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Research Article

The Effect of Intelligence Games Lesson on Metacognitive Thinking Skills [1]

Abstract

This study aimed to scrutinize to what extent the intelligence games course affects the metacognitive thinking skills of seventh-grade secondary school students. The research consists of a mixed method in which the quasi-experimental model from quantitative methods and the case study design from qualitative methods are used. The study group consisted of 40 participants from seventh-grade students in a secondary school in the 2021-2022 academic year. 20 of the participating students were in the experimental group and they chose elective intelligence games lesson, and the remaining 20 students were in the control group and they did not choose the elective intelligence games lesson. For quantitative data analysis, non-parametric tests, the Wilcoxon signed-rank test for related measurements, and the Mann Whitney U-test for unrelated measurements were used. Descriptive analysis was used for qualitative data. Research results revealed that the intelligence games lesson significantly affected metacognitive thinking skills. The views stated by the students after the intervention also supported this finding. Hence, it can be suggested that the intelligence games lesson, should be applied at other education levels and the necessary workshop environments should be provided.
Keywords: Intelligence games, metacognition, skill.

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Araştırma Makalesi

Zekâ Oyunları Dersinin Üst Bilişsel Düşünme Becerilerine Etkisi [2]

Öz

Bu araştırmada zekâ oyunları dersinin ortaokul yedinci sınıf öğrencilerinin üst bilişsel becerilerine etkisinin incelenmesi amaçlanmıştır. Araştırma, nicel yöntemlerden yarı deneysel model ile nitel yöntemlerden durum çalışması deseninin kullanıldığı karma bir yöntemden oluşmaktadır. Çalışma grubunu 2021-2022 eğitim-öğretim yılında bir ortaokul yedinci sınıf öğrencilerinden 40 katılımcı oluşturmuştur. Katılımcı öğrencilerden 20'si deney grubunda olup seçmeli zekâ oyunları dersini seçmiş, geri kalan 20 öğrenci ise kontrol grubunda olup seçmeli zekâ oyunları dersini seçmemiştir. Nicel verilerin analizinde parametrik olmayan testlerden, Wilcoxon işaretli sıralar testi ile Mann Whitney U-testi kullanılmıştır. Nitel verilerde ise betimsel analiz tekniğine başvurulmuştur. Araştırma sonuçları, zekâ oyunları dersinin, üst bilişsel düşünme becerilerini anlamlı düzeyde etkilediği ortaya koymuştur. Uygulama eğitiminden sonra görüşlerine başvurulan öğrencilerin bu durumla ilgili ortaya koyduğu fikirler de bunu destekler niteliktedir. Bu nedenle, zekâ oyunları dersinin, eğitimin diğer kademelerinde de uygulanması ve bunun için gerekli atölye ortamlarının oluşturulması önerilebilir.
Anahtar Kelimeler: Zekâ oyunları, üst biliş, beceri.

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[1] Bu araştırma yayımlanmamış doktora tezinden üretilmiş olup, araştırmanın nicel verileri 12. Uluslararası Kültür ve Medeniyet Kongresi'nde sözlü sunum olarak sunulmuştur (Azerbaycan, 21-22 Haziran 2022).
[2] This research was produced from an unpublished doctoral thesis and the quantitative data of the research were presented as an oral presentation at the 12th International Congress of Culture and Civilization (Azerbaijan, 21-22 June 2022).

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Genişletilmiş Özet

Giriş

Öğrenmeyi öğrenen ve öğrenme esnasında üst düzey düşünme becerilerini hayatına yansıtan bununla birlikte sahip olduğu bilgi ve beceriyi günlük yaşantısında aktif bir şekilde kullanabilenler donanımlı kişiler olarak değerlendirilir. İnsan yaşantısının, çeşitli problemlerle iç içe bir yapıda olduğu düşünülürse bireyin bilgi birikimini ve deneyimini bu problemlerle baş edebilmede ve yeni durumlara uyarlamada kullanabilmesi üst düzey düşünme becerileri açısından iyi olduğunu gösterir (Moon, 2004). Bir üst düzey beceri olarak araştırmaya konu olan üst bilişsel düşünmede geçen "biliş" ifadesi, bireyin çevreyi anlamaya çalışması, tanıması ve öğrenmesini içeren tüm zihinsel süreçleri içine alan bir kavramdır (Yaycı, 2005). Liberman (1994) bilişi, farklı ve çok sayıdaki zihinsel süreç, yapı ve işlevlerin birlikte meydana getirdiği bir üst işlem işleyişi olarak tanımlar. Garner ve Alexander (1989) biliş kavramını, bilme, hatırlama, algılama ve anlama gibi zihinsel süreçlerle açıklarken üst biliş kavramını da bireyin kendi düşüncelerini bilmesi, hatırlaması, algılaması ve anlaması şeklinde ifade etmiştir. Gourgey'e (1998) göre biliş, öğrenme sürecini ve bilgiyi oluşturmak anlamına gelirken, üst biliş ise bireyin kendini gözlemleyebilmesi, geliştirebilmesi, değerlendirebilmesi ve öğrenme süreçlerini uygulayabilmesi anlamını karşılamaktadır. "Üst biliş" ifadesi ise ilk önce Flavell'in çalışmalarında, bireyin öğrenme süreçlerine ilişkin farkındalığı, şeklinde tanımlanmıştır. Akpınar'a (2011) göre üst biliş, son zamanlarda öğretme-öğrenme süreçlerinde sıklıkla vurgulanan, önem verilen bir kavramdır. Eğitimde öne çıkan "kendi kendine öğrenme" ve "öğrenmeyi öğrenme" gibi yeterliklerle ilişkilendirildiği için üst biliş kavramına ayrı bir değer atfedilmektedir.

Alan yazında zekâ oyunlarının, okul performansı ile olan ilişkisini (Bottino ve diğerleri, 2013), öğrencilerin matematiksel becerilerini geliştirmeye yönelik matematiksel kavramların nasıl öğretilebileceğini (Erdoğan ve diğerleri 2017), öğrencilerin uzamsal düşünme becerilerine (Demirkaya ve Masal, 2017), liderlik becerilerine (Zengin, 2018), matematiksel düşünme becerilerine (Taş ve Yöndemli, 2018) ve saldırganlık davranışlarına etkisini (Gençay ve diğerleri, 2019) inceleyen çalışmalar görmek mümkündür. Bu araştırmada ise zekâ oyunları dersinin üst bilişsel düşünme becerileri açısından bireylerin olay, durum veya gelişmelere ilişkin yaklaşımlarında nasıl bir etkiye sahip olduğunu görmek amaçlanmıştır. Bundan dolayı söz konusu etkinin, bireyin hem eğitiminde hem de normal yaşantısında ortaya koyduğu davranışlara ve sergilediği yaklaşımlara ilişkin destekleyici bir rol oynayıp oynamadığını belirlemek gerekebilir. Özellikle ortaokul öğrencileri açısından durum değerlendirildiğinde, zekâ oyunları aracılığıyla üst bilişsel düşünme becerilerini inceleyen çok sınırlı sayıda çalışmanın olması bu araştırmayı, alana katkısı açısından önemli kılmaktadır. Ortaokul öğrencilerine yönelik bu gibi çalışmaların, eğitim programları ve öğretimine ilişkin hazırlanması muhtemel ortaokul programlarına da katkı sağlayabileceği düşünülmektedir. Dolayısıyla bu araştırmada ortaokul yedinci sınıf öğrencilerinin almış olduğu zekâ oyunları dersinin, katılımcıların üst bilişsel düşünme becerilerini ne düzeyde etkilediğine ilişkin problem durumu araştırılmıştır. Bu problem durumu bağlamında aşağıdaki sorulara cevap aranmıştır:

Araştırmanın nicel soruları:

i) Deney grubu öğrencilerinin, ön ve son test puan ortalamaları arasında istatistiksel olarak anlamlı düzeyde bir fark var mıdır?
ii) Kontrol grubu öğrencilerinin, ön ve son test puan ortalamaları arasında istatistiksel olarak anlamlı düzeyde bir fark var mıdır?

iii) Deney ve kontrol grubu öğrencilerinin, son test puan ortalamaları arasında anlamlı bir fark var mıdır?

Araştırmanın nitel soruları:

i) Deney grubunun, zekâ oyunları dersi sonrası ihtiyacı olması halinde kendi kendine öğrenmeyi nasıl gerçekleştirebileceğine ilişkin görüşleri nelerdir?
ii) Deney grubunun, zekâ oyunları dersinden sonra öz farkındalıklarındaki değişime ilişkin görüşleri nelerdir?

