

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

GAMIFICATION IN URBAN AND REGIONAL PLANNING EDUCATION



Ph.D. THESIS

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Department of Urban and Regional Planning

Urban and Regional Planning Programme

MARCH 2025

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ŞEHİR VE BÖLGE PLANLAMA EĞİTİMİNDE OYUNLAŞTIRMA

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To my father,



FOREWORD

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March 2025

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ABBREVIATIONS

AESOP	: Association of European Schools of Planning
AI	: Artificial Intelligence
GSRS	: Game-based Student Response Systems
ITU	: Istanbul Technical University
PAB	: Planning Accreditation Board
RTPI	: Royal Town Planning Institute
SDG	: Sustainable Development Goal
SRS	: Student Response Systems
TUPOB	: Association of Planning Schools of Türkiye



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GAMIFICATION IN URBAN AND REGIONAL PLANNING EDUCATION

SUMMARY

Education has undergone significant transformation, necessitating the adoption of innovative techniques. Universities have developed alternative methods to adapt, reflecting the evolving nature of the current generation's educational needs. This thesis investigates the implementation of gamification as an alternative method in planning education. While planning education has previously utilized gamification elements, including simulations and role-playing in project-design classes, the full potential of gamification remains untapped. The primary objective is to explore how gamification can enhance planning education. This study addresses specific research questions to guide this investigation:

- Do students believe that gamification contributes positively to learning and motivation?
- Does using gamification activities lead to increased academic success among students?

The findings are expected to significantly contribute to the discourse on gamification's impact on higher education, particularly within the context of planning education in Türkiye. Despite extensive research on gamification's educational benefits, there is limited focus on planning education. Most studies assess student perspectives, with little attention to the evaluation of student success. This study aims to address both aspects. This thesis is divided into five chapters: an introduction, an overview of gamification and education, an exploration of gamification in planning education and case studies, a results chapter, and a conclusion.

Courses in the planning education curriculum are divided into two groups: theoretical and applied. Theoretical courses aim to impart knowledge and develop research, writing, and communication skills. Applied courses, like studio classes, focus on project development, enhancing practical skills. At Istanbul Technical University, planning education is categorized into basic sciences, elective courses, and core departmental courses, with a strong emphasis on theoretical courses. To optimize learning, innovative techniques such as student response systems and gamification, which boost motivation and participation, are implemented. However, gamification in theoretical courses remains underexplored.

This thesis includes four gamification case studies. The first three cases provide key insights into students' perspectives on the gamification experience, while the final case study offers a more detailed examination of students' perspectives and the impact on academic achievement. The final and main case study was conducted with first-year students enrolled in the "Introduction to Urban and Regional Planning & Ethics" course, during the 2022-2023 fall academic year. Both qualitative and quantitative approaches were used, collecting data through a questionnaire, quizzes, and final exam results. The study aimed to provide a gamified learning experience, evaluate students'

perceptions, and explore its impact on academic achievement. The data analysis methodology used in this study involves performing correlation analysis.

This case study evaluates the impact of gamification on academic success and student attitudes. The analysis shows a weak positive correlation (0.22) between participation in activities and final grades, a moderately strong positive correlation (0.54) between quiz performances (of students who participated in all four quizzes) and final grades, and a weak positive correlation (0.30) between the mean class activity performance of all students and their scores from the section of the final exam that included the quiz questions. Students' attitudes towards gamification were assessed using a yes/no question and a Likert scale, with the highest scores for "remembering" (4.25) and the lowest for "focus" (3.75). Open-ended questions also captured students' positive and negative perspectives. Overall, students believe gamification aids long-term retention more than immediate focus.

In conclusion, this research investigates the impact of gamification on students' motivation, learning, and academic success. Findings suggest that gamification is beneficial as a supplementary tool in large theoretical urban planning classes, aiding efficient quiz creation and grading. At this stage, game-based student response systems prove beneficial by providing instant feedback, enhancing motivation and engagement, and enabling efficient quiz evaluation during lessons. However, for gamification to have a direct impact on academic success, it must evolve into more personalized and innovative applications that empower students to take control of their own learning experiences. The cumulative advancements will offer valuable insights for establishing standards that promote more permanent learning in theoretical courses through gamification in urban and regional planning education. This study's limitations highlight the need for time-series data, the inclusion of instructors' perspectives in future research for more comprehensive results, and the integration of new technological advancements.

ŞEHİR VE BÖLGE PLANLAMA EĞİTİMİNDE OYUNLAŞTIRMA

ÖZET

Eğitim, yenilikçi tekniklerin benimsenmesini gerektiren önemli bir dönüşüm sürecindedir. Üniversiteler, yeni kuşağın eğitim ihtiyaçlarının değişen doğasını yansıtan alternatif yöntemler geliştirmiştir. Bu tez, planlama eğitiminde bir alternatif yöntem olarak oyunlaştırmanın uygulanmasını araştırmaktadır. Planlama eğitimi kapsamında, daha önce proje/tasarım derslerinde simülasyonlar ve “role-playing” gibi oyunlaştırma unsurları kullanılmış olsa da, oyunlaştırmanın potansiyeli henüz tam olarak değerlendirilmemiştir. Bu tezde ana amaç, oyunlaştırmanın planlama eğitimi nasıl geliştirebileceğini keşfetmektir. Bu hedefe yönelik iki temel araştırma sorusu bulunmaktadır:

-Öğrenciler, oyunlaştırmanın öğrenme ve motivasyona olumlu katkıda bulunduğuna inanmakta mıdır?

-Oyunlaştırma faaliyetlerinin kullanılması, öğrencilerin akademik başarısını artırıyor mu?

Araştırma bulgularının, Türkiye’deki planlama eğitimi bağlamında oyunlaştırmanın yükseköğretimdeki etkisi üzerine tartışmalara önemli katkılar sağlaması beklenmektedir. Oyunlaştırmanın eğitim alanındaki faydaları hakkında kapsamlı araştırmalar yapılmış olmasına rağmen, planlama eğitimi üzerine sınırlı sayıda çalışma bulunmaktadır. Çalışmaların çoğu, öğrenci perspektifini değerlendirmekte olup, öğrenci başarısını değerlendiren araştırmalar yetersiz kalmıştır. Bu çalışma, her iki önemli konuyu da ele almayı amaçlamaktadır. Tez; giriş, eğitimde oyunlaştırmanın incelenmesi, planlama eğitiminde oyunlaştırma ve vaka çalışmaları, araştırma bulguları ve sonuç olmak üzere beş bölümden oluşmaktadır.

Planlama eğitimi müfredatındaki dersler iki ana gruba ayrılmaktadır: teorik ve uygulamalı dersler. Teorik dersler, bilgi aktarmayı ve öğrencilerin araştırma, yazma ve iletişim becerilerini geliştirmeyi amaçlar. Uygulamalı dersler ve stüdyo dersleri, proje geliştirmeye odaklanır ve pratik becerilerin kazanımına önemli ölçüde katkıda bulunur. İstanbul Teknik Üniversitesi’nde planlama eğitimi, temel bilimler, seçmeli dersler ve zorunlu bölüm dersleri olmak üzere üç ana kategoriye ayrılmıştır. Öğrencilerin derslerden etkin bir şekilde yararlanması için uygun eğitim tekniklerinin geliştirilmesi ve entegrasyonu gerekmektedir. Öğrencilere öğrenme deneyimleri üzerinde daha fazla özerklik sağlamak amacıyla oyunlaştırma gibi yenilikçi eğitim sistemleri uygulanmaktadır. Oyunlaştırma, motivasyonu ve katılımı artırarak dinamik bir öğrenme ortamı yaratır. Güncel araştırmalar, planlama eğitiminde oyunlaştırmanın çoğunlukla stüdyo derslerinde uygulanmasına odaklanmaktadır. Ancak, teorik dersler için geliştirilen oyunlaştırma uygulamaları henüz yeterince araştırılmamıştır. Teorik derslerde bilgiyi hafızada tutma ve öğrenci motivasyonunu artırma önemlidir. Simülasyon ve “role-playing” gibi oyunlaştırma deneyimlerinin yanı sıra, oyun tabanlı

öğrenci yanıt sistemleri teorik dersler için alternatif bir yaklaşım olarak değerlendirilmelidir.

Bu tez kapsamında, dört farklı oyunlaştırma çalışması ilgili derslerde uygulanmıştır. Her bir çalışma, bir önceki çalışmanın eksikliklerini gidermeyi hedefleyerek geliştirilmiştir. İlk çalışma, küçük bir öğrenci grubuyla gerçekleştirilmiş olup, öğrencilerin arazi kullanımıyla ilgili farklı aktör rollerine bürünerek karar vermelerini sağlamıştır. Bu çalışma öğrenciler tarafından olumlu bir yaklaşımla değerlendirilmiştir. Ancak bu çalışmanın uygulanabilmesi için bir moderatörün mutlaka gerekli olması ve deneyimin bir saatten uzun sürmesi nedeniyle daha hızlı ve pratik uygulamalarla devam edilmesine karar verilmiştir. İzleyen iki vaka çalışması oyunlaştırılmış kısa sınav yöntemini esas almıştır. İlk çalışmaya kıyasla daha kalabalık öğrenci grupları ile bu çalışmalar yapılmıştır. Öğrenciler bu iki vaka çalışmasında da görüşlerini olumlu olarak belirtmişlerdir. Bundan sonra da daha fazla oyunlaştırılmış kısa sınav uygulamasıyla son bir vaka çalışması daha gerçekleştirilmiştir. Bu çalışma tezin ana çalışması niteliğindedir.

Bu ana vaka çalışması, şehir ve bölge planlama bölümü birinci sınıf temel derslerinden biri olan “Şehir ve Bölge Planlamaya Giriş ve Etik” dersine kayıtlı öğrencileri kapsamaktadır ve 2022-2023 akademik yılının güz döneminde gerçekleştirilmiştir. Çalışmada hem nitel hem de nicel yaklaşımlar kullanılmış; anketler, kısa sınav ve final sınav sonuçları aracılığıyla gerekli veriler toplanmıştır. Süreç, öğrencilere oyunlaştırılmış bir öğrenme deneyimi sunmayı, bu yaklaşıma dair algılarını değerlendirmeyi ve bu deneyimin akademik başarı üzerindeki etkilerini araştırmayı amaçlamaktadır. Bu kapsamda iki aşamalı bir yöntem geliştirilmiştir. İlk olarak, öğrenciler akademik dönem boyunca oyunlaştırma öğelerinin kullanıldığı toplam dört adet kısa sınava katılmıştır. Dönem sonunda öğrencilerin görüşleri anket ile toplanmıştır. Verileri değerlendirmek için kullanılan yöntem ise korelasyon analizidir.

Bu vaka çalışmasının sonuçları iki aşamada değerlendirilmiştir. İlk aşama, oyunlaştırma uygulamasının akademik başarıyı etkileyip etkilemediğini ölçmektir. İkinci aşama ise, bu uygulamaya yönelik öğrenci tutumlarını, akademik sonuçlardan bağımsız olarak değerlendirmedir. Akademik başarı üzerindeki etkiyi değerlendirmek için öğrencilerin katıldıkları kısa sınav sayısı ile final sınavı notları arasındaki korelasyon değeri 0.22 olarak hesaplanmıştır. Bu durum oyunlaştırma deneyimine katılım ile dönem sonu notları arasında zayıf bir pozitif ilişki olduğunu göstermektedir. Ayrıca, tüm sınavlara katılan öğrencilerin performansı ile final notları arasındaki korelasyon değeri 0.54 olarak hesaplanmıştır ve bu iki değişken arasında nispeten daha güçlü pozitif bir ilişki olduğu görülmüştür. Daha ayrıntılı bir değerlendirme yapmak amacıyla da tüm öğrencilerin kısa sınavlardan aldığı notların ortalamasıyla, final sınavında tekrar sorulan kısa sınav sorularından aldıkları notlar arasındaki korelasyon değeri 0.30 olarak hesaplanmıştır ve güçlü olmayan bir ilişki olduğu gözlemlenmiştir. Öğrencilerin oyunlaştırma deneyimine yönelik tutumlarını değerlendirmek için önce evet/hayır soruları sorulmuş, ardından olumlu yanıt verenler için bir Likert ölçeği (1-düşük, 5-yüksek) kullanılmıştır. Bu yanıtlara göre en yüksek değer 4.25 ile bilgiyi hatırlama sorusuna verilmiştir. Öğrenciler oyunlaştırma deneyiminin gelecekte ders içeriğini daha etkili bir şekilde hatırlamalarına yardımcı olacağına inanmaktadırlar. Öte yandan, en düşük değer ise 3.75 ile odaklanma sorusuna verilmiştir. Öğrenciler, oyunlaştırmanın derslerdeki konsantrasyonları üzerinde daha az etkili olduğunu düşünmektedir. Anketin açık uçlu soruları da öğrencilerin olumlu ve olumsuz görüşlerini ortaya koymalarını sağlamıştır. Öğrencilerin çoğunluğu oyunlaştırmanın

anlık ders içi odaklanmadan ziyade uzun vadede bilgi kalıcılığı için daha faydalı olacağını düşünmektedir.

Sonuç olarak, bu araştırma, oyunlaştırmanın öğrencilerin motivasyonu, öğrenme süreci ve akademik başarısı üzerindeki etkilerini incelemektedir. Bu çalışma kapsamında öğrencilerin öğrenme seviyelerini artırmak için hatırlama ve odaklanma yeteneklerini geliştirmelerinin önemli olduğu öne sürülmektedir. Ayrıca, derse eğlenceli aktivitelerin dahil edilmesi, öğrencilerin motivasyon seviyesinin yükselmesine yardımcı olmaktadır. Çalışmada, oyunlaştırma deneyiminin akademik başarıyı artırıp artırmadığı, öğrencilerin oyunlaştırılmış kısa sınavlara katılım düzeyi ve başarı oranı ile final sınav sonuçları karşılaştırılarak değerlendirilmiştir. Beklentinin aksine, oyunlaştırma deneyimine katılım sıklığı ile final sınav performansı arasında anlamlı bir ilişki saptanmamıştır. Bu durum, oyun tabanlı bir öğrenci yanıt sisteminin akademik başarıyı doğrudan etkileyebileceğini göstermektedir. Buna rağmen, oyunlaştırma aktiviteleri, özellikle öğrenci sayısının fazla olduğu şehir planlama eğitiminin teorik derslerinde, tamamlayıcı bir araç olarak hizmet edebilir. Bu aktiviteler, kısa sınav oluşturma ve notlandırma süreçlerini kolaylaştırarak ve verimli hale getirerek, kalabalık sınıflarda önemli bir destek sağlayacaktır. Oyunlaştırılmış arazi kullanımı karar alma deneyimi, daha küçük öğrenci gruplarıyla yürütülen uygulama tabanlı dersler için daha uygun gözükmektedir. Ancak, daha büyük öğrenci gruplarıyla yürütülen teorik dersler için oyun tabanlı bir öğrenci yanıt sistemi, içeriğin ve aktivite sıklığının, hem ders gereksinimleri hem de öğrenci öğrenme tercihleriyle uyumlu olacak şekilde tasarlanması halinde daha etkili bir seçenek olabilir.

Bu aşamada, oyun tabanlı öğrenci yanıt sistemleri; anında geri bildirim sağlaması, motivasyonu ve katılımı artırması ve dersler sırasında etkin sınav değerlendirmesine olanak tanınmasıyla faydalı bir yöntem olarak öne çıkmaktadır. Ancak, oyunlaştırmanın akademik başarı üzerinde doğrudan bir etkiye sahip olması için, öğrencilerin kendi öğrenme deneyimlerini kontrol etmelerini sağlayan daha kişiselleştirilmiş ve yenilikçi uygulamalara dönüşmesi gerekmektedir. Bu alandaki gelişmeler, şehir ve bölge planlama eğitiminde oyunlaştırma ile teorik derslerde daha kalıcı öğrenmeyi teşvik edecek standartlar oluşturmak için değerli bulgular sunacaktır.

Çalışmanın belirli bir örneklem ve zaman dilimine sahip olması temel kısıtlarından biridir. Daha kapsamlı sonuçlar elde etmek için zaman serisi verileri gerekmektedir. Gelecekteki araştırmalar için, uzun vadeli, farklı derslerde gerçekleştirilen ve öğretim üyelerinin de yaklaşımlarını içeren çalışmalar önerilmektedir. Ayrıca oyunlaştırılmış kısa sınavların dönem sonu ders değerlendirmelerinde kullanılması, kısa sınavlara katılım oranını artırabilir ve öğretim üyeleri için daha hızlı bir değerlendirme yöntemi sunarak olumlu etkiler yaratabilir. Genel olarak, bu alandaki araştırmaların artması, şehir ve bölge planlama eğitiminde oyunlaştırma yoluyla teorik derslerde daha kalıcı bir öğrenme sağlamak için standart geliştirmeye yönelik değerli bir rehberlik sağlayacaktır.



1. INTRODUCTION: THE NECESSITY OF GAMIFICATION IN PLANNING EDUCATION¹

Education evolves and transforms over time in response to the prevailing conditions of each era. Educational institutions at all levels strive to adapt to emerging needs, and universities are no exception. One significant challenge that has arisen is the difficulties encountered in the classroom environment due to increasing class sizes. A large number of students in a classroom can lead to diminished student interaction, a problem rooted in the structure of traditional education. Traditional university education is instructor-centred, with students passively listening to lectures and little interaction, leaving exams as the primary way to assess student understanding (Banfield & Wilkerson, 2014). A model in which students participate solely by listening during lessons does not provide the teacher with sufficient insight into how well the material is understood, especially in large classes. In addition to this communication gap, other factors also shape the educational framework. One such factor is the evolving needs of the new generation. Modern students find learning more interactive and effective when aided by technology, which enhances knowledge transfer and engagement (Raja & Nagasubramani, 2018). Thus, technology has facilitated the integration of innovative approaches into education to better meet students' needs. These approaches are increasingly necessary to address both the evolving needs of the current generation and the demands of the time. For instance, the COVID-19 pandemic has significantly accelerated the transformation of teaching methodologies. The pandemic compelled universities, along with other educational institutions, to adopt alternative methods in response to unprecedented challenges. The sudden shift to distance education due to the COVID-19 pandemic created a need for new methods to engage students and maintain their interest. These rapid changes, coupled with the demands of the current era, have sparked discussions on innovative approaches in university education.

¹ In this thesis, "Planning Education" is used for "Urban and Regional Planning Education"

One method that has gained attention and been increasingly integrated into education is gamification. With today's technological advancements, incorporating gamification into lessons has become easier. Gamification or game-based learning engages learners fully, enhances knowledge retention, and promotes active participation in the learning process through its experiential and playful nature (Lin et al., 2018). Given these features, to enhance educational effectiveness and learning outcomes gamification applications should be examined across various disciplines. Consequently, this thesis examines the integration of gamification into planning education. Although planning education has previously utilized gamification elements -such as simulations and role-playing, particularly in project-design classes- the full potential of gamification has yet to be realized. The objective of this thesis is to explore how planning education can benefit from gamification.

To achieve this aim, this study poses the following research questions:

- Do students believe that gamification contributes positively to learning and motivation?
- Does using gamification activities lead to increased academic success among students?

1.1 Research Significance

The findings of this thesis will make significant contributions to the ongoing discussion about the impact of gamification on learning in higher education, particularly within the context of planning education in Türkiye. While the importance of gamification in education and its effect on learning have been studied extensively, relatively little research has specifically focused on planning education. Moreover, most studies have solely evaluated students' perspectives on gamification, with limited research investigating its potential for assessing student success. This study aims to address both of these critical aspects by combining their exploration.

Conducting such studies in different universities and geographical locations and sharing the results is crucial for obtaining more reliable and generalizable conclusions. Since studies examining the effects of education and gamification inherently have limited sample areas, any research that contributes to this body of literature is essential for drawing stronger inferences. While many studies, including this one, assume that

gamification has positive effects on learning, it is imperative to support these assumptions with necessary quantitative and qualitative research.

1.2 The Structure of the Study

The overall structure of this thesis (Figure 1.1) consists of five chapters, beginning with this introductory chapter. The second chapter covers the literature background on the main concepts: urban games, gamification, and education. The third chapter explores gamification and its role in education, and the methodology of case studies. The fourth chapter presents the research results. Finally, the fifth chapter provides a concise summary and critique of the findings, analyses the results, and presents concluding remarks.

1. Introduction: The Necessity of Gamification in Planning Education

This chapter outlines the motivation, research questions, significance, and structure of the study.

