bireylerin duyuşsal davranışlarından birisi olan öz yeterlik inancı, öğrencilerin kendi kendilerini anlamalarını sağlayan kavram olarak belirtilmektedir. Bu bağlamda yeterlik, bireyin bir davranışı yapabilmeye yönelik bilgiye sahip olmasıdır. Öz yeterlik; bireyin bir işi gerçekleştirebilmesi ve başarabilmesi yeteneği konusunda yargıları olarak tanımlanabilmektedir. Bu doğrultuda bir bireyin herhangi bir işe yönelik olarak becerisi olsa bile eğer bu işe yönelik bir öz yeterlik algısı yoksa, işin başarılması mümkün olmayacaktır. Okullarda sınıf ortamında yeni bir şey öğrenmeye çaba gösterme inancı olmayan, başaramayacağını düşünen öğrencilerle her gün karşılaşılmaktadır. Bu yüzden öğrencilerin bu algılarını değiştirmeye yönelik öğretmenlerin öğrenme sürecini iyi bir şekilde planlamaları önemlidir. Derste kullanılan öğretim yöntemlerinin, öz yeterlikle güçlü bir ilişkisi olduğu belirtilmektedir (Usher, 2008). Bu duruma bağlı olarak öğrencilerin derslere karşı motivasyonunun artması, ilgisinin çekmesi, aktif olarak katılması ve yaratıcı düşünme becerisini sağlayacak öğretim yöntem ve tekniklerin kullanılması özyeterlik inancını arttıracağı düşünülmektedir. Öğrencilerin derslerdeki başarı durumunu etkileyen diğer duyuşsal özelliklerden birisi de inançtır. Pajares'e göre (1992), inançlar bireylerin hayatları boyunca

verdikleri kararları etkilemektedir. İnançlar erken yaşta şekillenmeye başlamakta ve değişime karşı dirençli olmaktadır. İnançların, bireylerin düşünce ve davranışları üzerinde belirleyici bir etkiye sahip olduğu belirtilmektedir. Bu sebeple eğitimciler inançları, öğrenme ve öğretim süreçleri açısından dikkate almak zorunda kalmıştır. Matematik eğitimi açısından da matematiksel inançların ele alınmasına ihtiyaç duyulmaktadır. Öğrencilerin inançları; kendi yeteneklerini değerlendirmelerinde, matematiksel etkinliklere katılmaya istekli olmalarında ve matematiğe yönelik tutumlarında etkilidir (Matematik Öğretmenleri Ulusal Konseyi [NCTM], 1989). Bu yüzden bireylerin matematiğe yönelik inançlarının olumlu olarak geliştirilmesi sağlanmalıdır. Öğrenciler ilköğretimden yükseköğretime kadar matematiğe yönelik olumlu bir inanca sahip olursa matematiğe yönelik başarısının da benzer doğrultuda olumlu gelişme göstermesi beklenmektedir.

Covid-19 pandemisi ile ülkemizde de 2020 yılında uzaktan eğitime geçilmek zorunda kalınmıştır. Uzaktan eğitim döneminde öğretim canlı dersler üzerinden sağlanmıştır. Bu dönemde öğrencilerin derslere yönelik ilgilerini yüksek tutarak başarılı olmalarını sağlayacak öğrenme ortamının oluşturulması planlanarak düzenlenmiştir. Matematik dersinin önemli alanlarından olan Geometri öğretimine yönelik ilgi, öz yeterlik ve inancı yüksek tutmak için ADDIE öğretim tasarım modeline dayanarak GeoHepta isimli bir mobil uygulama geliştirilmiştir. Geliştirilen mobil uygulama uzaktan eğitim döneminde 7. sınıf öğrencileri ile kullanılarak öğrenciler üzerindeki farklı yönlerden etkisinin incelenmesi amaçlanmıştır. Uzaktan eğitim sürecinin öğrencilerin; teknoloji kullanım becerileri, ilgileri ve tutumları üzerinde etkilerinin olduğu düşünülmektedir. Günümüzde teknolojik bir hayatın içerisinde bulunan öğrencilerin uzaktan öğretim dönemi içerisinde gerçekleşen öğretim ile teknolojiye yönelik tutumlarının nasıl değiştiğinin araştırılması bu yönüyle önem arz etmektedir. Tutum, öğrencilerin belirli bir alandaki başarıları veya bir öğretim programının tasarımının şekillenmesi üzerine temel değişkenlerden biridir. Öğrenciler uzaktan eğitim sürecinde cep telefonu, tablet, bilgisayar gibi teknolojik araçları daha çok kullanmıştır. Teknolojik araçları kullanma becerisi iyi olan öğrencilerin öğretim sürecinde öğrenmeye daha istekli olduğu düşünülmektedir. Bu durumda öğrencilerin teknolojik araçlara yönelik tutumlarına bağlı olarak derslere yönelik başarıları üzerinde etkisi olduğu belirtilebilir. Bu doğrultuda araştırmada geometri öğretimine yönelik geliştirilen GeoHepta mobil uygulamasının 7. sınıf öğrencilerinin geometriye yönelik öz yeterlik ve inanç algısı ile teknolojiye yönelik tutuma etkisini belirlemek amaçlanmıştır.