Yöntem

Bu araştırma, nicel yöntemlerden yarı deneysel model ile nitel yöntemlerden durum çalışması olmak üzere, karma bir yöntemden oluşmaktadır ve çalışmada açıklayıcı karma desen kullanılmıştır. Çalışma grubu, araştırmanın nicel boyutu için, 2021-2022 eğitim-öğretim döneminde, Siirt'te bir ortaokulda yedinci sınıf öğrencilerinden seçilmiştir. Bu grup, seçmeli zekâ oyunları dersini seçen 20 kişilik deney grubu ve bu dersi seçmeyen 20 kişilik kontrol grubundan oluşan toplam 40 katılımcıyı kapsamaktadır. Ayrıca araştırmanın nitel boyutu için katılımcılar, deney grubu öğrencilerinden seçilmiştir.

Araştırma verilerinin toplanmasında Sperling vd.'nin, (2002) geliştirdiği, Karakelle ve Saraç'ın (2007) Türkçe'ye uyarladığı "Çocuklar İçin Üst Bilişsel Farkındalık Ölçeği (ÜBFÖ-Ç)" ve araştırmacılar tarafından geliştirilen yarı yapılandırılmış görüşme formu kullanılmıştır.

Araştırmada veri analizleri örneklem grubunda öğrenci sayısı az olduğundan parametrik olmayan testlerden, ilişkili ölçümler için Wilcoxon işaretli sıralar testi ile ilişkisiz ölçümler için Mann Whitney U-testi kullanılmıştır. Can'a (2014) göre gruplardaki birey sayısı 20 ya da daha az olduğu durumlarda küçük örneklem için Mann-Whitney U testi kullanılabilmektedir. Analizlerde, etki büyüklüğünün hesaplaması için, Eta kare (η^2) sınıflamasına başvurulmuştur. Mann-Whitney U testi için etki büyüklüğü ölçütü, rank-biserial korelasyon katsayısı ile hesaplanmıştır. Araştırmada nitel verileri çözümlemek amacıyla betimsel analiz tekniğine başvurulmuştur.

Bulgular

Katılımcıların deney öncesinde ve sonrasında üst bilişsel düşünme becerilerinin, anlamlı düzeyde farklılık ortaya koyup koymadığına yönelik Wilcoxon işaretli sıralar testi analiz sonucunda, katılımcıların üst bilişsel düşünme testi puanları arasında anlamlı düzeyde fark olduğu saptanmıştır (z=3.46, p= .000< .05). Fark puanlarının sıra ortalaması ve toplamları dikkate alındığında, tespit edilen bu fark, pozitif sıralar yani son test puanı lehine olmuştur. Eta kare değeri $\eta^2 = .77$ çıkmıştır. Bu analiz sonucuna göre, düzenlenen zekâ oyunları dersinin, deney grubundaki katılımcıların üst bilişsel düşünme becerilerini geliştirmede büyük düzeyde bir etkiye sahip olduğu ifade edilebilir.

Kontrol grubundaki katılımcıların ön test ve son test üst bilişsel düşünme becerilerinin anlamlı düzeyde farklılık ortaya koyup koymadığına yönelik Wilcoxon işaretli sıralar testi analiz sonuçlarına göre, katılımcıların üst bilişsel becerileri testi puanları arasında anlamlı düzeyde fark olmadığı belirlenmiştir (z= 1.36, p= .38> .05).

Zekâ oyunları dersine katılan öğrenciler ile katılmayan öğrencilerin üst bilişsel düşünme becerileri, sekiz haftalık deneysel uygulama sonrasında karşılaştırılmıştır. Mann-Whitney U testi sonuçlarına göre ise, zekâ oyunları dersine katılan öğrencilerin üst bilişsel düşünme becerileri ile katılmayanların arasında anlamlı bir fark olduğu belirlenmiştir (U= 97.50, p= .006<.05). Sıra ortalamaları dikkate alındığında, zekâ oyunları dersine katılanların üst bilişsel düşünme becerilerinin, derse katılmayanlara göre daha yüksek olduğu saptanmıştır. Analiz sonucunda etki değeri (r_{rb}= 0,48) çıkmıştır. Bu bulguya göre, zekâ oyunları dersinin, katılımcıların üst bilişsel düşünme becerilerini artırmada orta düzeyde bir etkiye sahip olduğu

söylenebilir. Zekâ oyunları dersini aldıktan sonra deney grubu öğrencilerinin, kendi kendine öğrenmeyi nasıl gerçekleştirebileceklerine ilişkin görüşleri incelendiğinde daha çok farklı kaynaklara, kitaplara ve videolara başvurdukları öne çıkmıştır. Bilgi notları hazırlayarak, sık tekrarlar ve konu ile ilgili soru çözümleri yaparak kendi kendine öğrenme eylemini gerçekleştirme çabası katılımcılar tarafından önemli görülmüştür. Deneyimleyerek öğrenmenin, araştırıp sorgulamanın yeni fikirler üretmeye katkı sağlayacağı düşünülmüştür. Olayın veya sorunun kaynağını tespit edip içten dışa bir yol izleyerek, elindeki imkânları zorlayarak ve çevredeki yaşantıları örnek alarak kendi başına öğrenmenin mümkün olabileceği görüşleri ifade edilmiştir.

Zekâ oyunları dersini aldıktan sonra deney grubundaki katılımcıların kişisel farkındalıklarının nasıl değiştiğine dair görüşleri incelenmiştir. Öğrencilerin en çok öne çıkan görüşleri dikkat ve odaklanmada anlamlı bir gelişme olduğu yönünde olmuştur. Daha ayrıntılı bir hayal gücü ile üç boyutlu ve yaratıcı düşünme becerilerinin geliştiği belirtilmiştir. Ayrıca, katılımcılar mantıksal çözüm aramayı ve sorunlara daha fazla zaman ayırmayı önemli bulmuşlardır. Katılımcıların kendini tanıması, yeteneklerini keşfetmesiyle daha planlı ve az hata yapma farkındalığının geliştiği ifade edilen görüşler arasındadır. Yeni stratejiler geliştirme, daha cesaretli ve kendi başına hareket etme, özgüvende artış, soru sorma alışkanlığı ve parçaları birleştirme şeklinde değişim ve gelişmelerin olduğu görülmüştür. Kişisel farkındalığa ilişkin önemli düzeyde bir değişimin olmadığı düşüncesi de görüşler arasında yer almıştır.

Tartışma

Araştırmada uygulanan zekâ oyunları dersinin üst bilişsel düşünme becerilerini anlamlı düzeyde etkilediği ortaya çıkmıştır. Uygulama eğitiminden sonra görüşlerine başvurulan öğrencilerin bu durumla ilgili ortaya koyduğu fikirler de bunu destekler niteliktedir. Örneğin, ihtiyacı olması halinde bireyin kendi kendine öğrenmeyi nasıl gerçekleştirmesi gerektiğine ilişkin görüşler daha çok araştırma, sorgulama, tekrar etme ve çevredeki yaşantıları izleme eylemleri etrafında yoğunlaşmıştır. Yaparak, yaşayarak öğrenme yaklaşımına ayrı bir önem verilmesi, konu ile ilgili kendi başına öğrenmeyi sağlayacak materyallerin temin edilmesi, bu materyallerin olmaması durumunda mevcut imkânlarla öğrenme çabasının sürdürülmesi ortaya konan görüşleri desteklemektedir. Bu sonuçlardan yola çıkarak katılımcıların kendi başına öğrenmeyi gerçekleştirebilmek adına gösterdiği çabanın, sınırlı düzeyde de olsa öğrenme fırsatının olması halinde, bunu üst bilişsel düşünme becerilerini geliştirebilecek bir işlevselliğe dönüştürebildikleri şeklinde yorumlanabilir.