2. Exploring Gamification and Education

This chapter provides the theoretical background and basic concepts relevant to the study. It begins by discussing existing urban games, followed by an introduction to the gamification concept, along with its application in education and its role in planning education.

3. The Integration of Gamification in Urban Planning Education

This chapter explores the integration of gamification into urban planning education, particularly at the undergraduate level. It explains planning education accreditation, Türkiye's context, and Istanbul Technical University's curriculum. Additionally, it presents case studies demonstrating the implementation of gamification in planning courses. Subsequently, the sample area and data collection methods for the case studies are explained.

4. Results

The results chapter explains the data analysis method and presents the findings obtained from the case studies.

5. Conclusion

The final chapter discusses the study's findings in relation to the research questions. It also addresses the limitations and provides suggestions for future research.

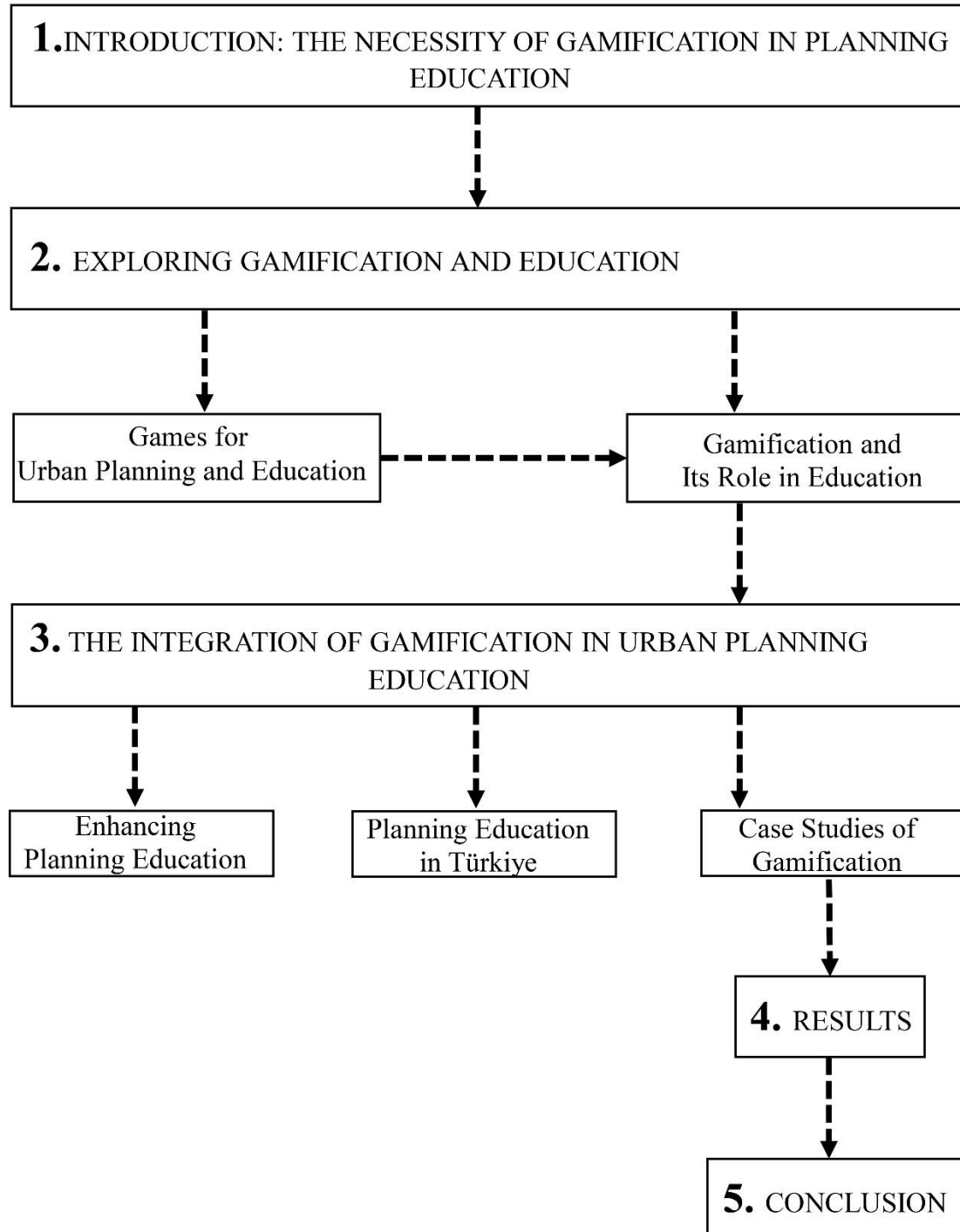


Figure 1.1 : The structure of the study.

2. EXPLORING GAMIFICATION AND EDUCATION

Games and gamification play an important role in various aspects of human life and are especially significant in urban areas, where population density is both high and continuously increasing. To comprehensively examine the relationship between games, gamification, and urban planning, it is crucial to establish a clear understanding of the fundamental concepts. Thus, this chapter offers an overview of games and gamification, beginning with their definitions and a review of how they are addressed in the existing literature. The subsequent section focuses on games related to urban issues, examining existing urban games and their defining characteristics.

2.1 Games for Urban Planning and Education

This section begins by providing a general definition of games, followed by an exploration of their purposes and applications within the discipline of urban planning. It then presents a database grounded in existing literature and studies on urban games.

2.1.1 Defining games

Before delving into the definition of games, it is essential to understand the concept of "play." While the literature does not draw clear distinctions between games and "play," these concepts exhibit slight differences.

According to Huizinga (1949), the features of "play" are defined as follows:

Summing up the formal characteristics of play we might call it a free activity standing quite consciously outside "ordinary" life as being "not serious", but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings, which tend to surround themselves with secrecy and to stress their difference from the common world by disguise or other means (p. 13).

Additionally, Caillois (2001) defines “play” as freedom, separateness, uncertainty, lack of productivity, adherence to rules, and an element of make-believe. Both of these definitions help in comprehending “play”’s broad scope and grasping the underlying concepts of “game”.

In the literature, while common usages often lead to the perception that "game" and "play" are interchangeable, some authors argue that there is a slight difference between the two concepts. Games are seen as a formal type of play (Zimmerman, 2004). Zimmerman (2004) provides the following definition: “A game is a voluntary interactive activity, in which one or more players follow rules that constrain their behaviour, enacting an artificial conflict that ends in a quantifiable outcome” (p. 160). According to the two definitions provided above, one can infer that similar to play, a game is a voluntary activity that adheres to certain rules and a framework. However, it is ultimately a more structured and formal activity, with specific elements like generating quantitative outputs. Moreover, Barron (2013) defines a game as involving several players, each with some strategies, leading to a quantifiable outcome that determines winners and losers. Players execute their strategy in a game, and their success determines the game’s outcome. While “play” is acknowledged to have specific constraints related to time, space, and rules, games tend to have more defined rules and clear consequences.

Contrary to arguments that assert a distinction between “game” and “play”, Csikszentmihalyi and Bennett do not make a clear differentiation between the two. Instead, they utilise terms like “play experience” or “a play form that is institutionalised” to describe the features of games. A game should involve establishing a board or a playing field and limiting choices for players by setting rules (Csikszentmihalyi & Bennett, 1971).

As previously mentioned, the essence of a game is rooted in play. Consequently, several characteristics delineated in defining play are also applicable to games. In this context, the leading game elements are as follows (Zimmerman, 2004):

- a. Voluntary
- b. Interactive
- c. Behaviour-Constraining Rules
- d. Artificiality
- e. Conflict

f. Quantifiable outcome

Having elucidated the fundamental game elements, it is imperative to explain basic game types. Therefore, it is necessary to examine basic game types as categorised by Csikszentmihalyi and Bennett (1971):

1. Games of chance: while contemporary games of chance associations often revolve around monetary pursuits, historically, their origins can be traced back to religious rituals (generally played with dice).
2. Games of strategy: these are games that require the use of abstract intellectual abilities. An exemplary instance of such a game is chess.
3. Games of physical skill: Throughout history, games that initially relied on physical abilities and were used against natural environmental challenges have evolved into diverse disciplines, including football, baseball, basketball, and the Olympic Games.

As elucidated above, a contemporary concept emerging within strategy games is that of serious games. The term “serious” denotes topics of significant interest and importance, often involving complex questions with important potential outcomes (Abt, 1987). Given the intricate nature of significant contemporary issues, it can be argued that the development of serious games has become essential. Serious games have extensive applications in diverse fields such as education, planning, analysis, industrial and governmental training, and evaluation (Abt, 1987). Across these various domains, the critical emphasis lies in human-centric perspectives and the discerning decisions individuals must navigate. Indeed, across numerous sectors, individuals regularly encounter intricate scenarios necessitating resolution. When discussing human-centric aspects, conducting experiments and examining the results of the decisions made in a laboratory environment is impractical. Hence, serious games have emerged as a pivotal tool in addressing these challenges. Serious games provide a safe and dynamic environment for exploring significant intellectual and social issues, allowing individuals to engage in role-playing experiences that serve as valuable preparation for future societal roles (Abt, 1987).

The features of games offer valuable applications for advancing urban development and planning practices. Games can simulate specific planning processes in an engaging manner, allowing players to assume various roles and act within the game’s rules, thereby promoting greater participation and interaction (Reinart & Poplin, 2014). Games can serve multiple

functions within the planning practice field. They can enhance decision-making by facilitating stakeholder communication and data collection from citizens, while also supporting education and professional training for urban planners through various game genres and technologies (Tóth, 2015). The relevant game categories, according to Tóth (2015), are:

- Raising awareness
- Encouraging citizen engagement
- Facilitating communication among stakeholders
- Collecting data from citizens
- Education

These games, utilized for various purposes within planning practice, offer numerous benefits throughout the process. The primary goal of adopting a gaming approach to planning is to simplify the process for citizens by clarifying its stages, stakeholders' roles, and implicated factors, while also facilitating knowledge sharing, idea generation, and testing of innovative solutions among stakeholders (Angelidou & Psaltoglou, 2019); this is particularly relevant in urban areas, where social issues and complexity are experienced most intensely.

2.1.2 Games and urban planning: A database for existing urban games

While conducting research on urban games, the first step was to review the existing literature to ascertain the specific topics that serious games in the urban planning discipline address. Electronic journal databases (e.g., Scopus, Google Scholar) were searched using the keywords “gaming” and “urban planning”. Among the studies found, papers featuring specific urban game examples were selected. Games for which detailed information could not be located were excluded. Subsequently, nine papers were selected for further in-depth reading (Appendix A). In total, 24 urban games were identified from these nine papers.

As the number of games found in the existing literature was insufficient for evaluation, the research on urban games was expanded by accessing a website called “Games 4 Sustainability” (Games4Sustainability, n.d.). Games that solely prioritise entertainment value without addressing urban issues are excluded from this study. This website relates urban games to sustainability and sustainable development goals (SDGs). In this thesis since the most relevant SDG for urban planning is Goal 11: “Sustainable Cities and Communities”, games focusing on

this goal are evaluated within the context of planning. According to the United Nations, this goal aims to “Make cities and human settlements inclusive, safe, resilient and sustainable.” Given the ongoing increase in urban population, this goal underscores the critical importance of urban areas. While higher population densities pose challenges for cities, they also represent opportunities for innovative solutions. Housing, transportation, and pollution are among the crucial issues that cities must address. Moreover, the recent global pandemic has profoundly impacted urban areas, highlighting the importance of Goal 11 even further. Therefore, the games obtained from this website provide valuable data for compiling existing urban games.

A total of 173 urban games were categorized in 2020 (Appendix B). As previously mentioned, 24 urban games were initially sourced from the literature. It is worth reiterating that these games aim to enhance participation, support decision-making processes, and contribute to planning education. During this phase, the games were categorised based on the available information, including their country of origin, whether they were individual or group-based (i.e., the number of players), target group, their purposes (i.e., benefit to the target group). These four criteria served as the primary means of classification at this stage. To expand the dataset, the website Games4Sustainability was utilized, adding 149 games to the study. Since this website primarily features serious games, no major exclusions were made. However, games lacking sufficient detailed information were excluded from the study. These categories will help to better understand the origins of the games and the specific objectives they aim to achieve.

This section will begin with a presentation of the findings, followed by a discussion of the results. Before analysing the games based on their categorical features, the primary themes they encompass are illustrated in the word cloud below (Figure 2.1), which reflects their prevalence. The games address various topics relevant to urban areas, emphasising themes including disaster management, urban planning, politics and economics, climate, and water-related issues. Disaster management involves a systematic approach aimed at mitigating long-term risks to human life and property resulting from disasters (Greve, 2016). When evaluating disasters, which are among the most critical issues affecting cities, natural disasters can be categorised into six distinct classes. These include geophysical like earthquakes, hydrological such as floods, meteorological like storms, biological such as pandemics, and extraterrestrial events, including space weather (Integrated Research on Disaster Risk, 2014). These disasters are increasingly intensified by human activities. In this context, it is essential to address the role of

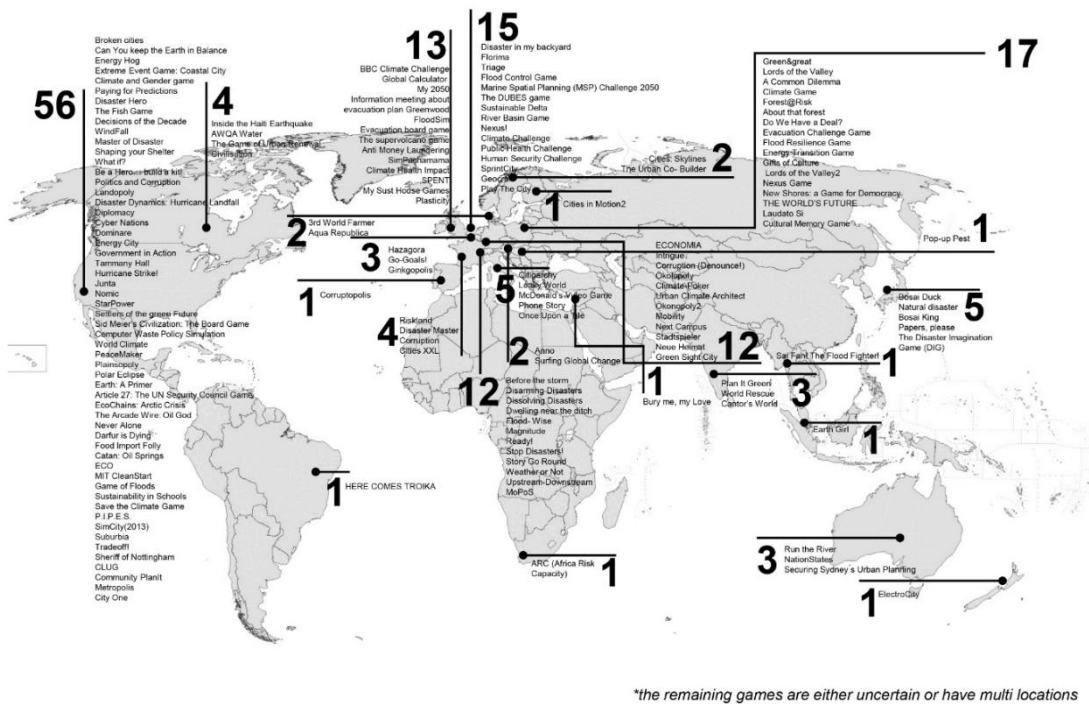


Figure 2.2 : Urban games categorised by location.

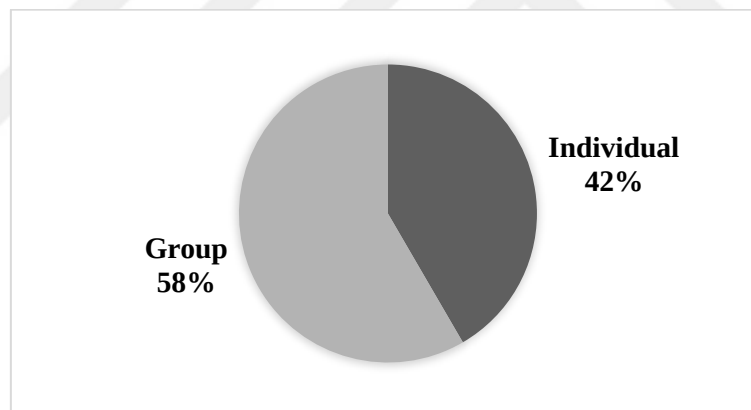


Figure 2.3 : Urban games categorised by the number of players.

Thirdly, games are classified into six groups based on their target groups. The target groups include:

- A (Children, Youth, Local Communities)
- B (Public Administration, Policy Makers, Law Enforcement Service)
- C (Business People, Financial Institutions, Insurers)
- D (Non-Governmental Organizations, Aid Workers)

- E (Farmers, Journalists, Educators, Sustainability Professionals)
- F (Everyone)

The games exhibit 29 combinations of target groups, including A, B, A+B+D, and A+B+C+D. However, upon separate analysis, Group A's predominant involvement was observed in most games (80%). This is followed by Group B, which constitutes 52%. Further analysis of combinations yielded several results (Figure 2.4). Firstly, the majority (17%) of games target only Group A, followed by games focusing solely on Group F (13%). Thirdly, the combination of Group A and F comprises 11% of the games. The fourth group (8%) includes games targeting Groups A, B, C, and D collectively. Finally, 6% of the games are designed for Groups A, B, and D. Moreover, there are 24 distinct target group combinations, each with a share of less than 5%.

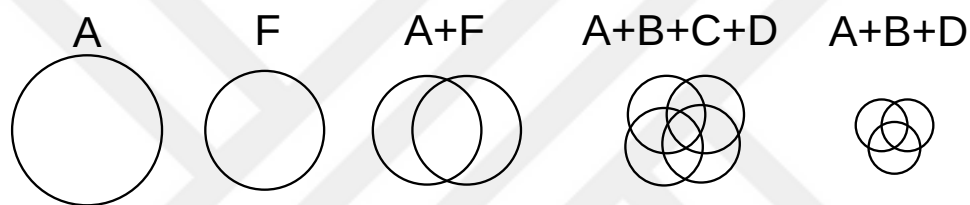


Figure 2.4 : Urban games categorised by target group combinations.

Across the target groups mentioned above, games aim to provide different benefits. These benefits were categorized into three groups: (1) supporting decision-making, (2) enhancing student learning, and (3) enhancing the learning of multiple stakeholders (e.g. the public, Non-Governmental Organizations, policymakers). With 56%, “enhancing the learning of multiple stakeholders” constitutes the largest share. In contrast, only 9% of the games prioritise “enhancing student learning” as a benefit.

The findings related to the internal characteristics of the games were assessed according to the main subjects, player count, target groups, and the benefits they offer to these target groups. To begin, the main subjects addressed by urban games will be discussed. Notably, games focus on disasters such as floods, earthquakes, and volcanoes. However, there appears to be a lack of games specifically addressing pandemics, necessitating widespread measures affecting the global population. Secondly, an examination is conducted to determine whether urban games are designed for individual or group play. Given societal shifts emphasising individualism, one might anticipate a prevalence of individual games. However, contrary to this expectation,

group-oriented games are more prevalent. This suggests that despite the growing emphasis on individuality, collaboration among various stakeholders remains essential for fostering robust social interactions. Thirdly, the primary target groups for urban games include children, youth, local communities (A), and everyone (F). Urban games are positioned to encourage citizen participation.

Nevertheless, the current landscape of urban games for facilitating professional urban planning and decision-making processes appears underdeveloped. Lastly, a majority of the games aim to enhance learning outcomes, yet only a small fraction (9%) specifically targets student learning. Despite the longstanding literature advocating for the use of games in planning education, this aspect has not received significant attention over time.

In conclusion, the following results can be drawn:

- There is an emerging trend of utilising games in urban planning practices, particularly for engaging multiple stakeholders.
- Existing games serve as a powerful tool for promoting public participation, a critical element in the planning process.
- The limited number of games used in decision-making processes and their focus on the general public suggest that the use of games in professional contexts is not yet widespread. As a result, measuring and evaluating their effectiveness for urban planning in this area remains challenging. Moreover, urban games should be more widely utilised to enhance coordination among various stakeholders.
- The finding that there are insufficient games designed for educational purposes in schools highlights a gap in urban planning education, suggesting the need for further development in this area.