Yöntem

Araştırma nicel boyutta, 7. sınıf matematik dersi bir deney ve bir kontrol grubu olmak üzere öğretim tasarımı basamaklarına göre oluşturulan öğretimin öğrencilerin geometriye yönelik öz yeterlik ve inanç ile teknolojiye yönelik tutuma etkisini araştırmak amacıyla ön test son test kontrol gruplu yarı deneysel desen ile gerçekleştirilmiştir. Araştırmanın çalışma grubunu oluşturan kontrol ve deney grupları seçkisiz olmayan atama yoluyla önceden kararlaştırılmış 7. sınıf şubeleri arasından yansız olarak belirlenmiştir. Kontrol grubunda 21 kişi ve deney grubunda 26 kişi olmak üzere toplam 47 öğrenci ile öğretimler sağlanmıştır.

Araştırmada GeoHepta mobil uygulamasına dayanarak sağlanan matematik öğretiminin; öğrencilerin geometriye yönelik öz yeterlik ve inançları ile teknolojiye yönelik tutumlarına etkisini ölçmek amacıyla Geometriye Yönelik Öz yeterlik Ölçeği (Cantürk-Günhan ve Başer, 2007), Geometriye Yönelik İnanç Ölçeği (Ünlü ve Ertekin, 2018) ve Teknolojiye Yönelik Tutum Ölçeği (Yurdugül ve Aşkar, 2008) kullanılmıştır.

Bulgular ve Tartışma

Yedinci sınıf öğrencilerin uzaktan eğitim döneminde GeoHepta mobil uygulamasına dayanarak "Doğrular ve Açılar, Çokgenler, Çember ve Daire, Birim Küplü Yapılar" konularının öğretiminin öğrencilerin geometriye yönelik öz yeterliklerine, inançlarına ve teknolojiye yönelik tutumlarına etkilerinin araştırıldığı çalışmadan elde edilen sonuçlar bu bölümde açıklanmıştır.

Araştırmada, deney ve kontrol grubu öğrencilerinin uygulamadan önce geometriye yönelik öz yeterlikleri arasında anlamlı bir farkın olmadığına ulaşılmıştır. İlişkisiz örneklemler için t-testinin sonuçlarına göre deney ve kontrol grubunun uygulamadan önce geometriye yönelik öz yeterlik testi puanlarına ait aritmetik ortalamalarının birbirine yakın olduğuna ulaşılmıştır. Yarı deneysel araştırma kapsamında uygulamadan sonra deney ve kontrol grubu sonuçları arasında istatistiksel açıdan anlamlı bir fark bulunmuştur. Bununla birlikte, çalışmada uygulama öncesi ve sonrasında deney grubu öğrencilerinin geometriye yönelik öz yeterlikleri arasında anlamlı farklılık bulunurken, kontrol grubunun geometriye yönelik öz yeterlikleri arasında anlamlı bir farklılık bulunmamıştır. Tüm bu bulgular; uygulama öncesinde geometriye yönelik öz yeterlik açısından birbirine yakın grupların olduğunu ve deney grubunda uygulanan yöntemin kontrol grubuna göre öğrencinin geometriye yönelik öz yeterliğinde daha etkili olduğunu ortaya koymaktadır. Bir başka deyişle GeoHepta mobil uygulamasına dayalı öğretimin öğrencilerin geometriye yönelik yeterliğini artırdığı sonucuna ulaşılmaktadır.

Çalışmada mobil uygulamaya dayalı öğretime bağlı olarak deney ve kontrol grubu öğrencilerinin geometriye yönelik inançları incelenmiştir. Uygulamadan önce iki grubun geometriye yönelik inançları arasında anlamlı bir farklılık bulunmamıştır. İlişkisiz örneklemler için t-testinin sonuçlarına bakıldığında deney ve kontrol grubunun uygulamadan önce geometriye yönelik inançları testi puanlarına ait aritmetik ortalamalarının birbirine yakın olduğu tespit edilmiştir. Deney ve kontrol grubu öğrencilerin uygulamadan önce geometriye yönelik inançları arasında anlamlı bir fark bulunamazken yarı deneysel araştırma kapsamında uygulamadan sonra aralarında anlamlı bir farklılık bulunmuştur. Çalışmada uygulama öncesi ve sonrasında deney grubu öğrencilerinin geometriye yönelik inançları arasında anlamlı fark bulunurken, kontrol grubunun geometriye yönelik öz yeterlikleri arasında anlamlı bir farklılık bulunmamıştır. Bulgulara göre uygulama öncesinde geometriye yönelik inançlar açısından birbirine yakın grupların olduğu ve deney grubunda uygulanan yöntemin kontrol grubuna göre öğrencinin geometriye yönelik inancında daha etkili olduğuna ulaşılmıştır.

Mobil uygulama destekli öğretimlerin öğrencilerin duyuşsal davranışlarına olumlu yönde etkilerinin bulunduğu farklı araştırmalar tarafından da desteklenmektedir (Bray ve Tangney,

2016; Calder ve Campbell, 2016; Çetinkaya, 2019; Fabian ve arkadaşları, 2016; Kearney ve Maher, 2013; Sunandar ve arkadaşları, 2017; Taleb ve arkadaşları, 2015; Wijers ve arkadaşları, 2010). Gerçekleştirilen araştırma sonucunda da mobil uygulamadan yararlanarak sağlanan öğretimin öğrencilerin geometriye yönelik öz yeterlik ve inançları üzerinde olumlu yönde etkilerinin olduğunu göstermektedir. Alan yazında matematik dersinde mobil uygulamaya dayanarak sağlanan öğretiminin geometriye yönelik öz yeterlik ve inanç üzerindeki etkisini araştıran çalışmaya ulaşılamamıştır. Bu sebeple ulaşılan bulgunun alana önemli bir katkısının olacağı düşünülmektedir. Alkhateeb (2019), 4. sınıf öğrencilerinin matematik başarısı üzerinde mobil oyunların etkisini incelemek için bir araştırma gerçekleştirmeyi amaçlamıştır. Deneysel yöntemin kullanıldığı çalışma sonucunda mobil oyunlar ile gerçekleştirilen matematik öğretimin öğrenci başarısını, ilgilerini ve motivasyonlarını arttırdığına ulaşılmıştır.