Üst bilişsel düşünmede kişisel farkındalığın da ayrı bir yeri vardır. Uygulanan zekâ oyunları eğitiminden sonra öğrencilerin kişisel farkındalıklarına ilişkin görüşleri bu tür eğitim uygulamalarına duyulan ihtiyacı ortaya koymak noktasında önemli bir ipucu olarak kabul edilebilir. Örneğin, zekâ oyunları dersini aldıktan sonra gerçek anlamda düşünmeye başlamak, sosyal ilişkileri geliştirmek için yeni stratejiler geliştirmek, gelişmeleri farklı ve pozitif bir bakış açısıyla değerlendirmek, daha planlı yaşamaya başlamak ve kendini daha iyi tanımaya başlamak gibi kişisel farkındalığa ilişkin olumlu yöndeki değişim ve gelişmeler bu ihtiyacın haklılığını ortaya koymaktadır. Literatürde, araştırmada ortaya çıkan bu sonuçları destekleyen çalışmaların olduğu görülmektedir. Benzer bir çalışma yapan Marangoz ve Demirtaş (2017) Türk Beyin Takımı'nın geliştirdiği mekanik zekâ oyunlarının, ilkokul 2. sınıfta okuyan öğrencilerin bilişsel becerilerine etkisini araştırmıştır. 14 haftalık eğitimden sonra zekâ oyunlarının, öğrencilerin bilişsel beceri düzeylerinin alt boyutlarının tamamında anlamlı düzeyde bir artış sağladığı tespit edilmiştir. Kel ve Kul (2021) Milli Eğitim Bakanlığı'na bağlı resmi kurumlarda verilen akıl ve zekâ oyunlarının öğrencilere katkılarına ilişkin, bu dersi veren eğitimcilerin görüşlerine başvurmuştur. Elde edilen sonuçlara göre akıl ve zekâ oyunlarının bu çalışmada olduğu gibi üst düzey düşünme becerilerine

olumlu anlamda etkisi olduğu tespit edilmiştir. Araştırmalardan bu şekilde elde edilen sonuçlar özellikle üst bilişsel düşünmede kişisel farkındalığın önemini dikkate almayı gerektirmektedir çünkü kişisel farkındalık, bireyin hem kendini daha iyi tanıyabilmesine hem de sahip olduğu becerileri uygun koşullarda değerlendirmesine fırsat verecektir. Allsop (2019) yaptığı çalışmada çocukların kendi bilgisayar oyunlarını tasarlarken düşünme, öğrenme ve üst bilişlerini incelemiştir. Amaç, bir öğrenme alanı olarak dijital oyun yapma etkinlikleriyle ilgili olarak, öğrencilerin 'öğrenme için düşünmeyi' harekete geçiren üst bilişsel süreçler hakkında bir fikir edinmektir. Çalışmada, oyun tasarımı etkinliklerinin çocuklar için birçok alanda öğrenmeye fayda sağladığı dolayısıyla üst bilişsel farkındalığa olumlu katkısı olduğu tespit edilmiştir. Dündar (2015) ise eğitsel bilgisayar oyunlarının 5. sınıf öğrencilerinin üst bilişsel becerilerine etkisini incelemiş ve çalışmanın üst biliş ölçeklerinden elde edilen sonuçlara göre, deney grubundaki katılımcıların puanlarının kontrol grubundaki katılımcıların puanlarına göre daha yüksek olduğu ortaya çıkmıştır. Oyunların öğrenme ve üst bilişsel becerilere olumlu katkı sağlamasına rağmen kontrol grubunun puanlarında da artış olduğu için gruplar arasında anlamlı düzeyde bir fark olmadığı saptanmıştır. Konu ile ilgili yapılan bu çalışmalar incelendiğinde bulguların bu araştırmadaki sonuçları yüksek düzeyde desteklediği ortaya çıkmıştır. O halde ortaya çıkan sonuçlar dikkate alındığında, bireyin uygun zekâ oyunları, materyalleri ile buluşturulması ve gerekli teknik destek veya donanımın sağlanması durumunda üst bilişsel farkındalıklarının gelişmesine önemli düzeyde katkı sağlayacağı söylenebilir

.

Introduction

Those who learn to learn and apply their higher-order thinking skills to their lives, and who can use their knowledge and skills actively in their daily life are considered as well-qualified people. As human life is intertwined with various problems, a individual's ability to use his knowledge and experience in coping with these problems and adapting to new situations shows that he is good at higher-order thinking skills (Moon, 2004). The concept of "cognition" in metacognitive thinking, which is the subject of research as a higher-order skill, is a concept that includes all mental processes that include the individual's struggle to understand, recognize, and learn about the environment (Yaycı, 2005). Liberman (1994) defines cognition as a higher level of processing that is created together by different and numerous mental processes, structures and functions. While Garner and Alexander (1989) reveal the concept of cognition as mental processes such as knowing, remembering, perceiving, and understanding. Gourgey (1998) states that cognition means creating the learning process and knowledge, while metacognition means the individual's ability to observe himself, develop, evaluate, and apply learning processes.

The term "metacognition" was first defined as the individual's awareness of learning processes in Flavell's (1979) studies. In other words, metacognition can be defined as a person's awareness about how he can best carry out the process of learning. Strategies used during the learning process, development of these strategies, and being aware of how learning takes place are the outcomes of thinking about metacognitive awareness (as cited in Karaoğlan Yılmaz et al., 2019). Lin (2001) states that metacognition as a concept was first used together by John Flavell and Ann Brown. They define metacognition as any activity or knowledge in which cognitive engagement is regulated. According to Akpınar (2011), metacognition is a concept that has been frequently emphasized and given importance in teaching-learning processes recently. Since metacognition is associated with such competencies as "self-learning" and "learning to learn" that stand out in education, a special value is attributed to it. Schraw (2001) thinks cognition and metacognition concepts are related to each other. While cognition is necessary to perform a task, metacognition is also required to understand how to perform this task. Kim et al. (2013) point out the difference between the concepts of cognition and metacognition, while they deal with the thoughts that arise in learning environments as individual and social-based thoughts. Therefore, in learning environments, cognitive and metacognitive components are considered two of the main arguments that display individuals' thoughts. Thus, cognitive actions are fed only from sources such as individual and social cognitive, while metacognitive actions are fed from individual, social cognitive and metacognitive sources.

Raising individuals with an inquiring perspective throughout the educational process is possible when students search for cause-effect relationships between events by making connections between what they have learned, rather than simply accepting the information (Gömleksiz and Kan, 2009). Therefore, education systems have an effective place in the upbringing of individuals. The place and value given to higher-order thinking skills in education, especially at the point of meeting the needs of the modern age make this effect very important (Kutlu et al., 2010). Higher-order thinking skills provide individuals with a curious and questioning mindset, encouraging them to think differently and be aware of how they learn, both within educational contexts and in their daily. The ideal educational environment for expressing this understanding is where constructivist education is available. Constructivist education gives the individual the opportunity to learn by actively participating in the process, by doing, and by adding his own interpretation. The education in this process is crucial in terms of contributing to an individual's development of versatile approaches to a situation or event.

The development of higher-order thinking skills can contribute to the acquisition of important attainments in many areas of an individual's life. According to Dempsey et al. (2002), different lesson materials used in the education of individuals help them acquire the desired attainments. In this

regard, games as a tool, especially intelligence games, contribute to this process. Therefore, intelligence games are important in terms of an individual's active use of metacognitive thinking skills. In the intelligence games curriculum, the attainments which are explained as the individual's awareness and development of his intelligence potential, and revealing a systematic thinking by presenting original approaches to problems (Ministry of National Education [MoNE], 2013) are important for students to use and develop their higher-order thinking skills.

In the literature, there are studies that examine intelligence games from different aspects. One such studies revealed a relationship that intelligence games positively increased school performance (Bottino et al., 2013). Another study supports how mathematical concepts can be taught through intelligence games to improve students' mathematical skills (Erdoğan et al., 2017). Other studies demonstrated that it had a significant effect on learners' spatial thinking skills (Demirkaya & Masal, 2017), leadership skills (Zengin, 2018), and mathematical thinking skills (Taş & Yöndemli, 2018). It is also possible to see studies examining its effect on reducing aggressive behavior (Gençay et al., 2019). On the other side, this research aims to discover how the intelligence games lesson affects individuals' approaches to events or situations in terms of metacognitive thinking skills. Therefore, it may be necessary to determine whether the mentioned effect plays a supportive role in the behaviors and approaches of the individual both in his education and daily life. Especially when considering secondary school students, the scarcity of studies examining metacognitive thinking skills through intelligence games highlights the significance of this research in contributing to the existing literature. It is believed that such studies for secondary school students can contribute to the possible secondary school curriculums related to educational programs and teaching.

In the longitudinal study conducted with secondary school students for two consecutive years, students were given tasks representing two different fields: a text-reading task for history and a problem-solving task for mathematics. It was observed that at the end of these tasks, there was an increase in the students' metacognitive skills and that these tasks contributed to learning (Van der Stel & Veenman, 2010). Piaget explained the thought transformation in the abstract operations period as potential change and development in generating some hypotheses and reasoning (Gander ve Gardiner, 2010). Piaget's theory of cognitive development demonstrates that children's abstract thinking skills develop during secondary school years (Senemoğlu, 2012). Therefore, it was thought that it would be more appropriate to conduct this study with secondary school students. As the fifth and sixth graders are in the transition phase from the concrete operations period to the abstract operations period, and the eighth graders are in the preparation phase for the high school entrance examination, seventh-grade students were decided to be the most appropriate group to conduct by considering that the long data collection process would be disrupted. Thus, in this study, the issue regarding what extent the intelligence games lesson taken by secondary school seventh-grade students affects the metacognitive thinking skills of the participants was investigated. Within the scope of this problem, answers to the following questions were sought:

Quantitative questions of the research:

i) Is there a statistically significant difference between the pre-and post-test mean scores of the experimental group students?

ii) Is there a statistically significant difference between the pre-test and post-test mean scores of the control group students?

iii) Is there a significant difference between the post-test mean scores of the experimental and control group students?