The urban games database developed within the scope of this thesis is rich in games aimed at raising awareness and fostering lifelong learning for all age groups. However, it reveals a notable gap in applications specifically designed for formal education in schools. To fill this gap, it is important to explore the gamification concept, which integrates game-like elements, within the educational context. The following section will explore the concept of gamification in detail.

2.2 Gamification and Its Role in Education

This section starts by offering a general definition of gamification, followed by a broad examination of its role in education. It then delves into its specific relevance within planning education.

2.2.1 Defining gamification

After providing definitions for "play" and "game," the next step is to elaborate on the concept of gamification. Gamification is defined as “the use of game design elements in non-game contexts” (Deterding et al., 2011, p.10). This definition originates from a paper considered to be the primary source for defining gamification (Vanolo, 2018). It is essential to differentiate gamification from games, as the central focus of gamification is not games themselves, but rather the incorporation of game elements such as badges, leader boards, and levels (Bolat & Taş, 2022). Gamification is not directly defined as a game; it only contains some game features. To better understand gamification, it is essential to explore its components. Cugelman (2013) identified seven main elements of gamification as follows:

1. Goal setting
2. Capacity to overcome challenges
3. Providing feedback on performance
4. Reinforcement
5. Comparing progress
6. Social connectivity
7. Fun and playfulness

These elements play a crucial role in creating engaging and motivating experiences for individuals interacting with gamified systems. By incorporating these components, gamification seeks to enhance user engagement, improve performance, and foster a sense of enjoyment and satisfaction in various non-game contexts. In the contemporary world, where the value placed on the individual is constantly rising and given significant importance,

enhancing individual motivation has become a pivotal focus across numerous sectors and domains.

The term “gamification,” originating from the digital media industry, is generating public debate alongside apps ranging from news and entertainment media, productivity, health, finance, sustainability, and education (Deterding et al., 2011). This growing interest in gamification is also reflected in academic research. A comprehensive search using the keyword "Gamification" on Scopus revealed a continuous and significant increase in the number of articles over the years, peaking in 2022 (Figure 2.5). In addition to the quantity of articles, examining the subject areas of these publications is crucial.

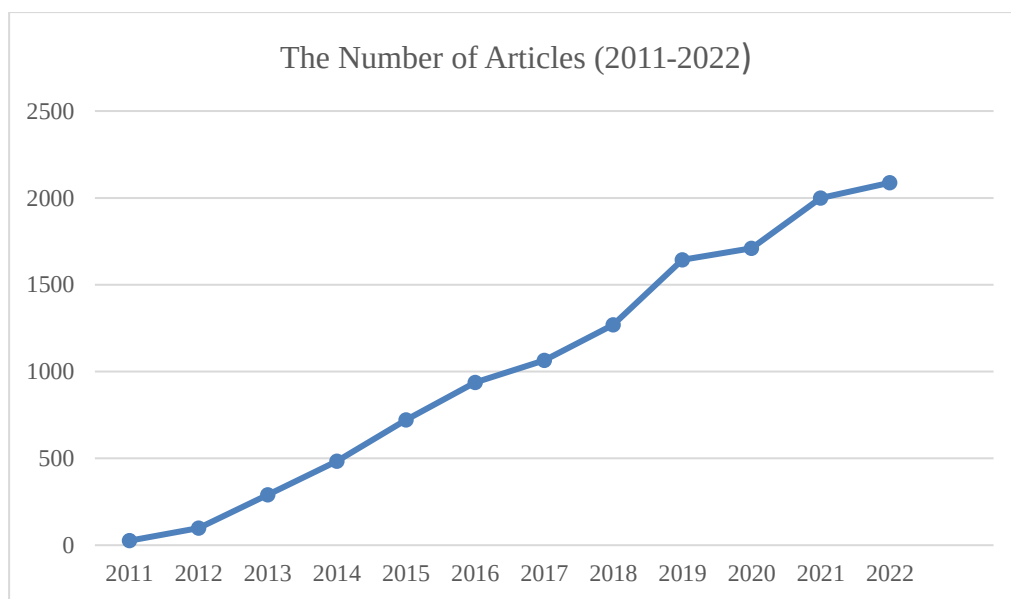


Figure 2.5 : Scopus search results.

Based on Figure 2.6, the top three subject areas for gamification research are computer science, social sciences, and mathematics. It is worth noting that while the subject areas are predominantly focused on science-related fields, the number of articles in social sciences, despite ranking second, is comparatively lower overall.

When the search was restricted to articles categorized under the social sciences, it was observed that 51 out of the 160 keywords used were related to education, indicating a robust association between gamification and education in the existing literature. We classified these keywords related to education into four categories: "education," "student," "learn," and "teach" (Table 2.1).

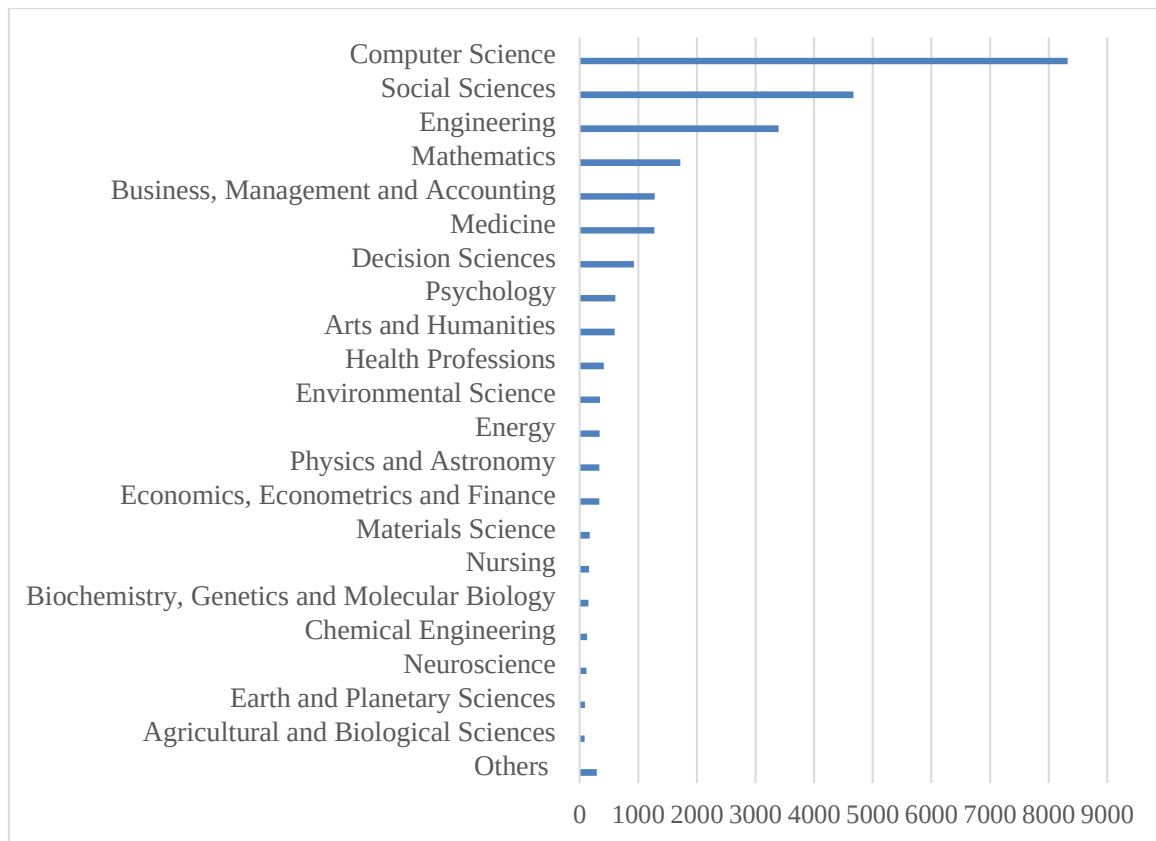


Figure 2.6 : The number of articles by subject area.

Table 2.1 : Keywords in four categories.

EDUCATION	STUDENT	LEARN	TEACH
❖ Education	❖ Students	❖ E-learning	❖ Teaching
❖ Engineering Education	❖ Student Engagement	❖ Game-based Learning	❖ Teaching and Learning
❖ Higher Education	❖ Student	❖ Learning Systems	❖ Teachers'
❖ Education Computing	❖ Student Motivation	❖ Learning	
❖ Curricula	❖ University Students	❖ Active Learning	
❖ Educational Game	❖ Nursing Student	❖ Online Learning	
❖ Educational Technology	❖ Undergraduate Students	❖ Learning Environments	
❖ High Educations	❖ High School Students	❖ Learning Experiences	
❖ Medical Education		❖ Mobile Learning	
❖ Educational Innovation		❖ Blended Learning	
❖ Educational Games		❖ Learning Process	
❖ Distance Education		❖ Learning Outcome	
❖ Curriculum		❖ Collaborative Learning	
❖ Primary Education		❖ Learning Activity	
❖ Gamification In Education		❖ Problem Based Learning	
❖ Physical Education		❖ Learning Performance	
❖ Nursing Education		❖ Machine Learning	
		❖ Language Learning	
		❖ Game Based Learning	
		❖ Gamified Learning	
		❖ Learning Motivation	
		❖ Learning Analytics	
		❖ Learning Management System	

The subsequent section of this thesis will provide an in-depth examination of the relationship between gamification and education.

2.2.2 Gamification and education

One of the fundamental components of education is learning, which serves as a crucial requirement for students. Learning is not a unilateral action, which is the responsibility of only the student, instead, it is a dynamic process in which teachers play a critical role. Unfortunately, the educational landscape often unfolds unilaterally, where teachers merely transfer information, and students do not actively engage. Traditional learning methods are viewed as not student-oriented, and educators use them less (Raju et al., 2021).

In contrast, contemporary discussions revolve around student-centred approaches and the learning process. McCarthy (2010) explains these diverse learning approaches under four titles:

1. Personality: an approach that incorporates personality types and character
2. Information processing: an approach that examines how students assimilate new information
3. Social interaction: an approach that focuses on how students behave in the classroom
4. Instructional preferences: an approach that focuses on teaching methods and learning environment preferences

These new student-centred learning approaches emphasize the importance of recognizing each student's individuality, regardless of class size, and addressing their diverse needs. Moreover, they highlight the need to carefully manage evolving conditions and changing student demands throughout the educational process.

Recent views on students' technology usage preferences and the effects of technology on learning have revealed that the use of technology and tools increases learning (Raja & Nagasubramani, 2018). As a result, the changing requirements of the new generations have led to the emergence of new teaching techniques and the transformation of education (Anak Yunus & Hua, 2021). It should be kept in mind that today's students are a group that loves to use technology; therefore, with the changing definitions of students in the new century, there is no doubt that they will prefer technology-supported learning (Sani-Bozkurt, 2021). Education approaches that harness the opportunities and advancements provided by technology will aptly cater to students' expectations and ensure a fulfilling learning experience.

An important element in the teaching-learning practice is motivation (López Carrillo et al., 2019). An activity is considered intrinsically motivated when it is performed for its inherent satisfaction, whereas extrinsically motivated activities are driven by external rewards such as money, food, or social recognition (Malone, 1980). The fundamental issue with the traditional education system is its tendency to promote extrinsic motivation (Dichev et al., 2014). A key criticism is that traditional education is teacher-centred and fails to foster sufficient intrinsic motivation in students. In this regard, as noted earlier, the advantages provided by technological innovations are instrumental in overcoming this limitation. Thanks to technological improvements, information sharing in electronic environments has become achievable, and thus the educational framework is able to go beyond classrooms that are traditional (Bolat & Taş, 2022). Traditional methods often involve general and standardized approaches, whereas, with the help of ICT, more personalized and motivation-enhancing activities can be produced (Carrión Candel & Colmenero, 2022). Additionally, teachers can complete their exercises in a more productive and effective way (Zuhriyah & Pratolo, 2020).

With the increasing pressure of technology in classrooms, educators are required to think about all the opportunities and benefits they could obtain from various resources they could use in their lessons (Arif et al., 2019). As a result, the teacher is responsible for promoting a learning process with higher participation whilst influencing the intrinsic motivation of students (Bíró, 2014). Necessarily, students cannot have a successful learning experience if their motivation is low, and it may be a difficult effort for educators to find appropriate tools or techniques which are appealing and can develop learning (López-Martínez et al., 2022). Hence, the education system necessitates continuous innovation to effectively address the complexities of enhancing students' motivation and participation.

Maintaining the interest and engagement of students becomes a challenge for educators (Raju et al., 2021). To address this, participatory methodologies in which students get an active learning approach are required by recent trends in education (López-Martínez et al., 2022). Novel educational systems are constantly being developed and implemented to give students greater autonomy over their learning experience and pace. As a result, students take on a more active role in shaping and controlling their learning trajectory. In this context, gamification emerges as an innovative approach within contemporary education systems.

Bíró (2014) suggests that gamification should be considered as a new learning theory alongside previous learning approaches (Figure 2.7). In the 21st century, in order to build more robust experiences in learning and teaching, it is critical to adopt gamification in education (Anak Yunus, 2021).

Components of learning	Behaviourist learning theory	Cognitivist learning theory	Constructivist learning theory	Connectivist learning theory	Gamification
The learner	instinct-driven individual	conscious individual	conscious individual	conscious individual	conscious individual
Motivation	extrinsic	intrinsic	intrinsic	extrinsic	intrinsic
Knowledge	external	internal	internal	external	internal/external
The learning process	environment-driven	ad hoc personal processing	systematic personal processing	ad hoc network processing	systematic personal processing
The teaching focuses on	the environment and the behaviour of learners	the cognitive process of learners	the cognitive process of learners with a special view to prior knowledge	the dynamics of networks with a special view to knowledge-allocation	the environment and the cognitive process of learners
Engagement	individual	individual	individual	network-based	group-based
The learning path is guided by the	teacher	teacher	teacher	learner (discover different paths), and the teacher (choose one path)	teacher (establish different paths), and the learner (choose one path)
The attitude of teacher	active	active	reactive	reactive	proactive
The attitude of learner	reactive	reactive	active	proactive	proactive
Feedback	individual	individual	individual	network-based	group-based

Figure 2.7 : Comparison of the learning theories (Bíró, 2014).

There are various types of gamification practices in education. Based on a literature review on gamification in education, the most commonly used practices include visible status, which involves recognition through badges, points, and leaderboards; social engagement, which promotes individual and team competitions that encourage collaboration among students; freedom of choice, allowing students to choose their own challenge, such as writing an essay, creating a video or completing a group project; freedom to fail, which provides opportunities for students to revise and resubmit assignments and retake quizzes; and feedback, offering prompt student feedbacks and rewards to students (Dicheva et al., 2015). Additionally, prizes & rewards and progress bars are also recognised as effective tools for motivating students (Nah et al., 2014). While these practices form the foundation for student engagement, gamification have shifted the learning process, positioning students as active participants in their educational journeys.

Recently, gamification has developed in education and changed the perspective of the inactive learning process, transforming students into active main figures to accomplish certain goals (López Carrillo et al., 2019). From an education perspective, gamification is defined as "the concept of applying game mechanics to engage and motivate students in learning" (Mohamad et al., 2018, p.22). Another definition is made by Saleh and Suleiman as "adding game elements or gameplay elements in education" (2019, p.030005-1). According to gamification, one of the most crucial actors of the learning process is the learner because learners should choose the learning method, and there is a competition to earn more badges (or points) depending on their intrinsic or extrinsic motivation (Bíró, 2014). Since the primary focus is on the learning process, the ultimate goal of gamification is to activate intrinsic motivation and maintain it throughout the learning experience (Sezgin et al., 2018). Intrinsically motivated students attend class driven by a genuine desire to learn, engaging in learning activities for their inherent value (Dichev et al., 2014). In alignment with this, gamification integrates games to foster active participation, supporting student engagement with course concepts (Creel et al., 2021). An essential goal of gamified activities is to enhance students' motivation. Gamified and innovational interferences should aim to alter the students' academic performances and motivational atmosphere to maximize their benefit and create increased engagement for students who are frequently more interested in getting successful grades instead of learning (López-Martínez et al., 2022). With the help of gamification, motivation levels rise, resulting in higher student participation and creating a gamified learning environment. Gamified learning means the inclusion of gamified design features in the learning environment that results in higher student engagement (Wang et al., 2021). Using gamification in the learning environment appears to be one of the most important additional tools of the learning experience, and this emerges as a result of educational research that highlights games as important components in formal and informal education (Arif et al., 2019).

Environments that are game-based provide important benefits to instructors as well as learners (Bolat & Taş, 2022). With the help of developing technology, educators find the chance to use game features in a non-game framework and advance lesson curriculum (Raju et al., 2021). As a result, a more advanced teaching-learning experience is facilitated by moving beyond traditional environments and methods. However, it is important to note that gamification does not entail abandoning old methods entirely. Tóth et al. (2019) suggest that gamification can be

adapted to education at different levels. The levels vary from a basic level in which the usual teaching method is kept but, in order to increase student activity, simply a gamified application is practiced, to a more complex level that considers various learner types and styles (Tóth et al., 2019). In other words, while the teacher continues with the traditional education method, gamification can serve as an add-on or reinforcement support. For example, gamification can be applied with the aims of assessment and evaluation, helping teachers understand students' learning situations instantly and allowing them to take feedback immediately (Bolat & Taş, 2022). The teacher can instantly measure and evaluate how much the student has learned. Gamified learning environments that meet the needs of teachers and students from the simplest to the most complex level have recently spread (Tóth et al., 2019). Evidence is growing that gamification makes the learning experience more engaging, so gamification applications in teaching are increasing (Carnero, 2021). The reason why gamification is so popular is directly related to transforming the boring aspect of education into fun by offering a more entertaining environment and content to students who are bored with the traditional approach (Sani-Bozkurt, 2021). By implementing gamification methods, teachers can provide a teaching experience that captivates students' attention.

Gamification is increasingly being integrated into various levels of education, each with distinct approaches. Its application across different educational stages is outlined as follows:

- **Preschool Education:** Uses tools like storyboards, puzzles, role-playing, and storytelling that incorporate visual and auditory elements to enhance learning experiences (Christopoulos & Mystakidis, 2023).
- **Primary Education:** Focuses on engaging students through interactive activities designed to teach topics such as arithmetic operations and grammar rules (Christopoulos & Mystakidis, 2023).
- **Secondary Education:** Promotes critical thinking and supports individualized learning experiences, encouraging students to actively engage in their own learning processes (Christopoulos & Mystakidis, 2023).
- **Higher Education:** Simulates real-world challenges through practical experiences, using leaderboards to foster competitiveness and a sense of achievement while encouraging

collaboration and mutual learning through teamwork-oriented assignments (Christopoulos & Mystakidis, 2023).

The growing adoption of gamification across all educational levels highlights its increasing relevance, with its integration in higher education driven by the need to enhance motivation and engagement. This growing emphasis can be linked to the new learning framework which has shifted towards active and student-centred learning (Martínez-Jiménez et al., 2021). There is increasing attention on comprehending how students' learning is affected by their motivation and involvement, and higher education institutions use learning technologies to increase motivation and involvement (Licorish et al., 2018). In addition, according to the Horizon Report 2017, higher education institutions should have strong strategies that integrate approaches such as blended, mobile, online learning, and monitoring how these models enrich learning is an important step (Becker et al., 2017). In light of this new understanding, which prioritizes student motivation and participation, and the guiding approaches that aim to enrich the education system, universities have increasingly recognized the significance of using games and gamification in recent years.

The gamification concept is one approach to focus on higher education's existing disputes in designing the experience and process of learning (Pikos & Olejniczak, 2016). Over the last decade, this innovative approach has been applied in education to increase student engagement and create a more attractive learning process; however, gamification in higher education does not directly affect knowledge and skills; it increases the motivation of students and enables them to have more advanced knowledge and skills (Martínez-Jiménez et al., 2021).