Mobil uygulamaların birbirinden farklı öğrenme stillerine ve tercihlerine sahip öğrenciler için materyaller oluşturulmasına ve sunulmasına imkân vermesinden (Nofriyanti ve Setyaningrum, 2019) dolayı da öğrencilerin geometriye yönelik öz yeterlik ve inanç algılarının gelişme gösterdiği belirtilebilir.

Nofriyanti ve Setyaningrum (2019) araştırmalarında, öğretmen ve öğrencilerin matematik dersinde cep telefonu kullanılması ile ilgili algılarını belirlemeyi amaçlamışlardır. Bulgular doğrultusunda katılımcıların, matematik derslerinde cep telefonlarını kullanılmasını desteklediğine ulaşılmıştır. Bu araştırma sonucuna benzer şekilde gerçekleştirilen çalışma sonucunda teknolojik araçları kullanmaya meraklı bir dönemde bulunan çağımız öğrencilerinin geometriye yönelik öz yeterlik ve inançlarının gelişme göstermesinde akıllı telefon, tabletlerin kullanılmasının etkili olduğu belirtilebilir.

Çalışmada ayrıca 7. sınıf öğrencilerin mobil uygulamaya dayalı öğretime bağlı olarak teknolojiye yönelik tutumları incelenmiştir. Deney ve kontrol grubu öğrencilerinin uygulamadan önce teknolojiye yönelik tutumları arasında ilişkisiz örneklemler için t-testinin sonuçlarına göre aralarında anlamlı bir farkın olmadığı tespit edilmiştir. Deney ve kontrol grubu öğrencilerin uygulamadan önce teknolojiye yönelik tutumları arasında anlamlı bir farklılık bulunmamış olmasına rağmen yarı deneysel araştırma kapsamında uygulamadan sonra istatistiksel açıdan anlamlı bir fark bulunmuştur. Ayrıca çalışmada uygulama öncesi ve sonrasında deney grubu öğrencilerinin teknolojiye yönelik tutumları arasında anlamlı farklılık bulunurken, kontrol grubunun teknolojiye yönelik tutumları arasında anlamlı bir farklılık bulunmamıştır. Tüm bu bulgular; uygulama öncesinde teknolojiye yönelik tutumları açısından birbirine yakın grupların olduğunu ve deney grubunda uygulanan yöntemin kontrol grubuna göre öğrencinin teknolojiye yönelik tutumunda çok daha etkili olduğunu ortaya koymaktadır. Buna bağlı olarak GeoHepta mobil uygulamasına dayalı öğretimin öğrencilerin teknolojiye yönelik tutumunu artırdığı sonucuna ulaşılmaktadır. Öğrencilerin teknolojiye yönelik tutumlarının olumlu yönde değişim göstermesi iletişim, araştırma yapma vb. amaçlar için kullandıkları araçların öğretmenleri rehberliğinde öğrenme amaçlı kullanılabileceğini görmeleri sağlamış olabilir. Cep telefonu ve diğer mobil araçların kullanılmasına yönelik algıların araştırıldığı çalışma sonuçlarına dayanarak öğrencilerin teknolojiye yönelik tutumlarının gelişme göstermesinde mobil araçların kullanılmasının etkisinin olduğu belirtilebilir (Nofriyanti ve Setyaningrum, 2019).

Deney grubundaki öğrencilerin mobil uygulamaların istenilen bilgiye herhangi bir ortamda ve zamanda ulaşabilme imkanları (Atan ve Shahbodin, 2018; Uzunboylu, Çavuş ve Erçağ, 2009) öğrencilerin geometriye yönelik öz yeterlik ve inançları ile teknolojiye yönelik tutumlarının artması üzerinde etkili olmuş olabilir.

Literatürde yer alan tüm bu görüşler çerçevesinde matematik dersinde uzaktan eğitim sürecinde mobil uygulamaya dayalı öğretimin geometriye yönelik öz-yeterlik ve inançlar ile teknolojiye yönelik tutum üzerinde bir etkisi olduğu söylenebilir. Bu araştırmanın sonuçları düşünüldüğünde, günümüz kuşağı öğrencilerine teknolojinin öğretim amaçlı kullanılabileceğine yönelik öğrenme fırsatları tanındığında ve öğrenmek için her zaman her yerden ulaşabilecekleri araçları görmeleri sağlandığında öğrencilerin geometriye yönelik öz-yeterlik ve inançları ile teknolojiye yönelik tutumlarının da olumlu etkileneceği belirtilmektedir.