Qualitative questions of the research:

i) What are the opinions of the experimental group regarding how they can self-learn if they need it after the intelligence games lesson?

ii) What are the experimental group's views on the change in self-awareness after the intelligence games lesson?

Method

Research Model

In this research, an explanatory mixed design, which is a mixed method, was used. A quasi-experimental model for the quantitative part and a case study for the qualitative part was employed. According to Creswell (2009), at least two different models are used in mixed methods. Creswell and Plano-Clark (2007) state that quantitative and qualitative methods support each other in mixed studies. Experimental research is a quantitative approach designed to reveal the effects of supposed causes (Christensen et al., 2015: 33). Experimental models are those in which data are collected to see cause-and-effect relationships between variables under the control of the researcher (Karasar, 2015: 87; Çepni, 2014: 120). According to Cohen, Manion, and Morrison (2000), quasi-experimental models are used in scientific education research when necessary controls cannot be fulfilled in true experimental approaches. A quasi-experimental model is a research model in which the same process as in experimental approaches is applied, but not all variables can be controlled (Christensen et al., 2015: 316). Studies in which matched groups are randomly assigned as experimental groups are considered to be quasi-experimental models (Büyüköztürk et al., 2014: 198).

The case study, which constitutes the qualitative dimension of the research, is considered as an approach that has a distinctive feature in answering scientific questions (Büyüköztürk et al., 2014: 21). McMillan (2000) defines a case study as an in-depth study of events, social groups, programs or environments. In addition, the case study can be used to describe the intense and in-depth analysis of one or more cases, reveal possible ideas about a situation, and evaluate it (Gall et al., 2007; Christensen et al., 2015: 416).

Study Group

The study group consisted of 40 participants from seventh-grade students in a secondary school in the 2021-2022 academic year. Twenty of the participating students were in the experimental group, and they chose the elective intelligence games lesson. The remaining rest 20 students were in the control group and they did not select the elective intelligence games lesson. In addition, for the qualitative dimension of the research, the participants consisted of the experimental group students.

The results obtained in the pre-test to determine whether the experimental group and the control group are equivalent in terms of metacognitive thinking skills before the application are given in table 1 below:

Table 1

Mann Whitney-U Pre-test Results of Metacognitive Thinking Skills by Groups

Group	n	$\bar{X}$	sd	U	P
Experimental	20	3.86	.43	184.50	.674
Control	20	3.79	.41		

Table 1 shows that there was no significant difference between the metacognitive thinking skills test scores of the participants (U= 184.50, p> .05). Accordingly, it can be said that the experimental and control groups are similar in terms of their metacognitive skills before the application.

Data Collection Tools

The data collection tools of the research are as follows:

The Metacognitive Awareness Inventory for Children (Jr. MAI)- A and B Forms

Sperling et al., (2002) developed a Metacognitive Awareness Inventory that consisted of A and B forms to measure the metacognitive thinking skills of 3-9 grade students. Karakelle and Saraç (2007) analyzed its validity and reliability in Türkiye. The study was carried out with 565 students studying in 3rd, 4th, and 5th grades for Form A, and 736 students studying in 6th, 7th, 8th, and 9th grades for Form B. They determined that both forms of the Jr. MAI were valid and reliable at a sufficient level. The Cronbach alpha value of the A form was .64 and the Cronbach alpha value of the B form was .80. The scales were 5-point rating. Factor structures were examined by exploratory factor analysis. Although a four-factor solution was obtained for both forms, considering the criteria for determining the number of factors, it was decided that the one-factor solution was more appropriate for the A and B forms. Regarding the age range covered by both forms of the Jr. MAI, it can be accepted that it has sufficient psychometric properties that can be used to measure metacognitive thinking. The B form of the inventory was used because it was suitable for the purpose of this research and the age of the participants. The Cronbach's alpha reliability coefficients of the used form were .71 for the pre-test and .81 for the post-test. These values show that the scale is reliable.

Semi-structured Interview Form

The semi-structured interview form developed by the researchers was prepared in order to obtain the views of the participants about the experimental process in a descriptive way and to support the quantitative data. After the quantitative data was analyzed, qualitative questions were prepared to support these data. These questions were then reviewed by two expert academicians in the field of curriculum and instruction. Incorporating feedback and corrections from the experts, the semi-structured interview form was finalized.

Observation data made by Observer 1 (researcher) and Observer 2 during the application process, in line with the observation form developed to obtain an objective observation environment by taking the views of another observer in the classroom environment during the eight-week period during which the applications were made, are presented in table 2 below:

Table 2

Eight-Week Intervention Program Observation Concordance Between Observer 1 and Observer 2

		Observer 1	Observer 2
Observer 1	Kendall's Tau	1	.764
	p		.009
	n	8	8
Observer 2	Kendall's Tau	.764	1
	p	.009	
	n	8	8

Table 2 demonstrated that there was a high level, positive, and significant concordance between Observer 1 and Observer 2 in the eight-week implementation program (W= .764, p<.05). The existence of such a relationship between the scores of Observer 1 and Observer 2 was found to be important in terms of the fact that the research was conducted objectively.

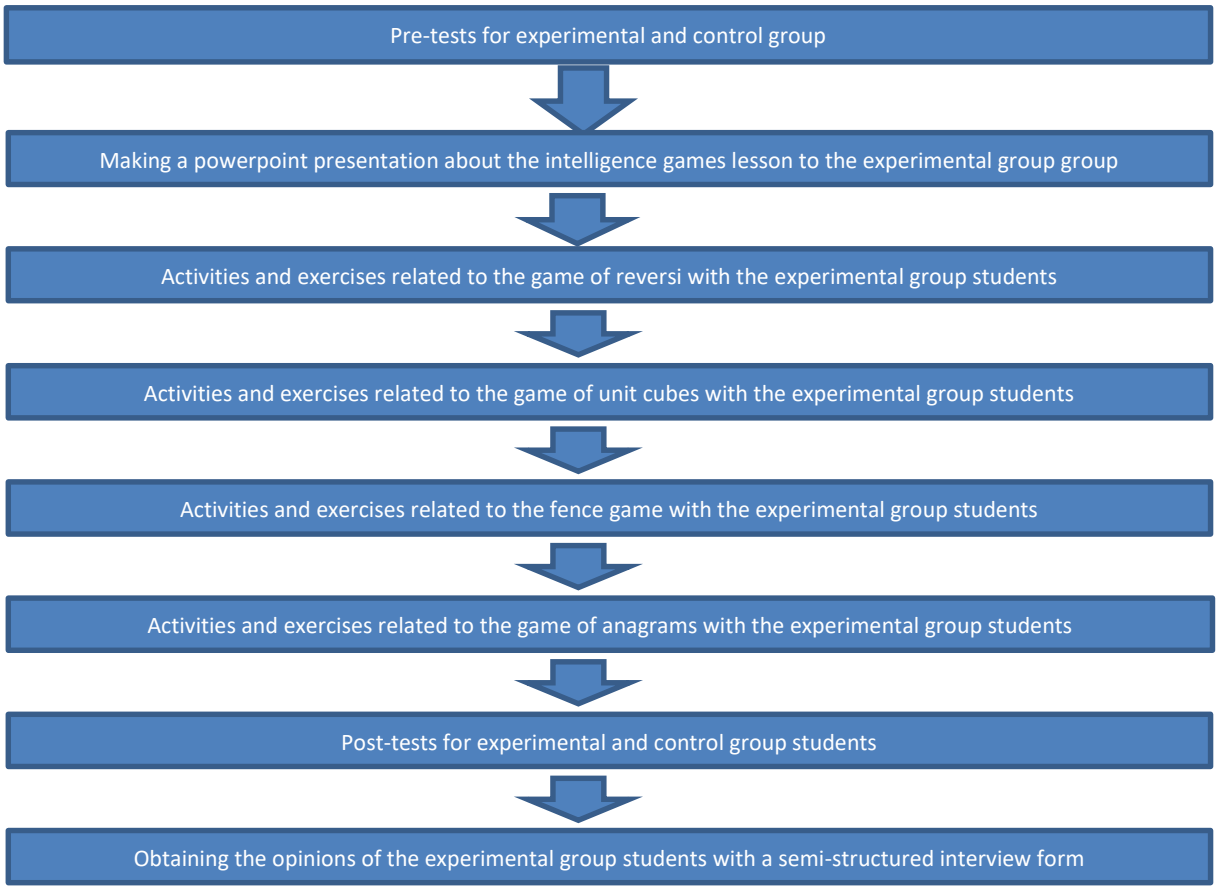
Process

Permissions were obtained from the relevant authorities to ensure that the research could be conducted under appropriate and efficient conditions. Afterward, the administrators of the institution where the research was going to be conducted were interviewed, and information was provided about the purpose, process, and scope of the research.