One approach rooted in gamification to enhance student motivation and participation, is the game-based student response system (GSRS). Before delving into this concept, it is important to explain the student response system (SRS), which has a long-standing history in education. Kaleta and Joosten (2007, p.2) define SRS as "a wireless response system that provides faculty the means to actively engage students in lecture classes." These systems grant students the ability to instantly answer closed-ended questions (mostly multiple choice) with an electronic device (Hall et al., 2005). In this system, which dates back to the 1960s (Hall et al., 2005), the students were expected to answer the question asked by the teacher with the devices called "clickers." The SRS has two uses: one is to encourage the discussion environment in the classroom, and the other is to measure how well the students comprehend the elements taught

in the lesson (Kaleta & Joosten, 2007). In other words, the main goal of SRS is to enable the teacher to adjust the speed and rhythm of the lesson instantly according to the students' answers (Judson & Sawada, 2002). However, providing this feedback under normal conditions may require more work for teachers. Especially when students do not ask many questions during the lesson, the teacher cannot comprehend how much the subject is understood (Hall et al., 2005). Thanks to SRS, teachers can easily communicate with the students through instant assessments, creating a more seamless learning environment. From the 1960s to the present, students have consistently supported using SRS and stated that these systems aid them in comprehending better (Judson & Sawada, 2002). In addition to students, a similar result was obtained in the study conducted with faculty members. According to this study, faculty members and students stated that SRS has a facilitating effect on learning, increasing student participation and it is thought that SRS can be included in lessons as a new active learning strategy that will encourage students' participation (Kaleta & Joosten, 2007). Despite this positive approach, there was no correlation between the use of SRS and academic achievement, according to studies conducted in the 1960s and 1970s (Judson & Sawada, 2002). In conclusion, while the SRS proves to be a facilitating and stimulating tool for the learning process, its impact on grade evaluation is limited.

In recent times, SRS has undergone revitalization and enhancement with novel add-ons, particularly with the inclusion of gamification elements. This integration has led to the emergence of "Game-based student response systems (GSRS)," in the literature, offering a new dimension to traditional SRS. GSRS increases student motivation more than standard SRS (Wang, 2015). Several applications have been developed to engage students and foster their participation and motivation. Prominent examples include Kahoot!, Socrative, Quizizz, and Quizalize. These online platforms present great activity alternatives which develop the participation and motivation of students (Raju et al., 2021). Quizizz is a technological design which is a game platform for more than one-player classroom activities (Zuhriyah & Pratolo, 2020). Another platform which is Kahoot (a Quizizz-like platform) can be used by teachers to review the subject with question solutions before the exam or a short application containing the topics covered in the previous lessons before starting each lesson (Creel et al., 2021). These GSRS tools represent a perfect combination of gamification and SRS, offering teachers valuable opportunities to enhance students' engagement and create an interactive educational

environment. Díez-Pascual and Díaz (2020) list some benefits of this approach, including: (1) students think this is a fun activity, (2) it enables them to actively participate in the learning process, (3) students share this experience with each other because everyone responds to the questions simultaneously, (4) teachers can instantly and fairly get information how well the students understand the lessons.

In summary, the integration of gamification into education offers a promising approach to enhancing student engagement, motivation, and learning outcomes, and holds significant potential for enriching planning education as well.

2.2.3 Gamification and planning education

The role and significance of games and gamification in planning education have been extensively discussed in academic discourse. This debate centers around critiquing the overreliance on traditional methodologies in planning education. Conventional education typically involves a blend of theoretical instruction and hands-on projects for both architecture and planning disciplines (Li et al., 2022). The current educational system rests upon robust foundations and has demonstrated commendable outcomes thus far. Nonetheless, its efficiency can be enhanced through valuable contributions to existing processes. As an additional component to conventional courses, games can provide significant value (Dodig & Groat, 2019). The value brought by games and gamification has been duly recognized and incorporated into planning education, especially in the realms of experiential learning, motivation, and memory.

With an emphasis on experiential learning, digital games and board games have emerged as practical tools. In some case-study investigations, digital games like *Cities: Skylines* and *SimCity* have been used as illustrative examples (Robinson et al., 2021; Li et al., 2022; Khan & Zhao, 2021; Minnery & Searle, 2014). Moreover, board games such as *Participology* and *Geopoly* are also utilized in planning education. Each category of games offers distinct advantages and disadvantages. Digital games excel in 3D visualization capabilities, but challenges like cost and computer proficiency may arise (Li et al., 2022). On the other hand, board games may involve associated fees, but teachers and students can incorporate free options with additional efforts and opportunities. Games can facilitate students' comprehension of learning content by merging theoretical concepts with real-world applications, bridging the gap

between two-dimensional and three-dimensional perspectives, and integrating static and dynamic elements (Li et al., 2022). In addition to such experiential learning effects, games elicit favourable psychological stimulation and enhance the learner's concentration and retention (Hartt et al., 2020). As a result, games offer students a real-world experience and impact their motivation and memory skills.

The existing literature on gamification in planning education predominantly concentrates on the use of games in applied courses. However, specific gamification practices tailored for planning education have not been thoroughly explored or identified. More attention must be given to information retention and student motivation, particularly within the context of theoretical courses. Alongside board games and video games, which offer simulation and role-playing experiences in planning practice, the GSRS discussed earlier should be critically evaluated as an alternative approach for theoretical courses.

2.3 Summary

Games and gamification are emerging as novel methods in education. Although the use of games in education dates back to the past years, it has come to the fore again, especially with the increasing number of information and communication opportunities. In particular, the widespread access to the internet makes this possible within the scope of information exchange. With the development of information and communication technologies, both information and entertainment can be added to the lessons without the need for an additional tool (Campillo-Ferrer et al., 2020). However, the mere existence of these opportunities is not a sufficient reason to adopt games in education. Another crucial factor is the evolving structure of education over the years. Instead of a one-sided exchange of information, learners are drawn into more active, experiential learning environments (Kriz & Manahl, 2016). As a result, integrating new teaching methods has become inevitable to cater to the demands of a more comprehensive and detailed curriculum. For several years, educators have recognized that experimental methods and alternative learning environments help students better understand and absorb knowledge (Chow et al., 2011).

Studies have shown that games are effective alternatives that provide students with an educational and entertaining learning environment at the same time (Chow et al., 2011). In addition, using games in the classroom will increase students' motivation to learn (Hanus &

Fox, 2015). Hence, games and gamification possess the dual advantage of boosting motivation and adaptability to the changing landscape of education. The following chapter explains the research process systematically, encompassing four case studies—three pilot case studies, with the primary case study following. These case studies are designed to examine the impact of gamification activities on students, aiming to analyse their perspectives and assess the influence on their academic success.



3. THE INTEGRATION OF GAMIFICATION IN URBAN PLANNING EDUCATION

This chapter examines the role of gamification in urban planning education, with a focus on its integration at the undergraduate level. In response to the demand for innovative educational methods, the chapter explores how gamified experiences can enhance educational outcomes. It begins with a discussion on the accreditation and adaptability of planning education, followed by an explanation of planning education in Türkiye and the undergraduate curriculum at Istanbul Technical University. The chapter then outlines the methodological structure of the gamification case studies conducted within this thesis, demonstrating how this approach can be integrated into planning courses.

3.1 Enhancing Planning Education: Accreditation and Adaptability

The global rise in population has led to numerous issues and demands, prompting the need for effective problem-solving strategies. In this context, the discipline of planning has emerged as a crucial facilitator in addressing these challenges. As a result, there is an increasing focus on planning education, leading to the establishment of various planning departments worldwide, including Türkiye. While the foundations of planning education are well-established, the evolution of societal requirements necessitates periodic evaluations to ensure that educational programs remain relevant and meet specific standards.

It is widely recognized that each institution maintains unique quality assurance standards, and specific accreditation bodies play a pivotal role in enhancing the quality of education offered. Across the globe, several accreditation institutions are dedicated to planning education. For instance, the Planning Accreditation Board (PAB) in North America and the Royal Town Planning Institute (RTPI) in the United Kingdom are prominent examples of such organizations. In addition to these accreditation bodies, Europe is represented by the Association of European Schools of Planning (AESOP), which represents planning schools across Europe and comprises 150 member

institutions. It facilitates collaboration and communication between schools while guiding discussions on planning education and competencies. Similar to the PAB criteria, AESOP's "core curriculum" outlines specific requirements for planning curricula, focusing on essential knowledge, competencies, and values for planners. It emphasizes that planners should (a) develop knowledge, (b) develop practical competencies, and (c) develop an attitude and responsibility in (1) spatial planning at different scales, (2) spatial interventions with a multi-actor perspective, and (3) continue their professional activities by assuming social responsibilities (AESOP, n.d.). Similarly, in Türkiye, the Association of Planning Schools of Türkiye (TUPOB) conducts research on the advancement of planning education and accreditation. According to PAB's guidelines, the planning education curriculum should incorporate three fundamental elements: necessary knowledge, skills, and values (Planning Accreditation Board, 2022). Frank (2006) extended this framework by adding "practice" as a fourth critical element in planning education. Evaluating the curriculum based on these values can significantly elevate its standard.

Within the planning education curriculum, courses can be categorized into two main types: theoretical and applied courses. The primary purpose of theoretical courses is to impart knowledge of the subject matter. Additionally, they focus on enhancing students' research, writing, and oral communication skills through term papers, oral discussions, and written assessments. On the other hand, applied courses, also known as studio courses, involve the development of projects, which greatly contribute to the acquisition of "skills." The notion of "values" is ingrained in students across all courses. As for "practice," students are expected to undertake internships that expose them to real-world scenarios.

The planning education curriculum is meticulously designed and continuously refined to align with the aforementioned fundamental aspects and dynamic shifts in the global and local landscapes. Its primary objective is to equip students with critical knowledge and skills. However, the methodology employed to deliver this education remains a significant concern within the realm of planning education. In his 2006 article that synthesized previous research on planning education, Frank reported that integrating pedagogical methods and practices from diverse disciplines within planning education yields innovative and successful outcomes. The approaches identified are as follows:

- Workshops/Studios,

- Work-based Learning and Service Learning,
- Role Play and Simulations,
- Multimedia,
- Online/E-Learning,

Implementing the approaches mentioned above within planning education varies across different contexts, as changing circumstances and environmental factors influence the selection of appropriate methods. For instance, the global COVID-19 pandemic compelled educational institutions to transition entirely to online learning. Similarly, the devastating earthquake that struck Türkiye in February 2023 necessitated universities to partially adopt online education. These scenarios underscore the necessity for the education system to remain adaptable to changes and capable of operating under diverse circumstances. It is worth noting that the identified approaches are subject to modifications and changes over time. As such, continuous evaluation and refinement of these methods are vital to ensure their relevance and effectiveness in the ever-changing landscape of planning education.

3.2 Planning Education in Türkiye

Planning education in Türkiye was initially integrated into architectural education. However, the first autonomous department dedicated solely to planning education was established at the Middle East Technical University in 1961, followed by Dokuz Eylül University in 1975 (Gülersoy et al., 2008). While maintaining its relationship with architecture, urban planning began to be recognized as a separate discipline (Gürbüz & Atlar, 2017). Subsequently, the department at Istanbul Technical University (ITU) was established in 1983 (ITU, 2018). Starting in the mid-1980s, the number of urban planning graduates began to rise (Gürbüz & Atlar, 2017). Urban planning education has continued to expand across Türkiye, with programs offered at 36 universities, including 33 public and 3 private institutions (Yükseköğretim Program Atlası, n.d.). Some universities offer programs either in English or Turkish, while Istanbul Technical University provides separate programs in both languages (Yükseköğretim Program Atlası, n.d.).

Following the department's establishment and the graduation of several students, efforts were initiated to obtain accreditation for the program. In 2001, a comprehensive

study was conducted which determined that the PAB criteria were suitable for the program (Gülersoy et al., 2008). Moreover, in 2004, TUPOB was established to coordinate urban planning schools, consistently improve the quality of education and the planning profession, and achieve internationally standardized practices (Gülersoy et al., 2008). An examination of school curriculums revealed differences in lesson hours and subject matter (Gülersoy et al., 2008). TUPOB conducted a study that categorized and compared courses into the following groups: urban planning application projects, urban planning built environment courses, architecture/landscape courses, environmental and engineering courses, social sciences, quantitative studies, electives, and additional courses (Gülersoy et al., 2008). The variation in course ratios was evident, with Gazi University offering a 45% application project ratio compared to Istanbul Technical University's 30% ratio (Gülersoy et al., 2008). Other institutions at the time of the study also exhibited similar variations between these two rates. In addition to course topics and intensities, evaluating the department's curriculum in conjunction with the PAB criteria is necessary.

The PAB criteria encompass three distinct elements: values, knowledge, and skills. Notably, the first criterion is covered across all courses in the curriculum. Additionally, the criterion Frank introduced, "practice," is fulfilled through internships. Therefore, the subsequent section will evaluate the undergraduate program curriculum of ITU based on the remaining two criteria —knowledge and skills.

3.2.1 Istanbul Technical University planning curriculum (undergraduate)

This section focuses on core departmental courses. First, it is essential to examine the changes in ITU's course plans. Until the fall 2011-12 academic year, there were 13 application-based departmental courses totalling 57 credits. During this period, the total program credits were 151, with application-based courses comprising 31% and theoretical courses 38%. Currently, the program's total credits have been reduced from 151 to 130, with 14 application-based courses comprising 54 credits (42%) and 14 theoretical courses comprising 41 credits (31%) (ITU Registrar's Office, n.d.). This shift indicates a reduction in the number of theoretical courses and an increase in the credit weight of application-based courses. Although application-based courses are more credit-intensive, the number of theoretical courses remains equal. Unlike application projects, theoretical courses are taught in larger class sizes rather than

small groups. While application-based courses primarily involve theoretical explanations, specific theoretical courses also include practical components. The tables below (Table 3.1 & Table 3.2) present the courses involved in the 100% English program. A separate program, with 30% of courses in English, also exists, and both programs share identical courses. The key distinction lies in the latter program, where 70% of the course content is delivered in Turkish. Recently, there has been a shift towards offering some theoretical courses in an online format. This transition gained momentum, particularly after the COVID-19 pandemic and the devastating earthquake in February 2023, which mandated the adoption of online courses. Despite the resumption of face-to-face education, some specific theoretical courses have persisted in their online format. The following tables present an overview of the theoretical (Table 3.1) and application-based core departmental courses (Table 3.2) within the planning education curriculum at ITU.

Table 3.1 : Theoretical courses (100%).

Theoretical Courses
❖ Introduction to Urban and Regional Planning& Ethics
❖ Land Use Planning
❖ Housing and Site Planning
❖ Landscape Planning and Design
❖ The City in History
❖ Planning Theory and Techniques
❖ Urban Economics
❖ Quantitative Methods in Planning
❖ Urban Sociology
❖ Urban Law and Management
❖ Regional Science and Planning
❖ Urban Transportation
❖ Urban Design
❖ Heritage Conservation and Planning

Table 3.2 : Application courses.

Application Courses
❖ Projects 1-8 (75 %)
❖ Visual Communication 1&2 (50%)
❖ Basic Design (100%)
❖ Statistics (66 %)
❖ Introduction to Computer Systems in Urban Studies (50 %)
❖ Geographical Information Systems and Planning (33 %)

As the tables above demonstrate, it is essential to provide a certain amount of theoretical knowledge in application-based courses. This emphasis on theoretical

knowledge acquisition aims to equip students with a strong foundational understanding. However, developing and integrating appropriate educational techniques is crucial to ensure that students can effectively engage with the curriculum. The subsequent section of this thesis outlines the methodological structure of the gamification case studies conducted for several of the courses.

3.3 Case Studies of Gamification

This subsection outlines the content and methodological approach of the case studies conducted as part of this thesis. It provides details on the distinct processes, objectives, participants, and data collection methods for the four case studies.

This thesis employs both qualitative and quantitative approaches, encompassing the collection and evaluation of data through questionnaires, quizzes, and final exam results. The primary objective of this thesis is to investigate the potential benefits of incorporating gamification into planning education. To achieve this goal, a two-step methodology was devised. Initially, students participated in a gamified activity; afterward, their perspectives and expectations were collected through a questionnaire. Four case studies were conducted across three different time periods. The three preliminary case studies, conducted before the main case study planned for this thesis, followed the established objective, methodology, participants, and data collection and analysis procedures.

A summary table of the cases is presented below (Table 3.3). Unlike the first three cases, the final main case study incorporates both qualitative and quantitative aspects. This approach allows for a comprehensive evaluation of students' perspectives while also assessing the impact on academic success.

This study explored various applications to determine the most suitable approach for courses of varying content and levels. To ensure effective evaluation and management, the implementation began with courses targeting smaller student groups and was gradually expanded to larger groups. Additionally, the tools used were adapted based on the course content and the number of students. Throughout the case study process, the number of quiz activities gradually increased in preparation for the main study, evolving from a one-time application to a long-term process. Additionally, the number of questionnaire questions was expanded, and open-ended questions were made

mandatory to gather a more comprehensive and detailed response pool. The following section outlines the details of the case studies separately.

Table 3.3 : Overview of the case studies.

Cases	Methodology	Participants	Gamification Activity	Tool	Data Analysis
Land Use Decision-Making Experience	Qualitative	4 students (Undergraduate)	Role-playing	Miro	Descriptive
1st Gamified Quiz Experience	Qualitative	16 students (Graduate)	GSRS	Kahoot!	Descriptive
2nd Gamified Quiz Experience	Qualitative	64 students (Undergraduate)	GSRS	Manually designed by the course instructor	Descriptive
Final Gamified Quiz Experience	Mixed-method (Qualitative+ Quantitative)	46-71 students (Undergraduate)	GSRS	Quizizz	Descriptive and correlation analysis

3.3.1 Land use decision-making gamification experience

This study, was conducted to demonstrate how a game or gamification experience can be integrated into a course and to assess both students' perspectives and the practitioner's observation as a result of this experience.

This case study provided a game experience for undergraduate students, aiming to create a land use decision-making activity that allowed them to play various roles. Given the ongoing distance education requirements, we used "Miro" as the platform. Miro is an online whiteboard designed for collaborative work, providing educators with a digital platform to facilitate group interaction and teamwork (Chan et al., 2024). The game consisted of four stages (Figure 3.1). In the first stage, students proposed a plan from an urban planner's perspective. After this, students reviewed the plan from the perspectives of various stakeholders, such as NGOs, local and central governmental organizations, citizens, and investors. Based on feedback from these diverse actors, the plan was revised. In the second stage, students evaluated the plan from the perspective of an environmental protection NGO and disadvantaged group NGO, deciding to reduce the size of the industrial area. Next, acting as representatives from the local municipality, they reduced the plan area, increased residential density, and grouped industrial and commercial areas along the main transportation route.

Finally, as citizen representatives, students made minor adjustments to reinforcement areas, bringing them closer together.



Figure 3.1 : Land use maps: (a) Plan proposal from an urban planner’s perspective. (b) Plan proposal from the perspective of an environmental protection NGO and a disadvantaged group NGO. (c) Plan proposal from the perspective of the local municipality representatives. (d) Plan proposal from the perspective of citizen representatives.

3.3.2 Gamification experience through a quiz for graduate students

For this case study, a theoretical course in the graduate program was selected, involving a smaller, more focused group of students.

This case study involved a gamification experience for graduate students in the course “Planning Theory and Policy”. The activity was structured as a quiz comprising multiple-choice questions, using questions the students themselves had posed after their presentations. The quiz was conducted on “Kahoot!,” which is an effective gamification tool that educators can use regularly in class or before exams to reinforce learning by reviewing course topics through interactive questions (Creel et al., 2021). 16 students participated in the quiz. Following this second study with graduate

students, it was decided to apply this approach to a course with a larger class size. Consequently, an undergraduate course was selected for the subsequent study.

3.3.3 Gamification experience through a quiz for undergraduate students

Similar to the previous study, a gamification experience was implemented using a quiz. However, in this instance, a course with a larger number of students was selected.

This study implemented a gamification experience for undergraduate students enrolled in the "Planning Theory" course. The gamified experience was structured around a quiz format consisting multiple-choice questions. Notably, students' own questions were utilized for the quiz. In the context of this quiz game, the course instructor meticulously prepared a question chart, allowing students to select questions they wished to answer. The procedural flow of this process is depicted in Figure 3.2.