Introduction

Understanding geometry can help us better comprehend nature and the cosmos in which we live. This viewpoint helps to clarify the significance of being aware of the existence of geometry in nature allows people to comprehend and learn about its place in their lives. Nature and living are the earliest sources of inspiration for the science of mathematics. As a result, connecting geometry to nature is simpler. Children will gradually encounter what humanity has experienced in the context of geometry during the teaching process. Thus, it is important to make sure that children's interest in, attitude toward, self-efficacy with regard to, and other affective behaviors are increased, as well as their willingness and success with regard to learning geometry. There should be consistency between these behaviors in the context of their affective aspects, according to a statement that intended to promote the effective features in the mathematics and geometry learning-teaching process (Mccoach, 2007). Competence in this sense refers to a person's awareness of their capacity to carry out an activity. Bandura (1977) defined self-efficacy as an individual's assessment of his or her ability to plan all the tasks required to complete a certain performance. Self-efficacy refers to the perception a person has of his or her capacity to carry out and succeed in a task. In this regard, even if a person possesses the necessary talents for any work, it will be impossible for him to succeed if he lacks self-efficacy. Every day, children who don't believe they can succeed and don't endeavor to learn something new in a classroom setting can be found in schools. To alter these students' perspectives, teachers must carefully design the learning experience. It is claimed that self-efficacy and the instructional strategies utilized in the course are closely related (Usher, 2008). Depending on the circumstances, it is believed that students' passion for the classes, interest in them, active involvement, and the use of instructional strategies that foster creative thinking will boost their self-efficacy beliefs. Studies in the literature on the geometry teaching process (Çontay, 2012; Duman & Özçelik, 2018; Kandil & Işıksal-Bostan, 2019; Orçanlı & Orçanlı, 2016; Yenilmez & Uygan, 2010) It shows that the techniques are effective on the development of students' self-efficacy towards geometry. Belief is another potent trait that influences how well students perform in their courses.

In accordance with Pajares (1992), decisions people make throughout their lives are influenced by their beliefs. At a young age, beliefs start to form and harden against change. It is said that a person's beliefs have a significant impact on their thoughts and behaviour. Because of this, educators have had to take into account students' perceptions about how to learn and how to educate. Mathematical beliefs must be addressed when analyzing mathematics education. Beliefs of students; It is successful in improving their self-evaluation, motivation to engage in mathematical activities, and attitudes towards mathematics (National Council of Mathematics Teachers [NCTM], 1989). Therefore, it is important to guarantee that people establish favorable ideas about mathematics. It is anticipated that students' progress in mathematics will show a good level of development in a consistent manner if they have a favorable belief in mathematics from basic education through higher education. According to the literature, attitudes about the purpose of mathematics and how it is taught have an impact on students' ability to learn the subject (İlhan, Gemcioğlu, & Poçan, 2021). The results of the study showed that there is a significant relationship between belief in geometry and success in geometry (Erdoğan, Baloğlu, & Kesici; 2011). In the literature, it is seen that a scale was developed by Ünlü and Ertekin (2018) in order to examine the beliefs of secondary school students about geometry in studies conducted in the country regarding belief in geometry, and the beliefs of teachers were examined according to branch and gender variables by Paksu (2008). Different studies have been reached abroad to examine the belief in geometry (Ambrose, 2004; Kajander, 2007). Because of this, it is important to create learning settings in the classroom that will help kids form good opinions about mathematics. Students' success in learning the material is anticipated to rise as their confidence in geometry and mathematics grows. It's critical to ascertain pupils' opinions on geometry during the maths class. The influence of the instruction given within the parameters of the quasi-experimental research on the beliefs of seventh-grade pupils on geometry could not be detected in any studies in the literature. For this reason, it is thought that the study will contribute to the field in terms of examining the effect of students' geometry belief.

In 2020, our nation had to transition to distance learning due to the Covid-19 pandemic. Life lessons were used as the primary teaching method during the remote education era. It was planned and set up during this time to create a learning environment that would help students succeed by maintaining their interest in the lectures. Based on the ADDIE instructional design paradigm, the GeoHepta mobile app was created to maintain student engagement, self-efficacy, and belief in teaching geometry, one of the key topics of the mathematics course. During the distance learning period, the created mobile application was utilized with 7th grade students with the intention of examining the effects on students from various angles. Students enrolled in distant learning programs; it is believed that this outcome had an impact on attitudes, interests, and abilities related to technology use. In this regard, it's crucial to look into how the teaching that occurs during the distant education era has impacted students' attitudes, given that they now live in a technologically advanced world. One of the key factors influencing a student's success in a certain subject or the creation of a curriculum is attitude. Over the course of distant learning, students used additional technological instruments, including computers, tablets, and mobile phones. It is believed that students who are proficient with technological tools are more open to learning during instruction. In this instance, it may be said

that students' growth is influenced by how they feel about using technology in the classroom. In this approach, it was sought to ascertain the impact of the GeoHepta mobile application – which was created to teach geometry – on the self-efficacy, belief perception, and attitudes toward technology of the 7th-grade pupils. The following issues and issues with sub-problems were sought solutions for in this regard. The research question addressed in this study is, "What effects does the use of the GeoHepta mobile application have on students' self-efficacy, beliefs about geometry, and attitudes toward technology when teaching geometry and measurement field subjects to 7th-grade students?" as established. For this reason, the experimental group which received instruction based on mobile applications and the control group which received instruction based on textbooks, both received the study sub-problems listed below:

i) Is there a significant difference between the pre-test results of the experimental and control group students' self-efficacy towards geometry, beliefs and attitudes towards technology?

ii) Is there a significant difference between the post-test results of the experimental and control group students' self-efficacy towards geometry, beliefs and attitudes towards technology?

iii) Is there a significant difference between the pre-test and post-test results of the experimental group students' self-efficacy towards geometry, beliefs and attitudes towards technology?

iv) Is there a significant difference between the pre-test and post-test results of the control group students' self-efficacy towards geometry, beliefs and attitudes towards technology?