Since the 8th graders at the secondary school level did not choose the intelligence games lesson due to the high school entrance exam, and the 7th-grade students were more ready in terms of their age and abstract thinking skills compared to the 5th and 6th grades, it was more appropriate to conduct this research with 7th-grade students. Experimental and control groups were assigned after determining the number of 7th-grade classes and students in the school. The fact that the school had two classes in the 7th-grade level and that the classes were formed according to the equal distribution of success according to the class determination exam of the institution had a facilitating effect in the selection of the experimental and control groups. For the experimental group that chose the intelligence games lesson, four intelligence games were selected from different categories together with the intelligence games lesson teacher of the institution. Since the control group students did not choose this lesson, no intervention was carried out in this group. During the research process, the draft regarding the implementation calendar was shared with the school administration. The process flow in this process is given in the figure 1 below.

Figure 1.

Research Process Flow



The research process flow, as seen in Figure 1, shows that preliminary testing took only one week. In the intelligence games lesson, a PowerPoint presentation was made for a week in order to inform the students about the introduction of the games and tasks. Two weeks were allocated for each of the previously determined reversi, unit cubes, fence, and anagrams games to be applied in the intelligence games lesson. Post-tests were carried out the following week. Shortly after the post-tests were applied and the quantitative data were analyzed, a week was arranged for the students in the experimental group to collect the qualitative data. In this case, 12 weeks were allocated for the collection of data during the application process of the research: one week for the pre-tests, one week for the lecture presentation, eight weeks for the game applications in the intelligence games lesson, one week for the post-tests, and one week for the semi-structured interview form to get opinions from the experimental group students.

Data Analysis

Due to the small number of students in the sample group, non-parametric tests were used while analyzing the data. Wilcoxon signed-rank test and Mann-Whitney U-test were used for related and unrelated measurements, respectively. According to Can (2014), Mann-Whitney U-test can be used for small sample when the number of individuals in the groups is 20 or less.

In cases where significant difference exists, the effect size was calculated to determine the size of the difference. The formula of $lzl/\sqrt{n}$ was used to calculate the effect value, which expresses the size of the significant difference in the Wilcoxon signed-rank test analysis results. With this formula, the effect values calculated as .10 - .30 low, .30 - .50 medium, and .50 and above were evaluated as high (Cohen, 1988, as cited in Kinay, 2015).

Although common language effect size is widely used in non-parametric distributions, a more widely used criterion is correlation. The effect size criterion for the Mann-Whitney U-test is calculated by the rank-biserial correlation coefficient. An easy-to-use formula (Wendt formula) for calculating effect size in Mann-Whitney U-test analysis results is given below. The given formula calculates the rank biserial correlation coefficient by using the U statistic and the sample size of the two groups. When U is zero, the maximum is assumed to be $r_{rb} = 1$. Since U is by definition non-directional, the rank-biserial correlation coefficient calculated by the Wendt formula is also non-directional and always positive (Wendt, 1972, as cited in Yabacı Tak, 2021).

$$r_{rb} = \frac{1-(2U)}{n1\ x\ n2}$$

When the interpretation intervals of the rank-biserial correlation coefficient were evaluated, it was classified as $0.1 \leq r_{rb} < 0.30$ small effect size, $0.30 \leq r_{rb} < 0.50$ medium effect size, $r_{rb} \geq 0.50$ large effect size (Kerby, 2014).

The descriptive analysis technique was used to analyze the qualitative data. According to Yıldırım and Şimşek (2010), the main purpose of the descriptive analysis technique is to organize and interpret the data collected at the end of observations and interviews and present it to the reader. Descriptive analysis is a technique that involves the steps of handling qualitative data, identifying and interpreting findings according to a preconceived framework. A cause-effect relationship can be established between the obtained data. If needed, some comparisons can be made between the data. According to Creswell (2008), the data collected during descriptive analysis can be summarized and interpreted in line with previously thought-out themes. The data can be organized according to the themes developed by considering the research questions, or handled in line with the questions or

dimensions asked in the interviews and observations. In the use of this technique, the researcher can often include direct quotations to reflect the thoughts of the participants. The primary purpose is to present the findings to the reader by summarizing and interpreting them. The answers in the semi-structured interview form were organized in four stages with the descriptive analysis technique. In the beginning, the thematic framework was determined in line with each research question, and the answers given by all participants were read. Then, the statements of the participants were presented through direct quotations. Since there was more than one attainment in the answers given by the participants, no percentage evaluation was made, only the frequency values were included and comments were made on the findings accordingly.

Validity and Reliability

In order to ensure internal validity, the opinions of more than one researcher were taken during the data analysis process (Creswell & Miller, 2000). After the collected data were analyzed, they were compared with the analysis of another researcher. As a result, it was revealed that there was a sufficient level of consistency between the codings. The method of the research to ensure external validity is clearly stated.

In order to ensure the reliability of the research, the results of the descriptive analysis of the qualitative data were shared with two expert academicians in the field of educational curriculum and instruction, and feedback was received. As a result, there was consistency between the shared results of the research and the feedback of the academicians. According to Glesne and Peshkin (1992, as cited in Yıldırım, 2010), sharing the data obtained in qualitative research with individuals who are experts in the field of qualitative research and receiving feedback will increase the reliability of the study.

Ethic Procedures

During the current research, the "Higher Education Institutions Scientific Research and Publication Ethics Directive" has been acted upon. The research was approved by the decision of the Social and Human Sciences Research and Publication Ethics Committee of the "xxx University" dated 02.02.2021, and numbered 10926. In the research, Higher Education Institutions Ethical Behavior Principles, Higher Education Institutions Scientific Research and Publication Ethics Directive were complied with, and the participants were informed about the study and signed the consent form.

Findings

Quantitative Findings

Findings related to the sub-problems of the research are given in tables below:

Is there a statistically significant difference between the pre-test and post-test mean scores of the experimental group students in terms of metacognitive thinking skills?

Table 3

Wilcoxon Signed Rank Test Results of Experimental Group Pre-Test and Post-Test Metacognitive Thinking Skills Scores

Pretest-Posttest	n	$\bar{X}$	sd	z	p	η^2
Pretest	20	3.86	.43	3.46*	.000	.77
Posttest	20	3.97	.50			

*Based on negative ranks

Table 3 illustrates that there was a significant difference between the metacognitive thinking test scores of the participants *(z*=3.46, *p*< .05). Based on this analysis, it can be stated that the intelligence games lesson has a remarkable effect on improving the metacognitive thinking skills of the participants in the experimental group.

Is there a statistically significant difference between the pre-and post-test mean scores of the control group students in terms of metacognitive thinking skills?

Table 4

Wilcoxon Signed Rank Test Results of Control Group Pre-Test and Post-Test Metacognitive Thinking Skills Scores

Pretest-Posttest	n	X̄	sd	z	p
Pretest	20	3.79	.41	1.36*	.38
Posttest	20	3.75	.59		

*Based on negative ranks

Table 4 showed that there was no significant difference between the metacognitive skills test scores of the participants (*z*= 1.36, *p*> .05).

Is there a significant difference between the achievement mean scores of the experimental and control group students in terms of metacognitive thinking skills?

Table 5

Mann Whitney-U Test Results of Metacognitive Thinking Skills by Groups

Group	n	X̄	sd	U	P	r_{rb}
Experimental	20	3.97	.50	97.50	.006	.48
Control	20	3.75	.59			

Table 5 revealed that at the end of the eight-week experimental application, there was a significant difference between the metacognitive thinking skills of those who attended the intelligence games lesson and those who did not (*U*= 97.50, *p*<.05). The analysis showed that the metacognitive thinking skills of the participants in the intelligence games lesson were higher than those who did not attend the lesson. The analysis demonstrated that the effect value was found to be r_{rb}= .48. Thus, it can be stated that the intelligence games lesson has a moderate effect on increasing the metacognitive thinking skills of the participants.

Qualitative Findings

Experimental group students' views after taking intelligence games lesson;

i) What are the opinions of the experimental group about how they can self-learn if they need it after the intelligence games lesson?

Table 6 illustrates that students mostly refer to different sources, books, and videos. The effort to realize the self-learning action by preparing information notes, making frequent repetitions, and solving questions about the subject is considered important.

Table 6

Theme of Realizing Self-Learning

Codes	f	Participants
Applying to different resources, books, videos	15	P2,4,5,6,7,10,12,13,14,15,16,17,18,19,20
Preparing information notes, repeating, and solving questions	6	P1,3,4,12,14,19
Learning by doing	3	P6,11,17
Questioning, generating new ideas	2	P1,8
Tracing a path from the inside out	1	P9
Pushing existing possibilities	1	P5
Starting from the surrounding life	1	P1

It is thought that learning by experience, researching, and questioning will contribute to producing new ideas. Among the opinions expressed are that it is possible to learn by identifying the source of the event or problem, following a path from the inside out, forcing the possibilities at hand, and taking the experiences in the environment as an example.