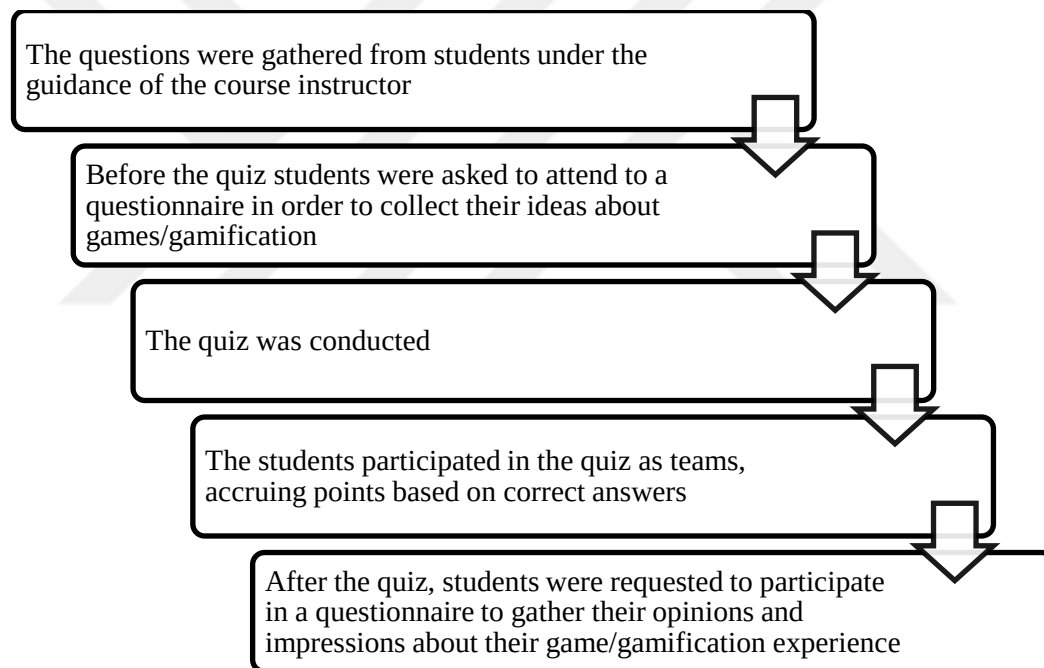


Figure 3.2 : Process of the case study.

Before and following the quiz, a questionnaire was administered to the students to gather their insights regarding their participation in the gamification experience. A total of 64 students participated in the pre-quiz questionnaire, while 38 students participated in the post-quiz questionnaire (Figure 3.3).

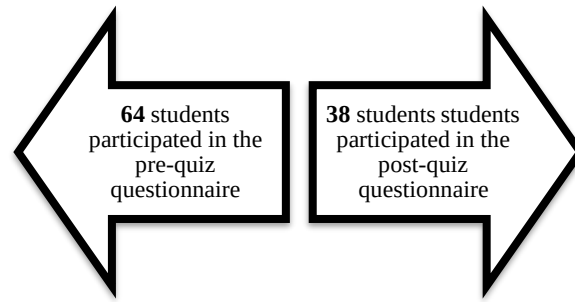


Figure 3.3 : Participation in the questionnaires.

3.3.4 Main case study: Gamification experience through four quizzes for undergraduate students

In this final and main case study, a gamified quiz experience was again implemented. To observe the effects of gamification over time and assess its impact on academic success, a total of four quizzes were conducted, allowing for interventions to enhance effectiveness. The following sections provide a detailed overview of the study participants, data collection methods, and data analysis approaches.

3.3.4.1 Participants & Data collection

The study involved students enrolled in the "Introduction to Urban and Regional Planning & Ethics" course, an integral part of the first-year curriculum offered by the ITU Urban and Regional Planning Department. The content of this course is described as "The conceptual basis of urban and regional planning; concepts of environment, human settlements, and town planning; basic information about human settlements presented in the order of village, town, metropolis, megalopolis, new town and urban functions; definition of urban planning and team work; conceptual; essential principles of ethics; urban planning and professional ethics; sustainable urban development." (ITU, n.d.). As evident from the description, this course is heavily focused on providing essential knowledge to students. When evaluating the course content in terms of knowledge, skills, and values, the most impactful knowledge components include settlement elements, planning and planning process, and the assessment of the situation. While skill components do not exhibit as high an impact as knowledge components, they are closely linked to critical thinking, as well as verbal and written communication skills. Lastly, the course is designed to have the strongest influence on sustainability as a core value.

This case study was conducted during the fall semester of the 2022-2023 academic year. Notably, the study was executed in the context of transitioning from online education, necessitated by the pandemic, to a complete return to face-to-face instruction. Consequently, the administration of quizzes for this case study occurred in the classroom, while the post-quiz questionnaire was conducted online with the participating students (Figure 3.4).

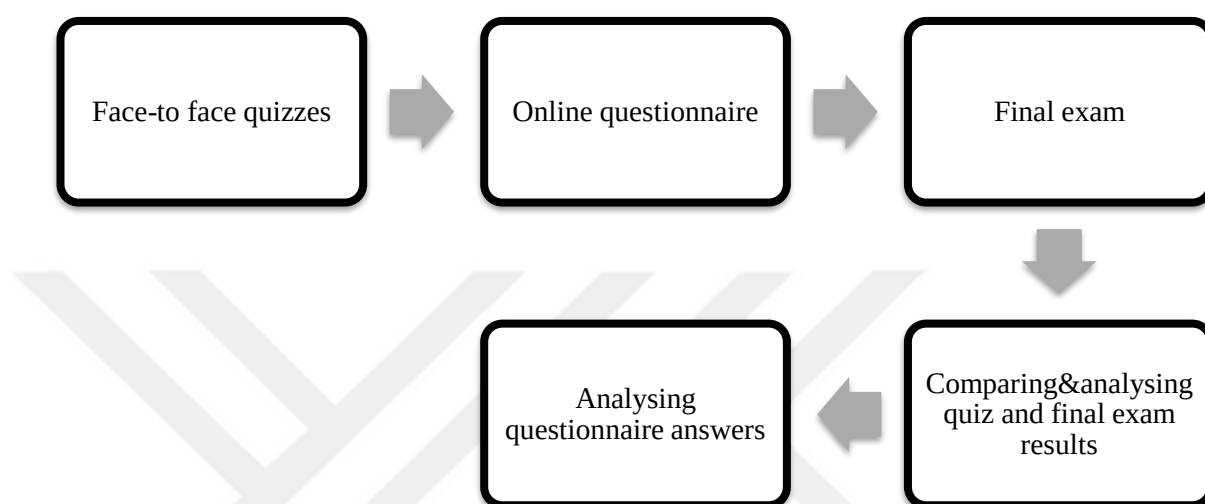


Figure 3.4 : The case study process.

The primary objective of this study is to evaluate students' perceptions of the Game-Based Student Response System (GSRS), an example of gamification in education, and to investigate the potential influence of this application on students' academic performance. To achieve this goal, students participated in four quizzes administered throughout the semester. These quizzes were facilitated using Quizizz, an online platform for GSRS (Zuhriyah & Pratolo, 2020). Noteworthy examples of online platforms integrating gamified educational elements include Kahoot!, Socrative, Quizizz, and Quizalize. Kahoot! and Quizizz stand out among these applications due to their engaging interfaces. The choice among these platforms typically depends on factors such as cost, number of participants, question types, and more. Although all platforms offer both free and paid versions, this study focuses on their free versions as they were available between September and December 2022. As shown in Table 3.4, all four platforms offer multiple-choice or open-ended questions. Kahoot! and Socrative offer relatively limited features in their free versions, while Quizalize restricts the number of quizzes. Ultimately, Quizizz emerges as the most suitable platform for educational gamification, particularly in higher education where classes

are crowded and regular assessments are necessary. Hence, the Quizizz platform has been selected as the preferred tool for examination purposes in this study.

Table 3.4 : Comparison of various platforms.

Online Platforms (Free Version)	Launch Date	Maximum Participants	Question Types	Maximum number of quizzes
Kahoot!	2013	40	Multiple Choice	No restriction
Quizalize	2015	200	Multiple Choice+	3 classes by 5 activities (quizzes, homework)
Quizizz ²	2015	100	Open-ended Multiple Choice+	No restriction
Socrative	2010	50	Open-ended Multiple Choice+	5
			Open-ended	

Quizizz (Figure 3.5, Figure 3.6, and Figure 3.7) is a platform that launched in India in 2015 (<https://quizizz.com>). It is free to use and provides question alternatives such as multiple-choice and fill-in-the-blanks. The free version of this platform offers features such as various types of questions and the opportunity for up to 100 participants. As previously indicated, these features led to the preference for Quizizz in this thesis. Quizizz is recognized as one of the most widely used online learning platforms with game-based features (Raja & Nagasubramani, 2018). With the help of Quizizz, students can understand motivation and effort in learning, participation in activities, and academic accomplishment (Zuhriyah & Pratolo, 2020).

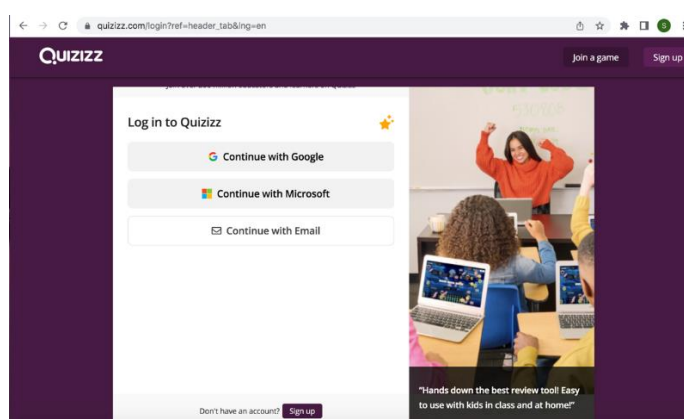


Figure 3.5 : Quizizz home page (Screenshot).

² During this research period (September-December 2022), Quizizz used to have a free version, but it was later updated to a 7-day trial version.

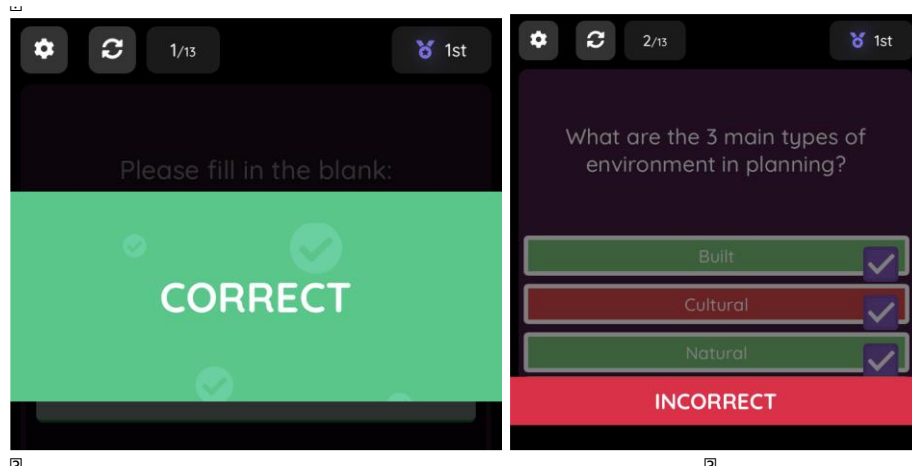


Figure 3.6 : Quizizz - Student screen with question answer (Screenshot).

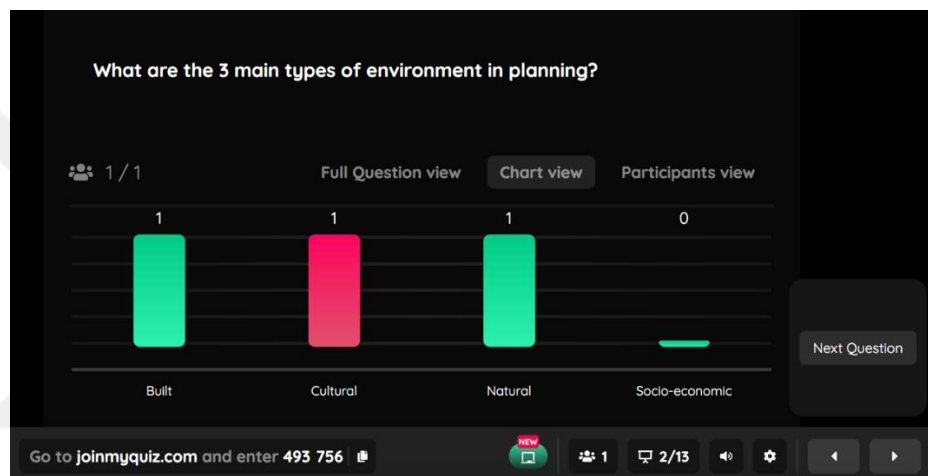


Figure 3.7 : Quizizz - Teacher's screen with question results (Screenshot).

To understand the impact of Quizizz in education, a literature review for this thesis was conducted between September 2022 and December 2022 using Scopus with the keywords “Quizizz” and “Education”. This review identified 49 documents related to education that align with the scope of this study (Appendix C). The studies span various disciplines and education levels, which were categorized into higher education and pre-higher education. Moreover, the studies evaluate perspectives from diverse groups, including both students and teachers. Learning outcomes were grouped according to educational elements: knowledge, skills and participation/motivation. Various findings regarding the use of Quizizz in education were identified from the existing literature, as outlined below:

- Studies examining the use of Quizizz have gained importance alongside the advancement of online and virtual educational environments. Notably, there

has been a noticeable increase in the number of studies in the year 2021, which can be attributed to the impact of the Covid-19 (Figure 3.8).

- The primary discipline that uses Quizizz is language learning.
- These studies encompass different education levels; however, there is a greater emphasis on higher education.
- The majority of existing studies (90%) evaluate the perspectives of students.
- Regarding learning outcomes (knowledge, skills, participation), most studies focus on knowledge.

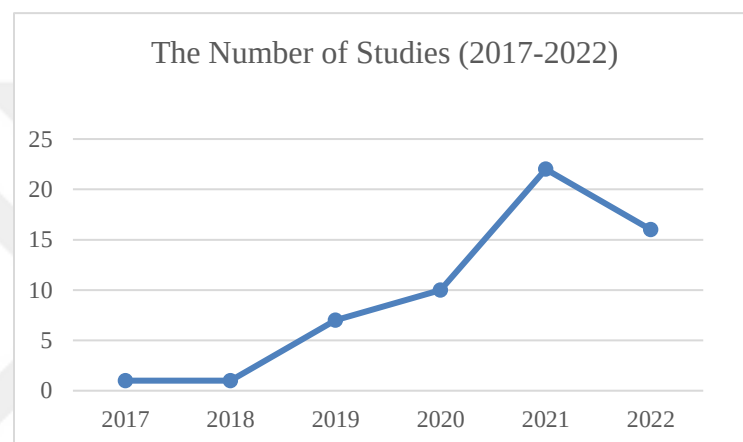


Figure 3.8 : The number of studies.

The distribution of articles across learning outcomes is illustrated in Figure 3.9 below. Notably, the studies predominantly adopt qualitative methodologies. Specifically, only four studies incorporate quantitative assessments aimed at measuring academic success alongside the qualitative results.

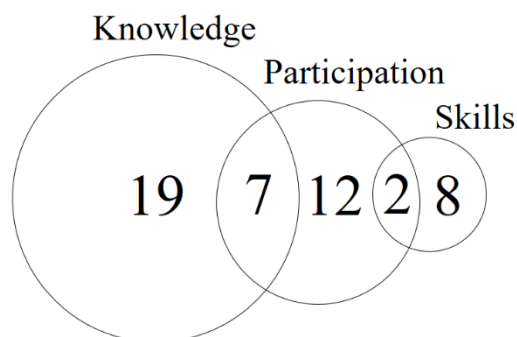


Figure 3.9 : Learning outcomes.

Existing studies highlight that Quizizz is most prominently used in various disciplines, particularly in language learning. Although less common than in language learning,

there are related studies in fields such as physics, chemistry, and mathematics. Therefore, it has the potential to be used in natural and social sciences. Furthermore, the extensive incorporation of Quizizz within foreign language education suggests that its application is particularly effective in facilitating the retention and memorization of essential information. In this context, Quizizz emerges as a viable tool to facilitate the permanent internalization of key informational content. Subsequently, a discernible trend was identified in which the utilization of Quizizz is more prevalent within higher education contexts. The application of Quizizz is not limited to younger students; rather, it encompasses a broader spectrum of learners. This observation challenges the perception that this game-based learning platform is exclusively tailored for children. Ultimately, the effects of Quizizz are evaluated in terms of learning outcomes, assessed across the dimensions of knowledge, participation, and skills. Notably, the most pronounced impact is observed in the realm of "knowledge" attainment. In alignment with the scholarly discourse, the employment of Quizizz within instructional contexts yielded the most favourable influence on knowledge acquisition, a significant outcome particularly when contemplating the acquisition of theoretical content within educational courses. Furthermore, the number of quantitative studies measuring academic success is inadequate. Consequently, considering its benefits, such as knowledge retention and acquisition, sustaining student engagement within densely populated classrooms, providing quick feedback from instructors, and its seamless integration within distance learning contexts owing to its online accessibility, Quizizz emerges as a fitting supplementary instrument for education.

Following the literature review, the data collection process for the main case study, conducted using the Quizizz platform as part of this thesis, will be described. Utilizing Quizizz as a tool, four quizzes were administered as integral class activities throughout the academic term. These quizzes were sequentially conducted, introducing new questions as a new subject matter was covered. Examples of the questions are provided in Appendix D. Notably, these quizzes did not contribute to the students' final grading. Instead, their primary objective was to gauge the extent of students' knowledge retention and recall while maintaining their engagement. Although the quiz scores were not factored into the final term grades, the final exam included a question worth 40 out of 100 points that was based on questions previously covered in the quizzes. This approach aimed not only to assess the overall impact of the gamified quizzes on

academic success but also to determine the particular influence on the repeated questions. The first quiz comprised 13 questions, including 12 multiple-choice and one fill-in-the-blank question. The second quiz consisted of 32 questions, with 31 multiple-choice and one fill-in-the-blank question. The third quiz consisted of seven multiple-choice questions, and the fourth quiz had 29 questions, including 28 multiple-choice and one fill-in-the-blank question. Each question had a stipulated time limit (ranging from 30 to 60 seconds) within which students were expected to respond, and they garnered points for every accurate answer provided. Following the completion of each quiz, Quizizz generated a ranking based on scores, yet only the rankings of the top three students were disclosed. Seeing scores on the screen increases students' motivation to rise to the top in leadership (Licorish et al., 2018).

All students present in the classroom participated in these activities:

- First activity: 71 students,
- Second activity: 70 students,
- Third activity: 46 students,
- Fourth activity: 55 students,

Upon completing all classroom activities, the students were invited to participate in a questionnaire to investigate their perspectives and opinions regarding this experimental approach. As Martínez-Jiménez et al. (2021) recommended for future studies, questionnaires that ask students for their satisfaction and evaluation about the learning process will be very impressive practices which students could be responsible for their own learning experiences. The questionnaire, created using Google Forms, was distributed to the students. Participation in the questionnaire was voluntary. The questionnaire encompassed two demographic questions, six yes/no questions, five questions utilizing a Likert scale, and four open-ended questions (Appendix E). The questionnaire content focused on how students felt during this gamification experience, their positive and negative opinions, and their attitude towards using it in the future. A total of 20 students participated in this questionnaire.

At the culmination of this process, two distinct forms of data were obtained. The first type pertains to the scores attained by students through their participation in the quizzes. The second type encompasses the opinions expressed by students as gathered

from the questionnaire. The third data category, necessary for assessing academic achievement comprises the final exam scores. This dataset was provided by the course instructor.

3.3.4.2 Data analyses

The data analysis methodology employed in this study involves correlation analysis. The initial step focused on assessing the impact of gamification on students' academic achievement. The correlation coefficient was first computed to examine the relationship between students' final examination grades and the number of quizzes they participated in. Additionally, to provide a deeper understanding of the results, the correlation coefficient was calculated between students' success rates in all four quizzes and their performance in the final examination. Moreover, a correlation was calculated between the grade point average students received from the quizzes and the grade they earned on the section of the final exam that included a mix of these quiz questions. This analysis aimed to determine whether achieving positive quiz results correlated with a successful performance in the final exam.

3.3.4.3 Limitations & Ethical concerns

Several limitations were encountered during the field study, necessitating thorough consideration and discussion. To begin, the sample group faced certain constraints. The sample size was inherently constrained due to the voluntary nature of student participation in the quizzes conducted throughout the course and the end-of-semester questionnaires. Additionally, the study was confined to a specific period and age range of students, primarily driven by time limitations. Consequently, the extent of quantitative generalizability of the findings is restricted. Despite these inherent limitations, the study yielded qualitatively substantial and valuable results with significant implications.

Ethical considerations were diligently addressed throughout the study, adhering to established guidelines. Firstly, during the formulation of questionnaire questions, no inquiries were made concerning students' personal information, ensuring their privacy and confidentiality. Furthermore, prior to the commencement of the study, an official approval certificate was obtained from the university's ethics committee, affirming compliance with ethical standards. Informed consent (Appendix F) was sought from the participants, who were duly informed about the study's objectives and procedures

prior to their voluntary participation. Anonymity was maintained for all participants, and those who voluntarily chose to partake provided signed informed consent, signifying their agreement to be involved in the study.