Method

Research Design

The research was conducted using a pretest-posttest control group quasi-experimental design to examine the impact of the instruction, which was formed in accordance with the stages of instructional design, in a quantitative dimension, using a 7th grade mathematics lesson as an experiment and a control group, on students' self-efficacy, belief in geometry, and attitude toward technology. Non-random assignment was used to fairly distribute the control and experimental groups, which make up the research's study group, among the pre-selected 7th grade branches. 47 pupils in total, 21 in the control group and 26 in the experimental group, received instruction.

Data Collection Tools

The Geometry Self-Efficacy Scale (Cantürk-Günhan & Başer, 2007), the Geometry Belief Scale (Ünlü & Ertekin, 2018), and the **Scale of** Pupils' Attitude towards Technology (Yurdugül & Aşkar, 2008) were all employed in the research on mathematics education based on the GeoHepta mobile application. The experimental and control groups underwent pre – and post-tests using the Geometry Self-Efficacy Scale (Cantürk-Günhan, 2007), Geometry Belief Scale (Ünlü & Ertekin, 2018), and **Scale of** Pupils' Attitude towards Technology (Yurdugül & Aşkar, 2008). substantial deviation between pre – and post-test scores. The Geometry Oriented Self-Efficacy Scale, created by Cantürk-Günhan and Başer (2007), was used to assess students' perceptions of their own self-efficacy in geometry. Its

reliability and validity were tested on 7th-grade secondary school students. 25 items make up the self-efficacy scale, 18 of which are positive and 7 of which are negative. Use of geometry knowledge, positive self-efficacy views, and negative self-efficacy beliefs make up the scale, which is made up of three elements. Cantürk-Günhan and Başer assessed the scale's alpha reliability coefficient to be 0,90 (2007).

The Geometry Belief Scale, created by Ünlü and Ertekin (2018) and whose validity and reliability were confirmed on secondary school students, was used to ascertain students' beliefs about geometry. The 3-factor Beliefs Towards Geometry Scale has 16 items on a five-point Likert scale. The Cronbach alpha coefficient of the scale was calculated as 0,755 as a result of the reliability investigation.

Yurdugül and Aşkar used the Turkish version of the Pupils' Attitude towards Technology (PATT-TR) to gauge students' attitudes about technology (2008). The Scale of Attitudes Toward Technology, created by Yurdugül and Aşkar (2008) for students, was translated into Turkish, and its reliability and factorial validity were examined. Turkish primary and secondary school students were used in the scale's validity and reliability evaluation. The initial scale was based on the PATT-USA scale, which was created by Dugger and Blame in the US and consists of 58 components. Following the analysis, it was determined that the sub-dimensions of "tendency towards technology," "the importance of technology," "negativeness of technology," and "technology for everyone" could be employed in research as a whole with the PATT-TR scale.

Research Process

In this research, based on the ADDIE design model, a mobile application named GeoHepta was developed for the 7th grade Geometry and Measurement learning area "Lines and Angles, Polygons, Circle and Circle, Views of Unit Cube Structures from Different Sides". It was developed according to the 5E learning model in the creation of the content of the GeoHepta mobile application.

Teaching in the experimental and control groups was carried out with 7th grade students studying in a secondary school in the Central Anatolia Region in the 2020-2021 academic year. Teaching in the experimental group was carried out during the distance education period in the Covid-19 period by using the GeoHepta mobile application. The GeoHepta mobile application was sent to the students, enabling them to install it on their phones or tablets. In the learning process of the students, they were taught through the mobile application under the guidance of the teacher. In the control group, the teaching was based on the textbook. Data were collected by applying data collection tools to both groups before and after the instruction.

Analysis of Data

In this section, it is stated how the obtained data were analyzed. The Self-Efficacy Scale for Geometry (Cantürk-Günhan, 2007) is a 5-point Likert-type scale consisting of 25 items. The items in the scale are "1. Never, 2. Sometimes, 3. Undecided, 4. Often, 5. Always". The data obtained from the scale were entered into the Excel program.

Beliefs Towards Geometry Scale (Ünlü & Ertekin, 2018) is a 5-factor scale consisting of 16 items in five-point likert type. The items of the scale were graded as "strongly disagree (1), disagree (2), undecided (3), agree (4) and completely agree (5)". The answers obtained from the scale during the research process were scored as 5, 4, 3, 2, 1, respectively, from completely agree (5) to strongly disagree (1) for positive items, and reversed for negative items. The obtained data were entered into Excel program respectively.

PATT-TR scale (Yurdugül & Aşkar, 2008), the Turkish version of Pupils' Attitudes towards Technology (PATT) Scale, consists of 24 items in four five-point likert type sub-dimensions. The items of the scale were graded as "strongly disagree (1), disagree (2), undecided (3), agree (4) and completely agree (5)". The obtained data were entered into Excel program respectively.