P1. If I need to, I learn to learn by myself by researching, questioning, repeating practices, and taking the experiences around me as an example.

P2. I learn by reading books on the subject and watching videos. I use essays to check whether I have learned or not.

P3. I prepare small information notes and read them repeatedly. If it is related to a subject at school, I go to the learning path by solving a lot of questions.

P4. First, I prepare my resources for the subject I will learn. Then, I take short notes on the subject. After learning the subject, I solve questions to reinforce it.

P5. If I can provide the materials I need on the subject, I can succeed in learning on my own. If the necessary materials are not available, I start looking for ways to learn with what I have. So I do not give up.

P6. I prefer the way of learning by doing and experiencing the events. As for the lessons, it is enough to learn by myself, to reach the books, that is, the resources.

P7. I try to reach relevant books and resources.

P8. I try to realize learning by thinking about the situation and generating ideas. I try to use a method to distinguish between right and wrong.

P9. I go to the source of the event or problem. I prefer to learn by myself by following a path from the innermost to the outermost.

P10. I can get information from different sources. I can cope with my problems by using different learning paths.

P11. By interpreting my experiences, I reach the right results and enable myself to learn.

P12. First of all, I research the topics I lack and watch videos on the subject. I take notes while watching the video. Then, I reinforce the topics by solving the test.

P13. I can learn by myself with the help of the internet or books.

P14. I draw important places by looking at the subject explanation books. I take short notes. I look at videos on the internet that I don't understand. I reinforce it by solving questions.

P15. I use the internet and books.

P16. I resort to relevant resources.

P17. I research the necessary resources. I try to learn by experience.

P18. I can learn by watching lesson videos online.

P19. I watch videos. I solve the question.

P20. I research from books and the internet.

ii) What are the experimental group's views on the change in self-awareness of the intelligence games lesson?

Table 7

Change in Self-Awareness Theme

Codes	f	Participants
Improvement in attention and focus	9	P1,3,6,7,9,10,11,13,14
An increase in deeper, three-dimensional thinking, imagination, and creativity	7	P1,3,10,12,13,16,17
Efforts to reach the most logical solution, spending time on the problem	4	P3,5,6,8
Self-knowledge, discovering talents, planned living	4	P12,14,15,20
Developing new strategies, different ways	4	P2,4,10,17
Feeling courageous, self-solving, increased self-confidence	4	P3,8,10,19
Asking questions, developing the habit of questioning, bringing the pieces together	3	P3,17,20
Thinking that not much has changed	1	P18

Table 7 showed that there was a significant improvement in attention and focus. It was stated that a more detailed imagination, three-dimensional and creative thinking skills developed. Furthermore, participants considered searching for logical solutions and spending more time on problems important. It was expressed that the awareness of being more planned and making fewer mistakes developed due to the participants' self-knowledge and discovery of their talents. It turned out that there were changes and developments in generating new strategies, acting more courageously and independently, increasing self-confidence, the habit of asking questions and combining the pieces. There were also opinions that there was no significant change in self-awareness.

P1. I can describe the change in my self-awareness after taking the intelligence games lesson as follows: I used to not care about other people's opinions. But now I'm trying to think about it and find its true meaning. I started to think better in a three-dimensional way by playing with unit cubes.

P2. After playing with unit cubes, I started playing easier when building a house in Lego. After playing Reversi, I started to apply new strategies to improve my relationships.

P3. When I faced a problem, I started asking games, my friends, and my elders to find out. As my attention increased with new games, I noticed places around me that I had not noticed. I try to spend more time solving long questions. Thanks to these games, I can say that I have improved myself and started to do more logical things. Now my imagination is stronger and I feel more courageous.

P4. I started to regard things from different angles and positively.

P5. I can say that as I spend more time understanding the problems, my social relations have improved, and I have started to communicate better with others.

P6. Thanks to intelligence games, I am more careful. In the face of an event or problem, I try to find solutions and use the best way.

P7. I started to pay more attention to the surrounding colors and geometric shapes.

P8. While I used to cry for everything, now I try to solve the problems myself. When I find a solution, I take care to think and make the right decision instead of immediately implementing it.

P9. I started to be more careful and alert.

P10. I have improved in many aspects such as my creativity, concentration, ambition, self-confidence, and solving problems in different ways. This change and development have taught me to use different ways of thinking.

P11. I started questioning my relationships with people. I learned to be more careful.

P12. I started living more planned. My thinking skills have improved.

P13. I focus better on things. I think in more detail and produce suitable solutions.

P14. I used to make a lot of attention mistakes in questions. But after the fence game, I learned to be more careful. In this way, I realized I made fewer mistakes while solving questions.

P15. I started to know myself better. I discovered my talents.

P16. Ever since I played the fence game, I've been looking at things from a broader perspective. I started noticing the pictures at school.

P17. After playing intelligence games, my perspective on everything that happens around me has changed. Every game has added something to me. Reversi improved my strategy. Unit cubes made me look more carefully at the structure of buildings and the idea of assembling the pieces. The fence made me pay attention to the details in the streets I passed.

P18. I don't think much has changed.

P19. I feel my self-confidence is better.

P20. I try to question my mistakes more and try to correct myself.

Results, Discussion and Recommendations

Metacognitive thinking is the explanation of an experience of how an individual has or can have knowledge about the knowing and learning processes in which he takes an active role, how he can structure it, and how he can realize learning on his own. In fact, the process of self-learning and restructuring of knowledge such as assimilation, control, and reorganization of learned information support the individual's life. It is expected that an individual who develops metacognitive thinking skills will act with a higher self-confidence in realizing learning on his own, expressing his own opinion on a subject, and re-monitoring and reorganizing cognitive processes in line with his perspective.

The inclusion of educational programs and practices that will help students develop higher-order thinking skills in their academic life will provide a more reliable way of presenting these kinds of learning styles. As a matter of fact, it was revealed that the intelligence games lesson in this study significantly affected metacognitive thinking skills. The ideas put forward by the students, whose opinions were examined after the intervention, also supported this point. For example, the views indicating that the individual should perform self-learning when necessary mostly revolved around researching, questioning, repeating, and monitoring the experiences in the environments. Attributing special importance to the way of learning by doing and experiencing, providing materials that would enable self-learning on the subject, and in the absence of these, continuing the learning effort with existing opportunities supported the views put forward in the present study. Based on these results, it can be interpreted that the effort of the participants to realize learning on their own, even if there is limited learning opportunity, can transform it into a functionality that can improve their metacognitive thinking skills.

If the necessary conditions are created and metacognitive thinking strategies are used, children's reading comprehension skills will improve (Çakıroğlu & Ataman, 2008), constructivist learning environments will contribute to metacognitive awareness (Yurdakul & Demirel, 2011), and education based on metacognitive teaching will improve students' academic achievements and a positive development will occur in their attitudes towards lessons (Ataalkın, 2012). Based on these developments, it is possible to say that providing educational activities supported by metacognitive approaches and supporting educational processes in this sense will positively affect children's metacognitive skills (Yıldız Altan & Temel, 2022). As revealed in the results of the present study, improving children’s metacognitive thinking skills by enriching their educational processes through such activities as intelligence games will make both their education and lives more qualified.

Self-awareness also has a special place in metacognitive thinking. After the intelligence games lesson, the students' views on their self-awareness can be considered as an important indicator to reveal the need for such educational practices. For example, good changes and developments related to self-awareness such as starting to think in a real sense, developing new strategies to improve social

relations, evaluating developments from a different and positive perspective, starting a more planned life, and getting to know oneself better, after taking the intelligence games lesson, demonstrate the justification of this need. In the literature, it is seen that there are studies supporting these results. Marangoz and Demirtaş (2017), who conducted a similar study, investigated the effects of mechanical intelligence games developed by the Turkish Brain Team on the cognitive skills of students studying in the 2nd grade of primary school. After a 14-week intervention, it was determined that there was a significant increase in all sub-dimensions of the cognitive skill levels of the students. Kel and Kul (2021) sought the opinions of the educators-who gave this lesson- on the contribution of mind and intelligence games to students in official institutions affiliated with the Ministry of National Education. In the current study, it was also determined that mind and intelligence games had a positive effect on higher-order thinking skills. The results obtained from the studies require considering the importance of self-awareness, especially in metacognitive thinking because self-awareness will allow the individual to get to know himself better and to evaluate his skills under appropriate conditions.