3.4 Summary

This chapter outlines the methodological approach used in the thesis. With planning education gaining significant prominence in Türkiye, quality assurance and accreditation practices have been continuously implemented to enhance educational standards. The integration of accreditation efforts into the curriculum has sparked discussions on both content and pedagogical approaches. In this context, four case studies are presented and analysed in detail. The chapter explains the research design and the case study approach employed to investigate the benefits of gamification in planning education. It also describes the data collection methods, including questionnaires, and provides a sample description. Additionally, the chapter discusses the constraints faced during data collection and addresses the ethical concerns raised.

The following chapter presents the results of these case studies individually. The findings from the first three case studies are based on students' responses to questionnaires, while the final case study includes both student responses and correlation analyses.

4. RESULTS

This chapter presents the findings from the gamification case studies conducted as part of this thesis. The data collected from the case studies are analysed and presented to offer a comprehensive understanding of the perceptions and impacts of gamification in urban planning education. The first three cases provide key insights into students' perspectives on the gamification experience, while the final case study offers a more detailed examination of students' perspectives and the impact on academic achievement. The results are presented in relation to the research questions and objectives established earlier.

4.1 Land Use Decision-Making Gamification Experience

This subsection presents the findings from the land use decision-making gamification experience, focusing on students' feedback gathered through a questionnaire.

At the end of the session, students completed a questionnaire with seven questions designed to gather their feedback on the gaming experience. Four students participated in the game, and all completed the questionnaire. According to the results, all four students expressed positive views on the experience. They noted that the game positively affected their learning and increased their motivation (Figure 4.1). Additionally, they expressed interest in incorporating similar games in other classes. Finally, some additional feedback included:

“This made it easier to understand the laws, like Article 18, in a spatial context by gamifying them. I was very satisfied.”

“During this gaming session, I observed that putting ourselves in the roles of various actors in such a realistic way while making plan decisions encourages comprehensive thinking. I believe that doing such studies in project courses could be useful to understand that environment through various actors' perspectives. Additionally, experiencing the game with students from different

disciplines, beyond just planning students, would provide insights from various perspectives.”

“Maps created after actor selections can be saved upon completion. This way, at the end of the session, all maps can be viewed side by side and the changes can be noticed clearly. Reinforcement and green area types could also be added. At the end of the game, map and actor matches could be scored, and comments could be added if a ‘send’ button is included. This would allow the game to be played individually as well as in groups.”

“It might be more efficient if actors briefly discuss land use decisions before they intervene in the land use plan. For example, actors could agree on a common concept before making interventions to the land.”

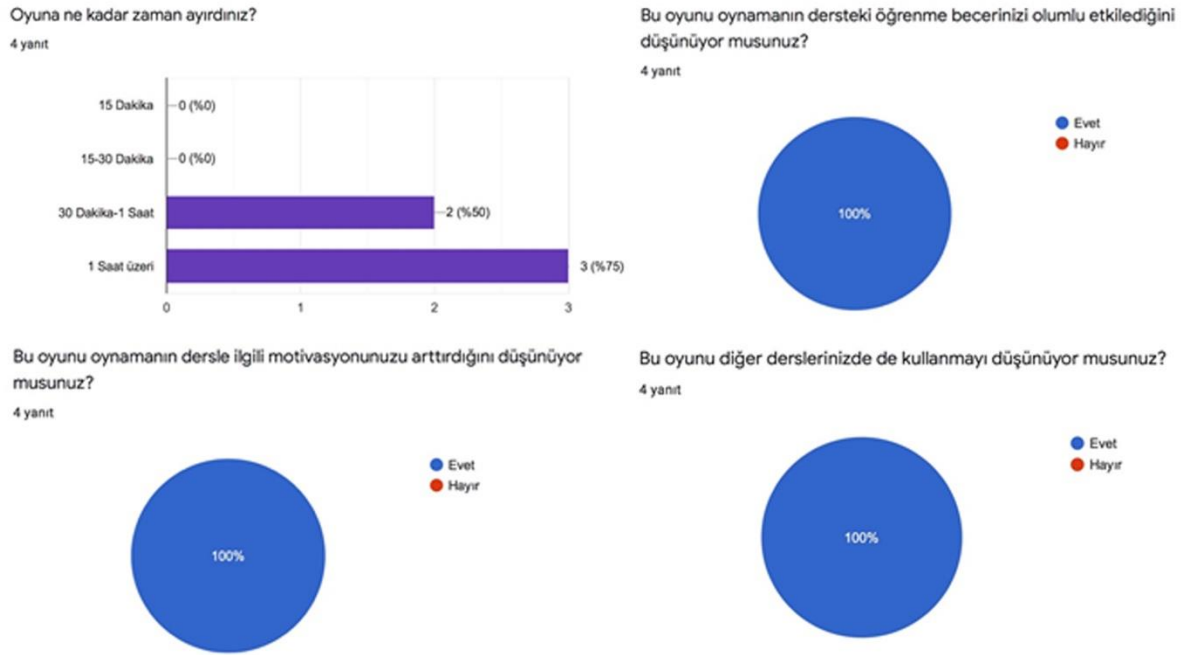


Figure 4.1 : Student responses (Land use decision-making experience).

Although this experience received positive feedback from students, it also presents some limitations:

- To ensure effective coordination and discussions, this activity is best suited for a limited number of participants.
- The whole session lasted over an hour.
- A moderator is crucial to guide the game.

Overall, students responded positively towards such a gamification experience, though it demands additional effort from the course instructor. In other words, while this experience fosters a positive learning environment for students, it is not well-suited for large groups. Instead, it is more appropriate for project-based courses conducted in smaller groups rather than theoretical courses such as land use planning, landscape planning and design, and urban design.

4.2 Gamification Experience Through a Quiz for Graduate Students

This subsection presents the findings from the gamified quiz experience, with a focus on students' feedback collected through a questionnaire.

After finishing the quiz, students completed a questionnaire consisting of seven questions to provide feedback on the gamification experience (Figure 4.2). Thirteen students responded to this questionnaire. According to the results, all respondents indicated that this activity positively affected their learning abilities. Similarly, the majority stated that the activity enhanced their motivation and expressed interest in incorporating similar activities into other classes. Finally, additional feedback was provided:

“I think it is very efficient.”

“Funny.”

“Funny and effective.”

“Maybe it would be better if there were different types of questions besides multiple choice questions.”

As in the previous study, students' responses were notably positive. This study, conducted with a larger group of 16 students compared to the previous case, was successfully implemented with the support of the chosen platform. The experience also demonstrated its potential for effective use in larger student groups.

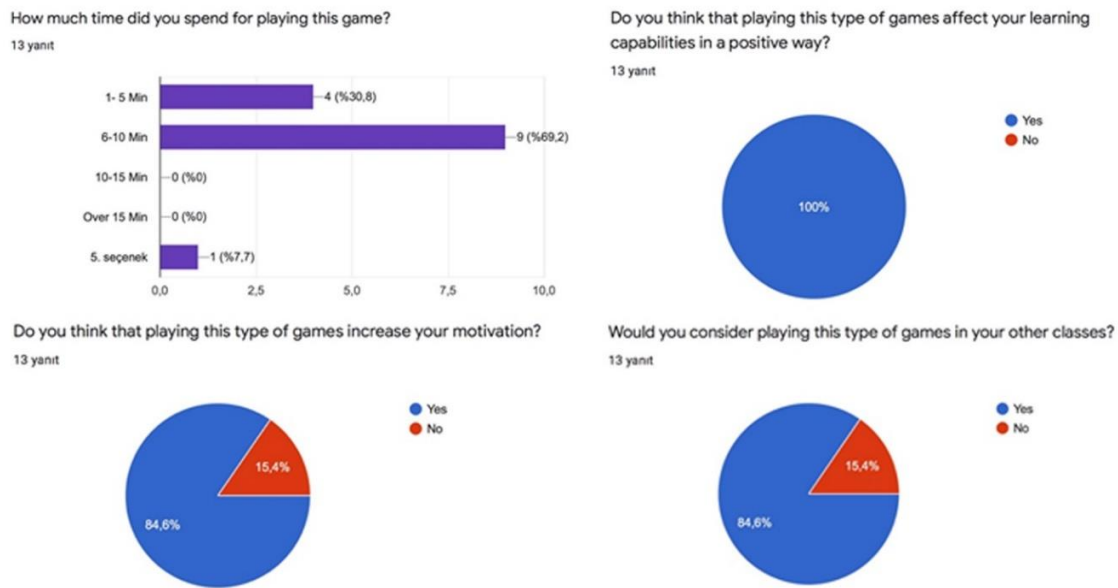


Figure 4.2 : Student responses (1st gamified quiz experience).

4.3 Gamification Experience Through a Quiz for Undergraduate Students

In this third case, which also involved a gamified quiz, both before and after questionnaires were administered, and the findings are presented as follows. The results from the before and after questionnaire exhibited remarkable similarity, suggesting that students already held pre-existing opinions about the use of gamification. Since the responses remained consistent, this section will solely present the outcomes of the post-questionnaire (Table 4.1). Based on the findings, a substantial majority (approximately 94%) of students indicated that participating in such gamified activities positively impacted their learning capabilities. This sentiment remained consistent after the quiz. In line with this, a significant proportion (almost 87%) of participants expressed that these games heightened their motivation levels. Nearly 90% of respondents found the game enjoyable; however, around 40% reported boredom during the activity. A smaller fraction (approximately 15%) encountered challenges while engaging with the game. One student stated the following as a reason for their difficulty:

“Some questions were complex and long.”

Lastly, nearly 70% of the students were willing to engage in similar game-based activities in other courses.

Table 4.1 : Questionnaire questions and answers.

Questionnaire Questions	Answers (%)	
	Yes	No
❖ Do you believe that games/gamification have positive effects on learning?	94	6
❖ Do you believe that games/gamification increase motivation?	87	13
❖ Do you believe the game you played was fun?	90	10
❖ Were you bored during the game?	40	60

Furthermore, the comprehensive course evaluation questionnaire administered by the instructor included the question, "What should I keep in the course next year?" Among the responses, a discernibly positive sentiment towards the quizzes and games was evident. Notably, the terms "games" and "quiz" appeared in six out of the 13 provided responses. A selection of these responses is presented below:

"I think the games should definitely stay because they make the lesson more fun."

"The games were fun and educational."

Based on the outcomes derived from this pilot study, several crucial insights have emerged that directly inform the implementation of the main case study:

- The preliminary "before questionnaire" did not yield significant insights; consequently, this component has been excluded from the main case study.
- In the questionnaire, the final question was, "Can you add anything about your gamification experience?" This inquiry was optional, resulting in a limited number of responses. This question has been made mandatory to address this limitation in the main case study.
- Students criticized specific questions for being lengthy and intricate. To mitigate this issue in the main case study, the researcher has formulated the questions to be more concise and straightforward.
- Students have shown a positive inclination towards the utilization of gamification. Affirmative responses were recorded for both learning and motivation-related queries. However, a comparison between gamification activity results and final exam outcomes was essential to comprehensively assess the impact on learning for the main case study. Furthermore, an in-depth

exploration of the motivational impact necessitated the inclusion of additional questions.

With the valuable insights gained from this study, the following section presents the results of the main case study.

4.4 Main Case Study: Gamification Experience Through Four Quizzes for Undergraduate Students

This subsection presents the findings from the main case study. The results of this case study are evaluated in two stages. The first stage is to measure whether gamification practices affect academic success. The second stage is to evaluate the students' approach to such gamification practices, independent of the academic achievement results.

4.4.1 Measuring academic success

Within the scope of this case study, four different quizzes were administered. Some students participated in all the quizzes, while others participated at varying rates (Table 4.2).

Table 4.2 : The number of activities that students participated in.

Number of Class Activities (Quizzes)	Number of Students
0	1
1	6
2	20
3	41
4	16

In order to measure whether gamification activities affect the academic achievement of students, first the relationship between the number of activities that students participated in and final term grades was evaluated. According to the results, the correlation coefficient was 0.22. While there is a positive relationship between the number of activities students participate in and the final term grade, this relationship is weak. In other words, this gamification activity did not have a significant effect on academic achievement (Figure 4.3).

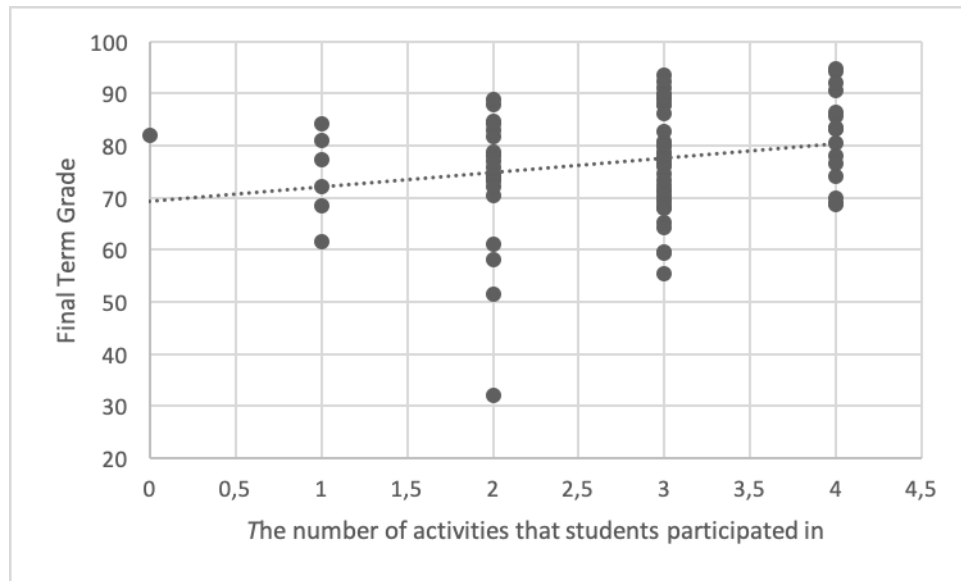


Figure 4.3 : Correlation between final term grade and the number of activities that students participated in.

The number of activities that the students participated in did not have a substantial effect on the final grade. In other words, if a student participates in all of the quizzes or only one, they will be able to achieve successful results. Of course, this shows that the student can improve his/her motivation and learning with different methods. However, the relationship between the performance of those who participated in all of the quizzes and the final grade was also examined. The success rate of the students in the quizzes is displayed in Table 4.3, while the mean performance of class activities and final term grades are presented in Table 4.4.

When the correlation coefficient between the quiz success averages and the end-of-term grade point averages of the students who participated in all quizzes was calculated, the result was 0.54 (Figure 4.4). This means that there is a positive and moderately strong significant relationship between these two variables.

For a more detailed analysis, specific correlated values were selected. The mean class activity performance of all students was correlated with their scores from the section of the final exam that included the quiz questions. The correlation result was 0.30, indicating a weak relationship (Figure 4.5).

Table 4.3 : Evaluation of participants according to four different class activities.

Students	Class Activity 1 Performance (out of 100)	Class Activity 2 Performance (out of 100)	Class Activity 3 Performance (out of 100)	Class Activity 4 Performance (out of 100)
1	61	28	71	48
2	53	84	100	68
3	76	81	100	62
4	38	40	85	48
5	76	56	71	41
6	76	46	85	48
7	46	37	57	41
8	15	50	57	37
9	61	56	71	58
10	69	56	71	58
11	61	59	85	68
12	76	71	57	51
13	84	75	28	96
14	46	40	28	34
15	61	62	28	37
16	84	75	28	72

Table 4.4 : Evaluation of participants according to class activity and exam results.

Students	Class Activity Performance Mean (out of 100)	Final Term Grade (out of 100)
1	52	68.7
2	76	90.5
3	80	83.2
4	53	78.1
5	61	83.1
6	64	85.6
7	45	76.6
8	40	74.05
9	61	80.4
10	64	94.4
11	68	92
12	64	69.9
13	70	86.3
14	37	83.4
15	47	69
16	65	95

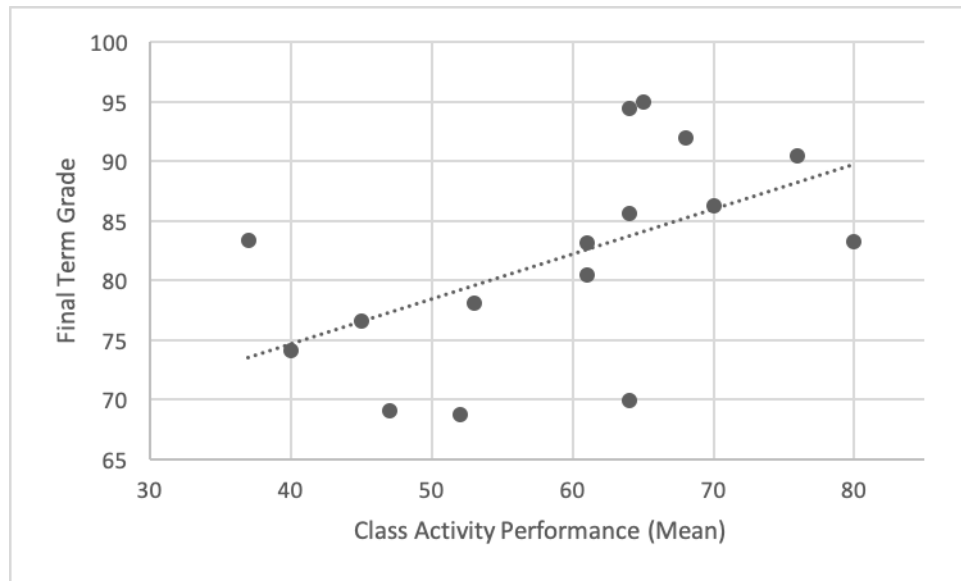


Figure 4.4 : Correlation between class activity performance and final term grade.

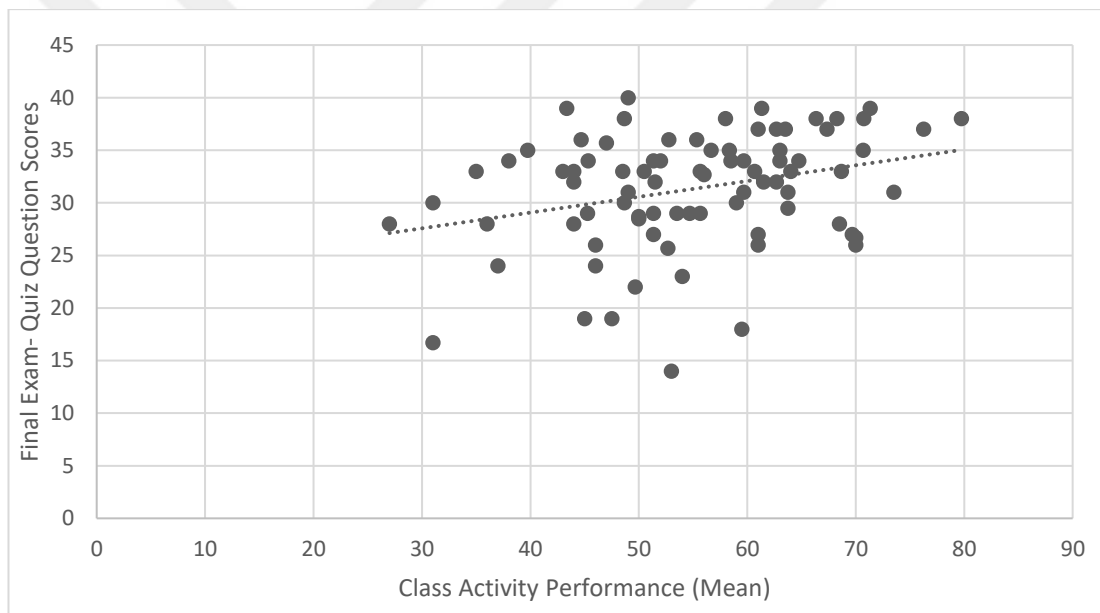


Figure 4.5 : Correlation between class activity performance and final exam question scores.

4.4.2 Evaluating student perspective

While measuring the students' approach to this gamification experience, first, a yes (positive)/no (negative) question was asked. Then, if the answer was yes, a Likert scale (1-low, 5-high) was used to assess effectiveness (Appendix G). Table 4.5 shows that the highest mean value is 4.25, which corresponds to the question about remembering. Students think that the gamification experience will help them remember the information they learned in the lesson more easily in the future. The lowest mean value

of 3.75 corresponds to the question about focusing. Based on these two results, the students believe that the impact of this gamification experience will be more effective in the future rather than during the classes.