The scores of the students in the experimental and control groups, which were entered into Excel, were transferred to the SPSS program. The data were analyzed in the SPSS program depending on the distribution of the scores obtained by the groups as a result of the pre-test and post-test applications. It was determined that the scores of the students showed a normal distribution. Accordingly, t-test was used for dependent samples in the analysis of data within the same group, and t-test was used for independent samples in the analysis between groups.

Results

i) "Is there a significant difference between the pre-test results of the experimental and control group students' self-efficacy towards geometry, beliefs and attitudes towards technology?" is the first sub-problem of the study.

The normal distribution of the averages of the pre-test scores of the student groups was examined separately. The normality test was used to check the distribution of the student scores from the groups on the self-efficacy pre-test for geometry. The test averages for the experimental group's students ($p=.825>.05$) and control group's students ($p=.903>.05$) exhibit a normal distribution. The group means indicated a normal distribution, hence the parametric test was used.

The normality test was used to assess the distribution of the student scores in the groups from the geometry belief test. The test averages of the experimental group's students ($p=.860>.05$) and control group's students ($p=.148>.05$) exhibit a normal distribution. The group means indicated a normal distribution, hence the parametric test was used.

The normality test was used to check the distribution of the scores that the students in the groups received on the attitude scale test about technology. The test averages of the experimental group's students ($p=.513>.05$) and those of the control group's students ($p=.278>.05$) display a normal distribution. The group means indicated a normal distribution, hence the parametric test was used.

Table 1.

Results of t-test for unrelated samples according to pre-application data from the Geometry Self-Efficacy Test, Geometry Belief Test and the Scale of Pupils' Attitude towards Technology

Test Name	Measurement	n	Arithmetic mean	Ss	Sd	t	p
Self-Efficacy Test for Geometry	Experiment	26	84.31	8.60	45	.973	.336
	Control	21	81.62	10.36			
Belief Test for Geometry	Experiment	26	3.11	.32	45	-1.188	.241
	Control	21	3.23	.42			
Pupils' Attitude towards Technology	Experiment	26	3.27	.34	45	.762	.450
	Control	21	3.19	.32			

When Table 1 is examined, it can be observed that there is no significant difference between the pre-test averages of the test scores of the experimental and control group students for their self-efficacy and beliefs about geometry. Similarly, there was no significant difference between the pre-test average scores of the experimental and control group students' attitudes towards technology.

ii) "Is there a significant difference between the post-test results of the experimental and control group students' self-efficacy towards geometry, beliefs and attitudes towards technology?"

The normal distribution of the averages of the pre-test scores of the student groups was examined separately. The Geometry-Oriented Self-Efficacy Post-Test results of the students in the groups were tested for normalcy using the normality test. The test averages of the experimental students ($p=.521>.05$) group display a normal distribution, in contrast to the control students' test averages ($p=.033<.05$) which do not. It was chosen to employ a non-parametric test since one of the group averages did not display a normal distribution.

The Belief Test for Geometry scores of the students in the groups were tested for normality using the normality test. The test averages for the experimental group's students ($p=.000<.05$) and the control group's students ($p=.000<.05$) do not follow a normal distribution. It was determined to apply a non-parametric test because the group means did not exhibit a normal distribution.

The **Scale of** Pupils' Attitude towards Technology averages for the experimental group's students ($p=.014<.05$) do not follow a normal distribution and the control group's students displays a normal distribution ($p=.269>.05$). The post-test averages of the two groups were compared using the Mann Whitney U-test for non-parametric unrelated samples because the posttest measurements revealed that the experimental group's students' test scores did not have a normal distribution.

Table 2.

Results of Mann Whitney-U test according to post-application data from the Geometry Self-Efficacy Test, Geometry Belief Test and the Scale of Pupils' Attitude towards Technology

Test Name	Group	n	Rank Average	Row Sum	U	p
Self-Efficacy Test for Geometry	Experiment	26	30.04	781.00	116.000	.001
	Control	21	16.52	347.00		
Belief Test for Geometry	Experiment	26	28.44	739.50	157.500	.013
	Control	21	18.50	388.50		
Pupils' Attitude towards Technology	Experiment	26	27.71	720.50	176.500	.039
	Control	21	19.40	407.50		

According to the post-test data shown in Table 2, there is a significant difference in the geometry self-efficacy scores of the experimental group and control group students (U=116.000; p<.05). The post-test assessments revealed a significant difference in the students' beliefs about geometry between the experimental and control groups (U=157.500; p<.05). There is a significant difference between the post-test measurements of the experimental group and control group students (U=176.500; p<.05).

iii) "Is there a significant difference between the pre-test and post-test results of the experimental group students' self-efficacy towards geometry, beliefs and attitudes towards technology?" has been identified as the third sub-problem of the study.

Since the pre-test and post-test mean scores of the experimental group students for the Geometry self-efficacy scale showed normal distribution, the t-test was used for the samples related to the relevant samples.

Table 3.

The results of the t-test for the related samples according to the pre-test post-test application data of the Geometry Self-Efficacy Scale in the experimental group

Test Name	Measurement	n	Arithmetic mean	Ss	Sd	t	p
Self-Efficacy Test for Geometry	Pre-test	26	84.31	8.60	25	-2.664	.013
	Post-test	26	90.35	5.98			

The results of the experimental group students' pre-test and post-test are significantly different, as shown in Table 3.