Likewise, Ricker and Richet (2021) examined the metacognitive awareness of children in their study on the opportunities provided by digital games for children aged 6-10. The results showed that exposure to games with high interactive features was positively associated with children's metacognitive awareness. However, it was revealed that exposure to games with less interactive features was not related to metacognitive awareness. In the study by Allsop (2019), children's thinking, learning, and metacognition while designing their own computer games were examined. The aim was to get an idea of the metacognitive processes that activated students' 'thinking for learning' in relation to digital game-making activities as a learning space. In the study, it was determined that game design activities facilitated learning in many areas for children and thus contributed positively to metacognitive awareness. Dündar (2015) examined the effects of educational computer games on the metacognitive skills of 5th-grade students. According to the results obtained from the metacognition scales, it was revealed that the scores of the participants in the experimental group were higher than the scores of the participants in the control group. Although it was said that games contributed positively to learning and metacognitive skills, it was determined that there was no significant difference between the groups as there was an increase in the scores of the control group. When these studies on the subject were examined, it was revealed that the findings supported the results of this study at a high level. Thus, it can be said that it will contribute significantly to the development of metacognitive awareness if the individual is brought together with appropriate intelligence games and materials and the necessary technical support or equipment is provided.

Although the development of metacognitive skills does not depend entirely on intellectual ability, it is possible to improve these skills by applying some intelligence tests or activities (Veenman & Spaans, 2005). Through metacognitive instruction, students can practice these skills over time, increasing the chances that these valuable thinking strategies will strengthen their practical intelligence and become part of their repertoire as learners (Joseph, 2009). Thus, creating opportunities that will support the development of metacognitive thinking skills and personal awareness will nurture the good development of children and enable them to obtain quality learning products.

The results of the current study indicated positive effects of the course of intelligence games on metacognitive thinking skills, so game activities should be included in the education programs at other levels. Based on this suggestion, opportunities may arise where students can implement the attainments they have gained from intelligence games lesson both in school and in their social life outside of school. Therefore, it should be considered that the determinations such as the students'

learning by having fun and developing a versatile perspective during the study can be supportive in the realization of the aforemetioned idea.

Based on the results such as the increase in self-confidence of the students after the educational practices, the fact that they started to be more extroverted, and the effort to realize their skills and improve them, elective lessons such as self-knowledge and discovery of talents should be included at least in secondary school education programs.

The inclusion of intelligence games as an elective lesson in the education program is an important development. However, in order to support this development in every school where this lesson is given, if there is not, intelligence games workshops should be established within the possibilities. It should not be forgotten that the establishment of these workshops can contribute to the cognitive and social development of students, as well as help to eliminate the problem of supplying game materials.

In order to make a positive contribution if studies similar to this are carried out in the future, mind games should be included as an academic lesson in teacher training, and undergraduate education programs. It should be taken into account that pre-service teachers who take this lesson at the undergraduate level can be effective in transferring their academic experience to their students in their teaching life and enabling them to present different perspectives.

According to the results of similar studies conducted in the literature, especially the current study, the effect and contribution of the intelligence games lesson on the multi-faceted development of the student should be taken into consideration. Therefore, giving such lessons or activities in different platforms of social life in order to be given in a more planned and systematic way will support the fact of reaching more people and spreading the contribution to a much larger area.

Since the mind games lesson can keep students' interest, attention and, motivation alive, and make the gains and learning more permanent, it should be ensured that this lesson takes place in a planned and regular way throughout the education process.

Ethical Statement

This research was ethically reviewed by “Fırat University Publication Ethics Committee” and was approved ethically with the;

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The authors contributed equally to the research at all stages of the research.

Conflicts of Interest

The authors have no conflict of interest to declare.

References

Akpınar, B. (2011). Biliş ve üst biliş (metabiliş) kavramlarının zihin felsefesi açısından analizi. [The analysis of the concepts of cognition and metacognition in terms of the philosophy of mind]. *Turkish Studies - International Periodical For The Languages, Literature and History of Turkish or*

Turkic Volume 6/4, 353-365. https://www.ajindex.com/dosyalar/makale/acarindex-1423933909.pdf

Allsop, Y. (2019). *An examination of children's thinking, learning and metacognition when making computer games.* [Doctoral dissertation, A thesis submitted in partial fulfilment of the requirements of the Manchester Metropolitan University for the degree of Doctor of Philosophy, Faculty of Education The Manchester Metropolitan University]. *Online Submission*.

Ataalkın, A. N. (2012). Üst bilişsel öğretim stratejilerine dayalı öğretimin öğrencilerin üst bilişsel farkındalık ve becerisine, akademik başarı ile tutumuna etkisi [The effects of teaching based on metacognitive teaching strategies in science and technology education on students' metacognitive awareness and skills, academic achievement and attitudes], (Tez numarası. 312622) [Yüksek Lisans tezi, Akdeniz Üniversitesi].

Bottino, R. M., Ott, M., & Tavella, M. (2013). Investigating the relationship between school performance and the abilities to play mind games. In: European Conference on Game-Based Learning. Academic Conferences International Limited, 62.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö., Karadeniz, Ş., & Demirel, F. (2014). *Bilimsel araştırma yöntemleri.* [*Scientific research methods*]. Pegem Akademi.

Can, A. (2014). *SPSS ile bilimsel araştırma sürecinde nicel veri analizi.* [*Quantitative data analysis in scientific research process with SPSS*]. Pegem Akdemi.

Christensen, L. B., Johnson R. B., & Turner, L. A. (2015). *Research methods design and analysis.* (Çev. Ed. Ahmet Aypay). Anı Yayıncılık.

Cohen L., Manion, L., & Morrison, K. (2000). *Research methods in education.* Routledge Falmer. https://doi.org/10.4324/9780203224342

Creswell, J. W. (2008). *Educational research planning, conducting and evaluating quantitative and qualitative research.* International Pearson Merril Prentice Hall.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches.* Sage Publications. http://www.ceil-conicet.gov.ar/wp-content/uploads/2015/10/Creswell-Cap-10.pdf

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice*, *39*(3), 124-130. https://doi.org/10.1207/s15430421tip3903_2

Creswell, J. W., & Plano-Clark, V. L. (2007). *Designing and conducting mixed methods research.* Sage Publications. https://psycnet.apa.org/record/2006-11884-000

Çakıroğlu, A., & Ataman, A. (2008). Üst bilişsel strateji öğretiminin okuduğunu anlama başarı düzeyi düşük öğrencilerde son test artırımına etkisi [The effect of metacognitive strategy training on improving the achievement level of students having low achievement levels of reading comprehension]. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi, 0*(16), 1-13. https://dergipark.org.tr/en/pub/sakaefd/issue/11212/133895

Çepni, S. (2014). *Araştırma ve proje çalışmalarına giriş.* [*Introduction to research and project work*]. Celepler Matbaacılık.

Demirkaya, C., & Masal, M. (2017). Geometrik-mekanik oyunlar temelli etkinliklerin ortaokul öğrencilerinin uzamsal düşünebilme becerilerine etkisi. *Sakarya University Journal of Education, 7*(3), 600-610. https://search.trdizin.gov.tr/tr/yayin/detay/266682/

Dempsey J. V., Haynes L. L., Lucassen B. A., & Casey M. S. (2002) Forty simple computer games and what they could mean to educators. *Simulation and Gaming, 33*(2), 157-168. https://doi.org/10.1177/1046878102332003

Dündar, B. (2015). *Eğitsel bilgisayar oyunlarının 5. sınıf öğrencilerinin kesirler konusundaki matematik başarısına, matematiğe karşı tutumuna ve üst bilişsel becerilerine etkisi.* [*Educational computer games on the mathematics grade 5 students fractions on success, the effect of mathematics and attitudes towards metacognitive skills*]. (Tez numarası. 463399) [Yüksek Lisans tezi, Başkent Üniversitesi].

Erdoğan, A., Eryılmaz Çevirgen, A., & Atasay, M. (2017). Oyunlar ve matematik öğretimi: Stratejik zekâ oyunlarının sınıflandırılması. *Uşak Üniversitesi Sosyal Bilimler Dergisi,10* (ERTE Özel Sayısı), 287-311.

Gall, D.M., Gall, P.J., & Borg, W.R. (2007). *Educational research: An introduction.* MA: Pearson. https://psycnet.apa.org/record/1996-97171-000

Gander, M. J., & Gardiner, H. W. (2010). Çocuk ve ergen gelişimi. (Çev. Ed. Bekir Onur). İmge Yayınları.