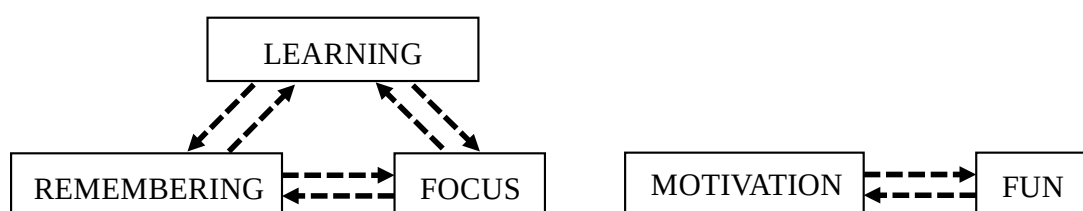
After evaluating the main themes separately (learning, remembering, motivation, focus, and fun), the correlation values were calculated to examine their relationships (Table 4.6). According to these values, the most vital relationships are between learning-remembering, learning-focus, and motivation-fun (Figure 4.6). Therefore, it was stated by the students who participated in this study that remembering information and focusing during the lesson has a substantial effect on learning, and entertainment and motivation are two essential elements that support each other.

Table 4.5 : Students' answers (Likert scale questions).

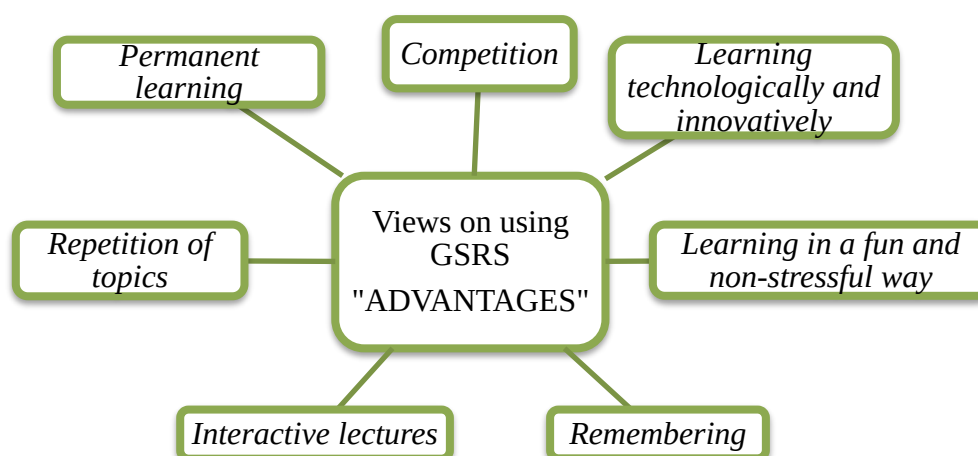
Questions	1	2	3	4	5	Mean
Q1.Do you think the games played in the lesson positively affect your learning skills? + How effective do you think it is?			6	7	7	4
Q2."I think I can better remember the information I learned in the lesson using such applications"			4	7	9	4.25
Q3.Do you think the games (Quizizz activities) played in the lesson increase your motivation ? + How effective do you think it is to increase your motivation?		1	2	8	7	4.16
Q4."When I use such applications, I can focus more easily and for a long time compared to normal lessons."		4	3	7	6	3.75
Q5.Do you think the games (Quizizz activities) you have played are fun ? + How much fun do you think it is?		1	3	7	6	4.06
Overall						4.05

Table 4.6 : Correlations between questionnaire results.

Questions	Q1_ Learning	Q2_ Remembering	Q3_ Motivation	Q4_ Focus	Q5_ Fun
Q1_ Learning		.790	.309	.756	.268
Q2_ Remembering	.790		.462	.733	.504
Q3_ Motivation	.309	.462		.529	.826
Q4_ Focus	.756	.733	.529		.504
Q5_ Fun	.268	.504	.826	.504	

**Figure 4.6 :** Correlations between questionnaire results.

The students' positive and negative perspectives were solicited through open-ended questions incorporated within the questionnaire. Their responses were collected and summarized visually in the accompanying images (Figure 4.7, Figure 4.8). Based on student feedback, the positive aspects of the experience include remembering, innovation, and learning in an entertaining way. Conversely, concerns were raised regarding the question content and technical issues. Notably, competitiveness was mentioned as both a positive and a negative aspect.

**Figure 4.7 :** Students' positive views.

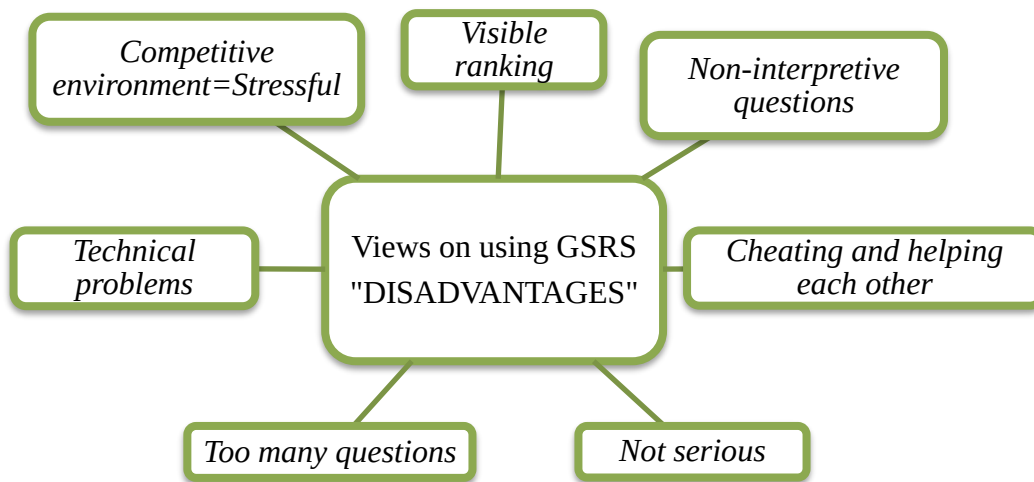


Figure 4.8 : Students' negative views.

The following chapter presents the conclusion of this thesis. The findings will be discussed in relation to existing literature, the research questions will be addressed, and final remarks will be provided, including recommendations for future studies.

5. CONCLUSION

Urban and regional planning education in Türkiye strives to continually renew itself and meet evolving standards, influenced by changing generations and methodologies. Despite these efforts, increasing department quotas have led to larger class sizes, particularly affecting the productivity of theoretical courses. Challenges arise from the inability to maintain one-on-one communication with students, a decreased student motivation, and difficulties for instructors in assessing comprehension during lessons. This scenario necessitates the exploration of new techniques for theoretical courses. Gamification, as a contemporary method, has been successfully implemented in various fields, receiving positive feedback. The central focus of this research is to explore the integration of gamification into urban and regional planning theoretical courses and its potential effects. The thesis addresses two main research questions:

- Do students believe that gamification contributes positively to learning and motivation?
- Does using gamification activities lead to increased academic success among students?

Through a series of three pilot studies and a main case study, this research aims to answer these questions. The key findings derived from these case studies are summarized below:

- Land use decision-making gamification experience:

Students appreciated the ability to understand legal concepts (e.g., Article 18) within a spatial context through gamification. The experience encouraged comprehensive thinking by allowing students to assume various roles and perspectives during planning decisions. They mentioned that this experience had a positive impact on their learning and enhanced their motivation.

- Gamification experience through a quiz:
 - Graduate Students: Feedback from graduate students revealed that these gamified quizzes had positive effects on their learning and motivation.
 - Undergraduate Students: The comparison between before and after questionnaire results showed minimal differences. Based on the after questionnaire answers, 94% of students found the activity beneficial for learning, and 87% indicated enhanced motivation. However, 40% reported feelings of boredom, and 15% encountered difficulties, particularly due to complex and lengthy questions.
- Gamification experience through four quizzes for undergraduate students:
 - Evaluation of Gamification's Effect on Academic Success:
 - The analysis of the relationship between the number of gamified activities attended by students and final term grades revealed a weak positive correlation (0.22).
 - The analysis of the relationship between the class activity performance and final exam question scores showed a weak positive correlation (0.30).
 - Student Perspectives: Students found gamification activities for enhancing learning and motivation with the highest perceived benefit being "remembering". Moreover, correlation analysis revealed strong associations between learning-remembering-focus, and motivation-fun.

Based on this summary, the findings presented in this thesis allow for a discussion comparing them with existing literature. This conclusion chapter will begin with a retrospective evaluation, followed by a prospective evaluation addressing limitations and recommendations. It will also highlight the contributions of the research, provide suggestions for future studies.

5.1 Retrospective Evaluations

This research's first question aimed to analyse how gamification activities impact students' motivation and learning. Gamification is considered a valuable tool in the learning process, particularly for enhancing motivation (Sezgin et al., 2018) and promoting active students participation in lessons (Dichev et al., 2014; Creel et al., 2021). The findings of this study support this view, suggesting that gamification positively influences motivation and learning. Beyond motivation, students' feedback highlight that the most significant impact of gamification is enhancing "remembering." Moreover, correlation analysis among five themes suggests that enhancing students' learning levels necessitates a simultaneous focus on improving their remembering and focus capabilities. Additionally, if motivation levels are low, incorporating fun activities into the classroom can effectively elevate motivation levels. Positive feedback from students across all case studies reveals that gamification has significant potential within urban planning education. While the literature and existing urban games database indicate that urban games constitute only 9% of the total, the findings from this research present a different perspective. This highlights a possible underutilization of gamification approaches tailored specifically for urban planning.

Another crucial research question addressed in this thesis is whether the incorporation of gamification methods improves students' academic success. The underlying assumption is that integrating enjoyable and engaging activities into learning can enhance academic outcomes. Contrary to expectations, the analysis reveals no significant correlation between the frequency of students' participation in gamified activities and their final exam performances. This result aligns with the findings of Judson and Sawada (2002), who also found no correlation between the use of an SRS and academic achievement. This unexpected finding suggests that Game-based Student Response Systems (GSRS) may not directly determine academic success, even with the inclusion of gamified elements. Moreover, the weak correlation between students' performance in the quizzes and their scores on the related quiz questions in the final exam supports the result that such methods have minimal impact. Although this study did not observe a direct impact of gamification on academic success, it did reveal an indirect positive effect. Students reported that gamification had a significant

positive impact, particularly in terms of remembering the information. This enhanced ability to remember can be attributed to the repetition of such gamified activities. In addition to the gamified quizzes experienced in class, students can also use these quizzes to practice at their convenience. This aligns with one of the key outcomes of planning education, which is providing students with the opportunity to cultivate a self-directed learning process (Fischler, 2012).

In addition to addressing the main research questions of this thesis, the findings present valuable contributions. The literature highlights that planning education has a rich variety of methodological approaches and curriculum content. TUPOB studies have evaluated curricula according to accreditation and quality standards, resulting in the development of programs that include interdisciplinary courses, alongside project-based and theoretical courses in planning (Gülersoy et al., 2008). Furthermore, various pedagogical approaches have been integrated into planning education (Frank, 2006). The land use decision-making gamification experience can be considered a novel approach within this diversity. Students' experiences of learning complex topics interactively, and their positive feedback align with the innovative methods mentioned in the literature, such as simulation and role-playing.

In the gamification experience conducted as part of this study, competitiveness was activated through the use of a leader board, as highlighted in the literature (Christopoulos & Mystakidis, 2023). By the end of the study, student feedback reflected both positive and negative perspectives on this aspect. This suggests that individual student characteristics and personal approaches play a significant role and should be considered when implementing gamification strategies.

Based on these findings, it is essential to address the study's limitations and develop new research directions. The following section will provide suggestions and evaluations in this regard.

5.2 Prospective Evaluations

This study was conducted on a specific sample within a defined time period; however, time series data is necessary to achieve more comprehensive results. Future studies could benefit from conducting interviews four years with a selected group of students.

Moreover, while this research focused solely on the students' perspectives, expanding the scope to include instructors' viewpoints could enhance the understanding of gamification's effectiveness in planning education. Additionally, the quizzes used as part of the gamification experience were not considered in course evaluations. Future studies might consider incorporating these quizzes as a component of the course grade, potentially increasing participation rates. This approach could also offer a faster evaluation method for instructors, thereby fostering a positive attitude among them.

The gamification case studies were designed as improvements to previous implementations, with each study building upon the last to address its limitations. The applicability of these cases varies depending on course characteristics and class size. While the first experience targeted a small student group, later cases incorporated the GSRS methodology to accommodate larger classes. The choice of tool or platform played a critical role in this process. The platform used in the second case allowed for a student group exceeding 40 participants within its paid version. In the third case, a quiz mechanism was developed by the course instructor to overcome platform limitations. While this solution enabled engagement with a larger number of students, it also introduced additional workload and challenges for the instructor. Furthermore, since the process was manually managed, it lacked the efficiency provided by dedicated platforms. In the final case, a platform capable of supporting a larger student group was utilized, effectively resolving previous limitations. However, this reliance on a specific platform highlights a potential dependency issue; any changes in platform availability or functionality may require instructors to develop their own alternative interfaces.

Although students expressed positive opinions about gamification, the lack of observable impact on academic achievement may be attributed to the design and content of the gamification activity. This suggests the need for further development and enhancement of gamification in education. At this point, leveraging technological opportunities is essential. The evolving technological preferences and needs of students have driven educational transformation, as technology-supported learning, which enhances learning outcomes, is increasingly favoured by students who prefer using technological tools (Raja & Nagasubramani, 2018; Anak Yunus & Hua, 2021; Sani-Bozkurt, 2021). This study utilized existing digital-technological interfaces for

gamification applications designed to align with students' preferences. However, these systems did not demonstrate sufficient effectiveness.

Despite attempts to refine gamification approaches through different cases, the results indicate that gamification did not demonstrate a measurable impact on academic success in the final case study. Based on student feedback, the content and frequency of quizzes must be carefully tailored to align with pedagogical principles. Moreover, generational characteristics influence student motivation, further emphasizing the need for a well-structured approach.

A critical limitation of gamification is its inability to accurately anticipate human experience, and artificial intelligence (AI) is considered a critical solution for advancing gamification in education (Arnold & Jantke, 2018). Through AI, the gamification system can be adjusted according to individual user preferences, needs, and abilities, providing a more personalized gamification experience (Bezzina & Dingli, 2023).

The application of gamification in courses can range from basic levels, where traditional teaching methods are largely maintained with gamification added to enhance student engagement, to more complex and comprehensive implementations (Tóth et al., 2019). In conclusion, based on the findings of this thesis, gamification, in its current form, cannot serve as a primary instructional method. However, the GSRS method explored in this study proves to be a valuable supplementary tool, particularly for theoretical courses. This becomes particularly relevant given the large number of students enrolled in theoretical courses, where obtaining individual feedback from each student can be challenging. Furthermore, the ease and efficiency of creating and grading quizzes in a crowded classroom setting underscore the supportive role that gamified activities can play in urban planning education. The gamified land-use decision-making experience appears to be well-suited for application-based courses with smaller student groups. However, for theoretical courses with larger student groups, the GSRS methodology offers a more engaging alternative—provided that the content and frequency of activities are thoughtfully designed to align with both course requirements and student learning preferences.

At this stage, GSRS can be considered a valuable tool for providing students with instant feedback, enhancing motivation and engagement, and enabling efficient quiz

evaluation during lessons. However, for gamification to directly impact academic success, it must evolve into more personalized and innovative applications that empower students to take control of their own learning experiences. The cumulative results of such developments will provide valuable insights for developing standards aimed at achieving more permanent learning in theoretical courses through gamification in urban and regional planning education. Furthermore, to enhance its effectiveness, integrating gamification with advanced technologies such as AI within planning education may yield more substantial impacts.





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APPENDICES

APPENDIX A: Reviewed Papers (Existing urban games)

APPENDIX B: The Inventory of Urban Games Employed in This Thesis

APPENDIX C: Reviewed Papers (Quizizz)

APPENDIX D: Quizizz Question Examples

APPENDIX E: Questionnaire

APPENDIX F: Ethic Form

APPENDIX G: Questionnaire Result

APPENDIX A : Reviewed Papers (Existing urban games)

Table A.1 : Reviewed papers (Existing urban games).

<i>Year</i>	<i>Title</i>	<i>Game(s)</i>	<i>Author (s)</i>
2010	Gaming the Interrelation between Rail Infrastructure and Station Area Development: Part2- Insights from the Serious Game ‘Sprint City’	SprintCity	Mayer, I. et. al.
2013	Social strategy games in communicating trade-offs between mitigation and adaptation in cities	Broken Cities	Juhola, S. et.al.
2014	Games in urban planning – a comparative study	*Broken Cities *C.L.U.G. *Ginkgopolis *Neue Heimat *Pop-up Pest *Stadtspieler *Anno *City One *Civilisation *Community PlanIt *Green Sight City *Plasticity *Securing Sydney’s Urban Planning *Surfing Global Change	Reinart, B.& Poplin, A.
2014	Breaking barriers to transit-oriented development: insights from the serious game SPRINTCITY	SprintCity	Duffhues, J. et.al.
2015	Potential of Games in the Field of Urban Planning	Metropolis	Tóth, E.
2016	The Evolution of City Gaming	Play the City	Tan, E.
2017	Geocraft as a Means to Support the Development of Smart Cities, Getting the People of the Place Involved- Youth Included -	Geocraft	Scholten, H. et. al.
2017	Utilising gaming technology for simulation of urban production	*Cities: Skylines *SimCity(2013) *Cities in Motion2 *Cities XXL *Mobility	Juraschek, M. et. al.
2018	The Urban CoBuilder – A mobile augmented reality tool for crowd-sourced simulation of emergent urban development patterns: Requirements, prototyping and assessment	*The Urban Co-Builder *Suburbia *Next Campus	Imottesjo, H.& Kain, J.H.

APPENDIX B: The Inventory of Urban Games Employed in This Thesis

Green&great	Triage	Oiligarchy	World Climate	Gifts of Culture	Geocraft
A.R.C. (Africa Risk Capacity)	Riskland	Lie, Cheat & Steal	PeaceMaker	Lords of the Valley	SimCity(2013)
3rd World Farmer	Weather or Not	Diplomacy	Cities: Skylines	Nexus Game	Cities in Motion2
Aqua Republica	Upstream-Downstream	Inside the Haiti Earthquake	Climate Game	New Shores: a Game for Democracy	Cities XXL
Before the storm	Paying for Predictions	Leaky World	Plainsopoly	Urban Climate Architect	Mobility
Broken cities	Disaster Hero	Disaster Master	Ökolopoly	THE WORLD'S FUTURE	Suburbia
B.B.C. Climate Challenge	Sai Fah! The Flood Fighter!	Cyber Nations	Polar Eclipse	E.C.O.	Play The City
Can You keep the Earth in Balance	The Fish Game	Dominare	Earth: A Primer	River Basin Game	Next Campus
The Disaster Imagination Game (D.I.G.)	Decisions of the Decade	Corruptopolis	Forest@Risk	Hazagora	The Urban Co-Builder
Disarming Disasters	FloodSim	Energy City	About that forest	Laudato Si	C.L.U.G. (Community Land Use Game)
CEO2	Wind-Fall	ECONOMIA	Climate Health Impact	M.I.T. CleanStart	Ginkgopolis
Disaster in my backyard	Run the River	NationStates	Article 27: The U.N. Security Council Game	Nexus!	Neue Heimat
Dramatising Difficult Concepts	Flood Control Game	Ars Regendi	EcoChains: Arctic Crisis	Game of Floods	Pop-up Pest
Dissolving Disasters	Evacuation board game	Government in Action	The Arcade Wire: Oil God	Climate Challenge	Stadtspieler
Earth Girl	Catchment Detox	MoPoS	Do We Have a Deal?	Public Health Challenge	Anno
Dwelling near the ditch	Bosai Duck	Tammany Hall	The D.U.B.E.S. game	Sustainability in Schools	City One
Flood- Wise	Natural disaster	Corruption	Climate-Poker	World Rescue	Civilisation
Energy Hog	Master of Disaster	Hurricane Strike!	A.W.Q.A. Water	Save the Climate Game	Community PlanIt
Extreme Event Game: Coastal City	Shaping your Shelter	Junta	Evacuation Challenge Game	Cultural Memory Game	Green Sight City
Florima (Flood Risk Management game)	What if?	Nomic	Never Alone	Go-Goals!	Plasticity
Magnitude	Bitten	StarPower	The Game of Urban Renewal	P.I.P.E.S.	Securing Sydney's Urban Planning
Global Calculator	The supervolcano game	Marine Spatial Planning (M.S.P.) Challenge 2050	McDonald's Video Game	Human Security Challenge	Surfing Global Change
ElectroCity	Be a Hero... build a kit!	Settlers of the green Future	Darfur is Dying	Cantor's World	Metropolis
My 2050	Bosai King	Intrigue	Sustainable Delta	Once Upon a Tile	SprintCity
Ready!	Politics and Corruption	Corruption (Denounce!)	Phone Story	Tradeoff!	Catan: Oil Springs
Plan It Green	Landopoly	Lords of the Valley	Flood Resilience Game	Ökonopoly	SimPachamama
Information meeting about evacuation plan Greenwood	Papers, please	Sid Meier's Civilization: The Board Game	Energy Transition Game	Bury me, my Love	Disaster Dynamics: Hurricane Landfall
Climate and Gender game	Anti Money Laundering	A Common Dilemma	SPENT	My Sust House Games	Story Go Round
Stop Disasters!	HERE COMES TROIKA	Computer Waste Policy Simulation	Food Import Folly	Sheriff of Nottingham	

Figure A.1 : The inventory of urban games employed in this thesis.