While the scores of the pre-test measures to determine the geometry beliefs of the experimental group students are normally distributed, the scores of the post-test measures are not normally distributed. Therefore, the scores of the pretest-posttest application data of the experimental group

students were analyzed with a non-parametric test. Table 4 presents the results of the Wilcoxon Signed Rank Test.

In addition, since the post-test measurements of the Attitudes towards Technology Scale of the experimental group students were not normally distributed, the relationship between the pre-test and the post-test was analyzed with the Wilcoxon Signed Ranks test, which is a non-parametric test.

Table 4.

The results of the Wilcoxon Signed Ranks test according to the pre-test post-test application data of the Geometry Belief Test and the Scale of Pupils' Attitude towards Technology in the experimental group

Test Name	Post test-Pre test	n	Rank Average	Row Sum	z	p
Belief Test for Geometry	Negative sequence	7	8.71	61.00	-2.910[b]	.004
	Positive sequence	19	15.26	290.00		
	Equal	0				
Pupils' Attitude towards Technology	Negative Sequence	7	12.71	89.00	-2.197[b]	.028
	Positive sequence	19	13.79	262.00		
	Equal	0				

[b] according to negative sequences

The results of the experimental group students' geometry belief pre-test and post-test show a substantial difference, as shown in Table 4. Similarly, the results of the experimental group students' attitude scale toward technology show a substantial difference between the pre-test and post-test results, as shown in Table 4.

iv) "Is there a significant difference between the pre-test and post-test results of the control group students' self-efficacy towards geometry, beliefs and attitudes towards technology?"

The normal distribution of the averages of the pre-test and post-test scores of the control group students were examined separately. The pupils in the control group's pre-test scores displayed a normal distribution, but the post-test results did not. The choice to utilize a non-parametric test was made since the post-test results did not exhibit normal distribution. The Wilcoxon Signed Ranks test was used to look at the correlation between the geometry self-efficacy scores of the control group students according to pre-test and post-test measurements.

The scores of the post-test measurements are not often ranked, whereas the scores of the pre-test measurements of the control group students are. As a result, a non-parametric test was used to examine the pre-test and post-test application data for the scores of the students in the control group. The Wilcoxon Signed Rank Test results are shown in Table 5.

Table 5.

The results of the Wilcoxon Signed Ranks test according to the pre-test post-test application data of the Geometry Self-Efficacy Scale and the Geometry Belief Test in the control group

Test Name	Post test-Pre test	n	Rank Average	Row sum	z	p
Self-Efficacy Test for Geometry	Negative Sequence	7	9.93	69.50	-1.327[b]	.185
	Positve Sequence	13	10.81	140.50		
	Equal	1				
Belief Test for Geometry	Negative Sequence	11	10.18	112.00	-.122[b]	.903
	Positve Sequence	12	11.90	119.00		
	Equal	0				

[b] according to negative sequences

The analysis's findings indicate that there is no statistically significant difference between the pre-test and post-test scores of the students in the control group on the geometry self-efficacy scale (z=-1.327; p>.05).

The results of the control group students' pre-test and post-test results on the geometry belief test did not significantly differ, as shown in Table 5.

It was decided to apply the parametric test since the technological attitude scale test results for the control group's students' pre-test and post-test average scores revealed a normal distribution. The t-test for related samples was used to evaluate the pre-test and post-test mean scores of the control group.

Table 6.

The results of the t-test for the related samples according to the pre-test post-test application data of the Scale of *Pupils' Attitude towards Technology in the control group*

Test Name	Meaurement	n	Arithmetic Mean	Ss	Sd	t	p
Pupils' Attitude towards Technology	Pre-test	21	3.19	.32	20	-.034	.973
	Post – test	21	3.20	.46			

The results of the students in the control group on the **Scale of** Pupils' Attitude towards Technology pre-test and post-test did not significantly differ, as shown in Table 6.

Discussion, Conclusion and Suggestions

This section explains the study's findings, which looked at how teaching seventh-grade students about "Lines and Angles, Polygons, Circles, and Structures with Unit Cubes" through distance learning affected their attitudes toward technology, self-efficacy, and beliefs about technology based on the GeoHepta mobile app.

Prior to the application, the study observed no discernible difference in the students' self-efficacy toward geometry between the experimental and control groups. As proven by The fact that

the t-test for unrelated samples revealed that the arithmetic means of the experimental and control groups' scores on the geometry self-efficacy test before the application were nearly identical. After the application within the purview of the quasi-experimental research, a statistically significant difference was discovered between the outcomes of the experimental and control groups. However, the study found that there was no significant difference in the geometry self-efficacy of the control group and a significant difference between the students in the experimental group before and after the application. These results demonstrate that the groups were similar in terms of self-efficacy toward geometry prior to the application and that the experimental group's application of the approach had a greater impact on student self-efficacy toward geometry than the control group did. In other words, it was found that using GeoHepta in the classroom helps pupils feel more confident about their ability to learn geometry.

The beliefs of the experimental and control group students toward geometry were compared according to the mobile application based teaching method used in the study. Before the application, there was no discernible difference between the two groups' opinions on geometry. The arithmetic mean scores of the experimental and control group's views regarding geometry exam scores prior to the application were found to be quite similar when taking the findings of the t-test for unrelated samples into account, demonstrating that before the application, there was no discernible change between the experimental and control group students' opinions about geometry; nevertheless, the quasi-experimental study indicated that there was a substantial difference between them while following the application. Although there was a significant difference in the experimental group students' geometry beliefs before and after the application, there was no significant difference in the control group's geometric self-efficacy. These results showed that groups with similar opinions about geometry existed before the application, and that the experimental group's strategy had a greater impact on students' attitudes about geometry than the control group. In other words, it is concluded that using the GeoHepta mobile application to teach geometry boosts students' confidence in the subject.