Garner, R. ve Alexander, P. A. (1989). Metacognition: Answered and Unanswered Questions". *Educational Psychologist, 24*(2), 143–158. https://psycnet.apa.org/record/1990-00358-001

Gençay, Ö. A., Gür, E., Gençay, S., Gür, Y., Tan, M., & Gençay, E. (2019). Zekâ oyunlarının 12-15 yaş aralığındaki çocukların saldırganlık davranışlarına etkisi. *Spor Eğitim Dergisi, 3*(1), 36-43. https://dergipark.org.tr/en/pub/seder/issue/42512/515270

Gourgey, A. F. (1998). Metacognition in Basic Skills Instruction. *Instructional Science, 26*(1), 81-96. https://doi.org/10.1023/A:1003092414893

Gömleksiz, M. N., & Kan, A. Ü. (2009). Sosyal bilgiler dersi öğretim programının eleştirel düşünme, yaratıcı düşünme ve girişimcilik becerilerini kazandırmadaki etkililiğinin belirlenmesi (Diyarbakır ili örneği). [Determining the effects of social studies curriculum on gaining critical thinking, creative thinking and entrepreneurship skills (case of Diyarbakır city)]. *Fırat Üniversitesi Doğu Araştırmaları Dergisi*, *8*(1), 39-49. https://dergipark.org.tr/en/pub/fudad/issue/47181/594083

Joseph, N. (2009). Metacognition needed: Teaching middle and high school students to develop strategic learning skills. *Preventing School Failure: Alternative Education for Children and Youth, 54*(2), 99-103. https://doi.org/10.1080/10459880903217770

Karakelle, S., & Saraç, S. (2007). Çocuklar için üst bilişsel farkındalık ölçeği (ÜBFÖ-Ç) A ve B Formları: Geçerlik ve güvenirlik çalışması. [Validity and factor structure of Turkish versions of the metacognitive awareness inventory for children (Jr. MAI) - A and B forms]. *Türk Psikoloji Yazıları 2007,10*(20),87-103. http://www.psikolog.org.tr/tr/yayinlar/dergiler/1031828/tpy1301996120070000m000163.pdf

Karaoğlan Yılmaz, F. G., Yılmaz, R., Üstün, A. B., & Keser, H. (2019). Examination of critical thinking standards and academic self-efficacy of teacher candidates as a predictor of metacognitive thinking skills through structural equation modelling. *Journal of Theoretical Educational Science, 12*(4), 1239-1256. https://doi.org/10.30831/akukeg.467435

Karasar, N. (2015). *Bilimsel araştırma yöntemi.* [*Scientific research method*]. Nobel.

Kel, S., & Kul, B. (2021). Akıl ve zekâ oyunlarının öğrencilere katkıları: Eğitmenlerin görüşleri. [The contribution of mind and intelligence games to students: Views of instructors]. *Uluslararası Bilim ve Eğitim Dergisi*, *4*(3), 207-225. https://doi.org/10.47477/ubed.840868

Kerby, D. S. (2014). The simple difference formula: An approach to teaching nonparametric correlation. *Comprehensive Psychology, 3*, 11. https://doi.org/10.2466/11.IT.3.1

Kim, Y. R., Park, M. S., Moore, T. J. ve Varma, S. (2013). "Multiple Levels of Metacognition and Their Elicitation through Complex Problem-Solving Tasks". *Journal of Mathematical Behavior, 32*(3), 377-396. https://doi.org/10.1016/j.jmathb.2013.04.002

Kinay, İ. (2015). *Otantik değerlendirme yaklaşımının öğretmen adaylarının problem çözme becerileri ile öğrenmeye ve katılımcı değerlendirmeye yönelik inançlarına etkisinin incelenmesi.* [*The investigation of effects of authentic assessment approach on prospective teachers' problem solving skills, beliefs towards learning and participative assessment*]. (Tez numarası. 398395). [Doktora Tezi, Gaziantep Üniversitesi].

Kutlu, Ö., Doğan, C. D., & Karakaya, İ (2010). *Öğrenci başarısının belirlenmesi.* [*Determining student success*]. Pegem Akademi.

Liberman, D. A. (1994). Behaviorism and the mind: A (limited) call for a return to instropection. T. O. Nelson, (Ed.). Metacognition: Care readings içinde. Allyn & Bacon.

Lin, X. (2001). Designing metacognitive activities. *Educational Technology Research and Development, 49*(2), 23-40. https://doi.org/10.1007/BF02504926

Marangoz, D., & Demirtaş, Z. (2017). Mekanik zekâ oyunlarının ilkokul 2. sınıf öğrencilerinin zihinsel beceri düzeylerine etkisi. [The effect of mechanical mind games on mental skill levels of primary school second grade students]. *Uluslararası Sosyal Araştırmalar Dergisi*, *10* (53). 613-622. http://dx.doi.org/10.17719/jisr.20175334149

McMillan, J. H. (2000). *Educational research: Fundamentals for consumer.* Longman. http://educationinpakistan.org/wp-content/uploads/2018/05/edrefu.pdf

Milli Eğitim Bakanlığı (2013). *Ortaokul ve imam hatip ortaokulu zekâ oyunları dersi (5, 6, 7, 8. sınıflar) öğretim programı.* Devlet Kitapları Müdürlüğü Basım Evi.

Moon, J. A. (2004). *A handbook of reflective and experiential learning theory and practice.* Routledge Flamer.

Ricker, A. A., & Richert, R. A. (2021). Digital gaming and metacognition in middle childhood. *Computers in Human Behavior*, 115: 106593. https://doi.org/10.1016/j.chb.2020.106593

Schraw, G. (2001). "Promoting general metacognitive awareness". In H. J. Hartman (Ed.). Metacognition in Learning and Instruction: Theory, Research and Practice (pp.3-16). Dordrecht: Kluwer Acdemic Publishers.

Senemoğlu, N. (2012). Gelişim, öğrenme ve öğretim, kuramdan uygulamaya. Pegem Akademi.

Sperling, R. A., Howard, B. C. Miller, L. A., & Murphy, C. (2002). Measures of children's knowledge and regulation of cognition. *Contemporary Educational Psychology,* 27, 51-79. https://doi.org/10.1006/ceps.2001.1091

Taş, İ. D., & Yöndemli, E. N. (2018). Zekâ oyunlarının ortaokul düzeyindeki öğrencilerde matematiksel muhakeme yeteneğine olan etkisi. *Turkish Journal of Primary Education, 3*(2), 46-62. https://dergipark.org.tr/en/pub/tujped/issue/42070/497233

Van der Stel, M., & Veenman, M. V. (2010). Development of metacognitive skillfulness: A longitudinal study. *Learning and Individual Differences, 20*(3), 220-224. https://doi.org/10.1016/j.lindif.2009.11.005

Veenman, M. V., & Spaans, M. A. (2005). Relation between intellectual and metacognitive skills: Age and task differences. *Learning and Individual Differences, 15*(2), 159-176. https://doi.org/10.1016/j.lindif.2004.12.001

Yabacı Tak, A. (2021). *Etki büyüklüğü yöntemlerinin karşılaştırılması*. [*Comparison of effect size methods*]. (Tez numarası. 690072). [Doktora Tezi, Bursa Uludağ Üniversitesi].

Yaycı, L. (2005). *Bilişsel gelişim ve dil gelişimi.* [Cognitive development and language development development and learning, in]. (Ed. Betül Aydın), Gelişim ve Öğrenme, içinde [Development and learning, in]. (s.101-122). Nobel Yayınları.

Yıldırım, A., & Şimşek, H. (2010). *Sosyal bilimlerde nitel araştırma yöntemleri.* [*Qualitative research methods in the social sciences*]. Seçkin Yayınları.

Yıldırım, K. (2010). Nitel araştırmalarda niteliği artırma. [Increasing the quality of qualitative research]. *İlköğretim Online*, *9*(1), 79-92. https://dergipark.org.tr/tr/pub/ilkonline/issue/8596/106955

Yıldız Altan, R., & Temel, Z. F. (2022). Okul öncesi eğitimde üst bilişsel becerileri destekleyen öğrenme süreçlerinin incelenmesi [Investigation of Learning processes supporting metacognitive skills in preschool education]. *Sosyal, Beşerî ve İdari Bilimler Dergisi, 5*(5), 582–602. https://doi.org/10.26677/TR1010.2022.978

Yurdakul, B., & Demirel, Ö. (2011). Yapılandırmacı öğrenme yaklaşımının öğrenenlerin üst biliş farkındalıklarına katkısı [Contributions of constructivist learning approach to learners' metacognitive awareness]. *Uluslararası Eğitim Programları ve Öğretim Çalışmaları Dergisi1*(1), 71-85. https://www.acarindex.com/dosyalar/makale/acarindex-1423936089.pdf

Zengin, L. (2018). Akıl oyunları uygulamasının ilkokul 4. sınıf öğrencilerinin liderlik becerilerine etkisinin incelenmesi. *Akademik Sosyal Araştırmalar Dergisi, 6*(68), 568-579. http://doi: 10.16992/asos.13563.