The positive impacts of mobile application-assisted instruction on students' affective behaviors are also supported by several studies (Bray & Tangney, 2016; Calder & Campbell, 2016; Çetinkaya, 2019; Fabian et al., 2016; Kearney & Maher, 2013; Peled and Schocken, 2014; Sunandar et al., 2017; Taleb et al., 2015; Wijers et al., 2010). The study's findings demonstrated that the training delivered through the use of the mobile application has favorable effects on the students' self-efficacy and beliefs about geometry. We were unable to locate any study in the literature examining the impact of mobile application-based instruction in math lessons on students' self-efficacy and belief in geometry. As a result, it is believed that the discovered information will significantly advance the field. Alkhateeb's (2019) research sought to determine how mobile gaming affected fourth-graders' academic proficiency. By employing the experimental methodology, the study in question discovered that using mobile games to teach mathematics boosted students' success, interests, and motivations. In the study conducted here, it was found that providing the learning process by making use of mobile learning in the distance learning process of the students had positive effects on their geometry belief and attitude towards technology. The effects of mobile learning technologies are seen in the

development of the affective dimension of the learning process of the students. In this study, it can be stated that students' self-efficacy and belief perceptions towards geometry have improved because mobile applications allow the creation and presentation of materials for students with different learning styles and preferences (Nofriyanti & Setyaningrum, 2019).

Nofriyanti and Setyaningrum's (2019) study sought to ascertain how teachers and students felt about using mobile devices in math sessions. According to the data, it was discovered that the participants were in favor of using mobile phones in math sessions. The use of smartphones and tablets is useful in the development of self-efficacy and beliefs of modern students, who are in a period of intense interest in using technological tools, according to the study that was conducted similarly to the methods of this research.

The study also looked at the attitudes of 7th grade pupils toward technology based on mobile application-based instruction. The t-test findings for unrelated samples before the application revealed that there was no significant difference between the students' views about technology in the experimental and control groups. Meaning that Before the application, there was no discernible difference in the attitudes of the experimental and control group students toward technology; nevertheless, within the purview of the quasi-experimental research, a statistically significant difference was discovered after the application. Additionally, the control group's attitudes towards technology did not alter significantly from those of the experimental group of students, despite their being a considerable difference between those sentiments before and after the application. All of these results show that there were groups with similar attitudes toward technology prior to application, and that the experimental group's strategy was significantly more successful in changing the students' attitudes toward technology than the control group. Thus, it can be said that instruction based on the GeoHepta mobile app improves students' attitudes about technology. Students' views about technology have changed favorably as a result of communication, research, and other activities. They may now realize that the tools they utilize for these activities can also be used for learning under the supervision of their teachers. According to the findings of the study looking at how people perceive using mobile phones and other mobile devices, it might be said that students' attitudes regarding technology change as a result of their use of mobile devices (Nofriyanti & Setyaningrum, 2019).

It's possible that the experimental group's students' access to the needed material at any time and in any place (Atan & Shahbodin, 2018; Uzunboylu, Cavus, & Ercag, 2009) had a positive impact on their attitudes toward technology as well as their self-efficacy and beliefs about geometry.

According to Fabian (2019), there is a new viewpoint on learning in the classroom as a result of the widespread use of mobile devices by generating a new context for mathematics learning. In his study, Fabian (2019) sought to assess students' performance in a variety of mobile learning activities. The study done with 7th graders in primary schools discovered that mobile learning activities enhanced active learning and aided visualization.

According to the framework provided by all of these viewpoints in the research, mobile application-based instruction in remote learning mathematics courses has an impact on students' self-efficacy, beliefs about geometry, and attitudes toward technology. The results of this study demonstrate

that students' self-efficacy and beliefs about geometry, as well as their attitudes toward technology, will all be positively impacted when they are given learning opportunities that demonstrate how technology can be used for teaching purposes and when they are given the tools they can access anytime, anywhere.

Suggestions

- This study indicated that seventh-grade students' use of mobile devices in the classroom helped them develop their self-efficacy, beliefs about geometry, and attitudes toward technology. In this manner, mobile devices like smartphones and tablets are used to teach various topics in math sessions. Therefore, it is advised to permit the use of mobile devices.
- This study was conducted during the Covid-19 pandemic while students were enrolled in distant learning courses. Similar research can be done to look at how students' affective behaviors regarding geometry are affected during the face-to-face schooling session.
- It has been seen that the mathematics teaching carried out by using the mobile application is effective in improving students' affective behaviors towards mathematics. Accordingly, it is possible to design and develop mobile applications that students at different grade levels can use in order to learn the subjects meaningfully in mathematics lessons.
- With this study, it has been determined that mobile application-based teaching has positive effects on the development of students' self-efficacy and beliefs about geometry. In future studies, the effects of teaching based on mobile applications on students' other affective behaviors towards geometry can be examined.

Ethics Committee Approval

This research was carried out with the approval obtained from the ethics committee of Necmettin Erbakan University. The ethical approval obtained on the 19/02/2021 and the Decision No is 2021/50.

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