APPENDIX C: Reviewed Papers (Quizizz)

Table A.2 : Reviewed papers (Quizizz).

Date	Authors	Education Level	Perspective	Discipline	Location	Learning Outcome		
						Knowledge	Skills	Participation(Motivation)
2017	Chaiyo&Nokham	Higher education	Students	Health Sciences	Thailand	✓		✓
2018	Parra-Santos <i>et al.</i>	Higher education	Students	Engineering	Spain			✓
2019	Saleh&Sulaiman	Pre-Higher education	Teachers	Mathematics	Malaysia	✓		
2019	Abdullah <i>et al.</i>	Pre-Higher education	Students	Language	Malaysia		✓	
2019	Rahmah <i>et al.</i>	Higher education	Students	Engineering	Indonesia	✓		✓
2019	Zhao	Higher education	Students	Business& Management	USA	✓		
2020	Zuhriyah,& Pratolo	Higher education	Students	Language	Indonesia		✓	✓
2020	Jiemsak& Jiemsak	Higher education	Students	Language	Thailand		✓	
2020	Razali <i>et al.</i>	Higher education	Students	Engineering	Malaysia			✓
2020	Purba	Higher education	Students	Education (Teacher training)	Indonesia		✓	
2020	Huamani <i>et al.</i>	Higher education	Students	Engineering	Peru	✓		

Table A.2 (continued) : Reviewed papers (Quizizz).

Date	Authors	Education Level	Perspective	Discipline	Location	Learning Outcome		
						Knowledge	Skills	Participation(Motivation)
2020	Mohamad <i>et al.</i>	Higher education	Teachers	Language	Malaysia			✓
2020	Zainuddin <i>et al.</i>	Pre-Higher education	Students	Natural Science	Indonesia	✓		✓
2020	Asfar& Asfar	Pre-Higher education	Students	Mathematics	Indonesia	✓		
2020	Abdul Halim <i>et al.</i>	Pre-Higher education	Students	Language	Malaysia			✓
2020	Pitoyo <i>et al.</i>	Higher education	Students	Language	Indonesia	✓		✓
2021	Awan Asri <i>et al.</i>	Pre-Higher education	Students	General	Indonesia		✓	
2021	Alajaji &Alshwiah	Higher education	Pre-service teachers	Education (Teacher training)	Saudi Arabia			✓
2021	Raju <i>et al.</i>	Higher education	Students	Engineering	India	✓		
2021	Munuyandi <i>et al.</i>	Higher education	Students	Language	Malaysia		✓	
2021	Carnero	Higher education	Students	Engineering	Spain	✓		
2021	Anak Yunus&Hua	Pre-Higher education	Students	Language	Malaysia	✓		✓
2021	Saputra& Rusmana	Higher education	Students	General	Indonesia			✓
2021	Hursen	Higher education	Students	Education (Teacher training)	Cyprus		✓	
2021	Nashar <i>et al.</i>	Pre-Higher education	Students	Social Studies	Indonesia		✓	

Table A.2 (continued) : Reviewed papers (Quizizz).

Date	Authors	Education Level	Perspective	Discipline	Location	Learning Outcome		
						Knowledge	Skills	Participation(Motivation)
2021	Nur Ismiatun <i>et al.</i>	Pre-Higher education	Pre-service teachers	Education (Teacher training)	Indonesia		✓	✓
2021	Magadan-Díaz&Rivas-García	Higher education	Students	Business&Management	Spain			✓
2021	Wulandari&Hartono	Pre-Higher education	Students	General	Indonesia	✓		
2021	Turhan Kariko&Ayuningtyas	Higher education	Students	Language	Indonesia	✓		
2021	Araújo&de Sousa	Higher education	Teachers	Language	Brazil	✓		
2021	Katamba&Sinuhaji	Pre-Higher education	Students	Language	Indonesia	✓		✓
2021	Morais <i>et al.</i>	Higher education	Students	Business&Management	Portugal			✓
2021	Hikmah <i>et al.</i>	Pre-Higher education	Students	Natural Science	Indonesia	✓		
2021	Huei <i>et al.</i>	Pre-Higher education	Students	Language	Malaysia		✓	
2021	Handoko <i>et al.</i>	Higher education	Students	Business&Management	Indonesia	✓		
2021	Santosa&Ita Priyanti	Pre-Higher education	Students	Language	Indonesia	✓		
2022	Carrión Candel&Colmenero	Higher education	Students	Music	Spain			✓
2022	Safar <i>et al.</i>	Higher education	Students	Engineering	Malaysia	✓		✓

Table A.2 (continued) : Reviewed papers (Quizizz).

Date	Authors	Education Level	Perspective	Discipline	Location	Knowledge	Learning Outcome	
							Skills	Participation(Motivation)
2022	Mahmud& Law	Pre-Higher education	Teachers	Mathematics	Malaysia	✓		
2022	Jankovic& Lambic	Pre-Higher education	Students	Natural Science	Serbia		o	
2022	Henukh <i>et al.</i>	Higher education	Students	Engineering	Indonesia	✓		
2022	Muafiah <i>et al.</i>	Higher education	Students	Social Studies	Indonesia	✓		
2022	Capinding	Higher education	Students	Engineering	Philippines			✓
2022	Arifin& Setiawan	Pre-Higher education	Teachers	General	Indonesia	✓		
2022	Dextre-Vilchez&Vásquez-Mercado	Higher education	Students	Health Sciences	Peru	✓		
2022	Pham	Higher education	Students	Language	Vietnam			✓
2022	Rivas-García&Magadán-Díaz	Higher education	Students	Business&Management	Spain			✓
2022	Páez-Quinde <i>et al.</i>	Pre-Higher education	Students	General	Ecuador	✓		
2022	Laura-De La Cruz <i>et al</i>	Pre-Higher education	Students	Language	Peru	✓		

APPENDIX D: Quizizz Question Examples

1. Please fill in the blank:
One of the main purposes of planning isinterest.

2. What are the 3 main types of environment in planning?

☐ A Socio-economic	☐ B Natural
☐ C Cultural	☐ D Built
3. Is the statement below true or false?
"Flora is a vegetation system."

☐ A True	☐ B False
---------------------------------	----------------------------------
4. Which of below is not one of the renewable energy sources?

☐ A Wind	☐ B Water
☐ C Natural Gas	☐ D Sun
5. 3 pillars of sustainability are:

☐ A Production-Import-Export	☐ B Nature-Social-Economy
☐ C Soil-Air-Water	☐ D Wealth-Health-Life Expectancy
6. In which city did the UN Conference on Human Settlements HABITAT II take place?

☐ A Mumbai	☐ B Istanbul
☐ C Kito	☐ D Vancouver
8. Who is the important city planner who prepared the Istanbul plan?

☐ A Prost	☐ B Jansen
☐ C Pervititch	
9. Is the statement below true or false?
"We can measure the migration of a settlement as;
(2022 population)-(2021 population)=Migration"

☐ A True	☐ B False
---------------------------------	----------------------------------
10. Who is the founder of the Garden City concept?

☐ A Kevin Lynch	☐ B Frank Lloyd Wright
☐ C Le Corbusier	☐ D Howard
11. Who is the founder of the Radiant City concept?

☐ A Le Corbusier	☐ B Frank Lloyd Wright
☐ C Kevin Lynch	☐ D Howard
12. Who is the founder of the Broadacre City concept?

☐ A Kevin Lynch	☐ B Frank Lloyd Wright
☐ C Howard	☐ D Le Corbusier

Figure A.2 : Quizizz question examples.

APPENDIX E: Questionnaire

1. Do you think the games played in the lesson positively affect your learning skills? (Yes/No question)
2. If your answer to the previous question is yes, how effective do you think it is? (Likert scale question; 1:low, 5:high)
3. "I think I can better remember the information I learned in the lesson using such applications." (Likert scale question; 1:definitely disagree, 5- definitely agree)
4. Do you think the games (Quizizz activities) played in the lesson increase your motivation? (Yes/No question)
5. If your answer to the previous question is yes, how effective do you think it is to increase your motivation? (Likert scale question; 1:low, 5:high)
6. "When I use such applications, I can focus more easily and for a long time compared to normal lessons." (Likert scale question; 1:definitely disagree, 5- definitely agree)
7. Do you think the games (Quizizz activities) you have played is fun? (Yes/No question)
8. If your answer to the previous question is yes, how much fun do you think it is? (Likert scale question; 1:low, 5:high)
9. In your opinion, what are the advantages of using such (Quizizz) applications in the lesson? (Open- ended question)
10. In your opinion, what are the disadvantages of using such (Quizizz) applications in the lesson? (Open- ended question)
11. Were you bored during the game? (Yes/No question)
12. Did you have difficulties during the game (technical problems, concentration problems, the complexity of the content, etc.)? (Yes/No question)

13. If your answer to the previous question is yes, you can state the reason: (Open-ended question)
14. Do you plan to use this game (Quizizz) in your other lessons? (Yes/No question)
15. What thoughts would you like to add about your gaming experience in this lesson? (Open-ended question)



APPENDIX F: Ethic Form

Bilgilendirilmiş Onam Formu		KATILIM VE AYRILMA:										
İstanbul Teknik Üniversitesi Mimarlık Fakültesi, Şehir ve Bölge Planlaması Bölümü öğretim üyesi Prof. Dr. Aliye Ahu Akgün ve Burcu Yaşlak tarafından yürütülen “Şehir Planlama Eğitiminde Oyun ve Oyunlaştırmanın Etkisi” konusunda yürütülen araştırmaya katılımınız rica olunmaktadır. Bu çalışmada katılımınız tamamen gönüllülük esasına dayanır. Lütfen aşağıdaki bilgileri okuyunuz ve katılmaya karar vermeden önce anlamadığınız her hangi bir şey varsa çekinmeden sorunuz. ÇALIŞMANIN ADI: Şehir Planlama Eğitiminde Derslerde Oyunlaştırmanın Öğrenmeye Etkisi ÇALIŞMANIN AMACI: Şehir planlama eğitiminde derslerde oyunlaştırmanın öğrenmeye olumlu ve belirgin bir etkisinin olup olmadığını, derslerde uygulanacak olan dijital quiz/ yarışmalar ile ölçmek ve değerlendirmek bu çalışmanın amacıdır. PROSEDÜRLER: Bu çalışmaya gönüllü katılmak istemeniz halinde yürütülecek çalışmalar şöyledir: Çalışmaya katılan öğrenciler belli aralıklarla internet ara yüzlerinden faydalanılarak yarışma sistemiyle derse ilişkin quizlere katılacaktır. En hızlı olan ve soruları doğru yanıtlayanlar birinci, ikinci şeklinde yarışmada derece elde edecektir. Quizler internet ve telefon ile en fazla 5-10 dakika sürecek etkinlikler olacaktır. Bu uygulamalar öncesi ve sonrası uygulamaya katılanlarla, görüşlerini almak için anket çalışması gerçekleştirilecektir. Daha sonrasında ise ankete ek olarak, daha detaylı görüş bildirmek isteyen öğrencilerle, mülakatlar gerçekleştirilecektir. OLASI RİSKLER VE RAHATSIZLIKLAR: Herhangi bir rahatsızlık oluşma beklentisi bulunmamaktadır. TOPLUMA VE/VEYA DENEKLERE OLASI FAYDALARI: Eğitim sisteminde yenilikçi yöntemlerin tartışılması ve değerlendirilmesi için bir altlık oluşturacaktır. ONAM FORMU TALEP YÖNTEMİ: <table><tbody><tr><td>yazılı belge</td><td>sözlü</td><td>sesli kayıt</td><td>görüntülü kayıt</td><td>çevrimiçi onay</td></tr><tr><td>x</td><td></td><td></td><td></td><td>x</td></tr></tbody></table> GİZLİLİK: Bu çalışmayla bağlantılı olarak elde edilen ve sizinle özdeşleşmiş her bilgi gizli kalacak, üçüncü kişilerle paylaşılmayacak ve yalnızca sizin izniniz ile ifşa edilecektir. Gizlilik, tanımlanmış bir kodlama prosedürüyle sağlanacak ve kod çözümüne erişim yalnızca çalışmanın sorumlusu araştırmacıyla sınırlı kalacaktır. Araştırma sonuçları tüm gizlilik ilkelerine uyularak sadece bilimsel çalışmalarda kullanılacaktır. Tüm veriler sınırlı erişime sahip güvenli ve şifreli bir veritabanında tutulacaktır.		yazılı belge	sözlü	sesli kayıt	görüntülü kayıt	çevrimiçi onay	x				x	Bu çalışmanın içinde olmak isteyip istemediğinize tamamen bağımsız ve etki altında kalmadan karar veriniz. Bu çalışmaya gönüllü olarak katılmaya karar vermeniz halinde dahi, sahip olduğunuz herhangi bir hakkı kaybetmeden veya herhangi bir cezaya maruz kalmadan istediğiniz zaman çekilebilirsiniz. ARAŞTIRMACILARIN KİMLİĞİ: Bu araştırma ile ilgili herhangi bir sorunuz veya endişeniz varsa, lütfen iletişime geçiniz: Burcu Yaşlak İstanbul Teknik Üniversitesi Şehir ve Bölge Planlaması Bölümü T: 0554 360 37 36 E: yaslak@itu.edu.tr <i>Yukarıda açıklanan prosedürleri anladım. Sorularım tatmin olacağım şekilde yanıtlandı ve dilediğim zaman ayrıma hakkım saklı kalmak koşulu ile bu çalışmaya katılmayı onaylıyorum. Bu formun bir kopyası tarafıma verildi.</i> Tarih: Katılımcının Adı,Soyadı: İmzası: İletişim Bilgileri: e-posta: Telefon: İletişim bilgilerimin diğer araştırmacıların benimle iletişime geçebilmesi için “ortak araştırma havuzuna” aktarılmasını kabul ediyorum kabul etmiyorum (lütfen uygun seçeneği işaretleyiniz) Sorumlu Araştırmacı-Öğretim Üyesi Prof. Dr. Aliye Ahu Akgün Yardımcı Araştırmacı Burcu Yaşlak İmza İmza
yazılı belge	sözlü	sesli kayıt	görüntülü kayıt	çevrimiçi onay								
x				x								

Figure A.3 : Ethic form.

APPENDIX G: Questionnaire Result



Figure A.4 : Students' responses to question 1.

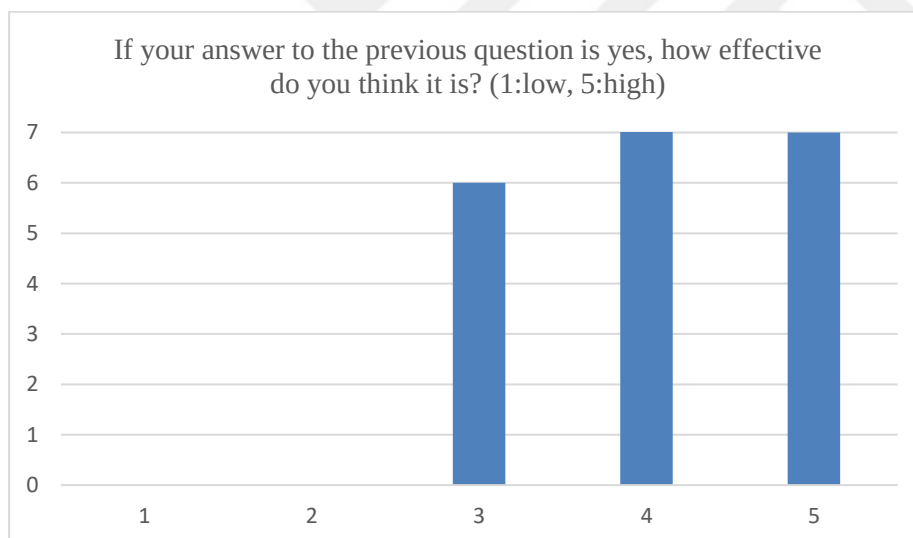


Figure A.5 : Students' responses to question 2.

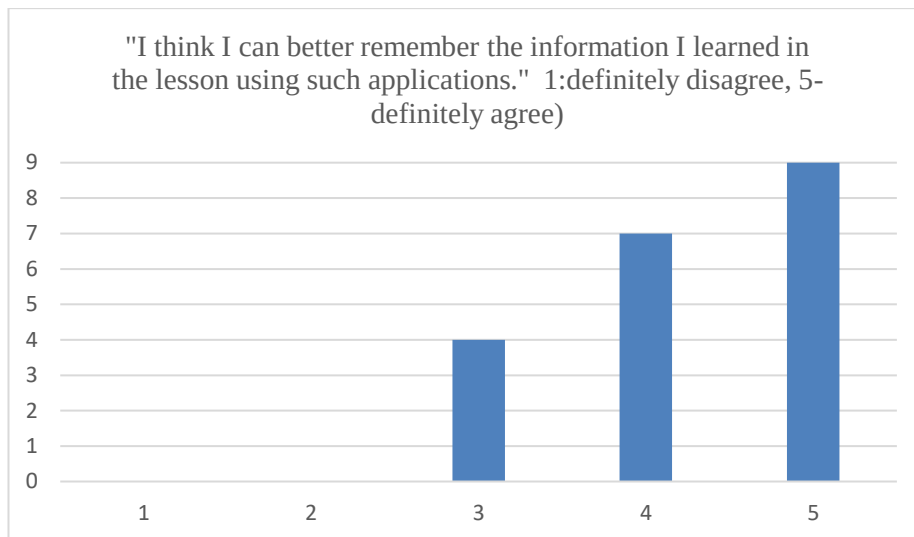


Figure A.6 : Students' responses to question 3.

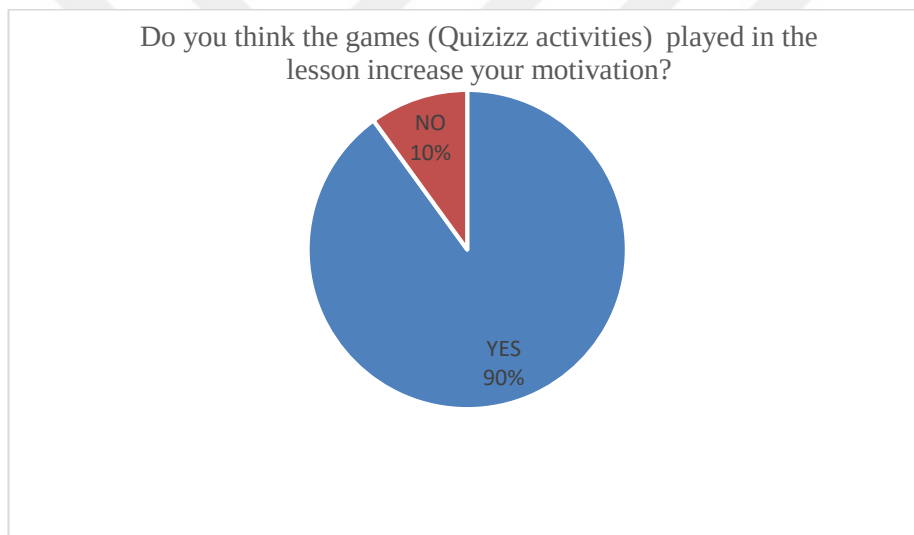


Figure A.7 : Students' responses to question 4.

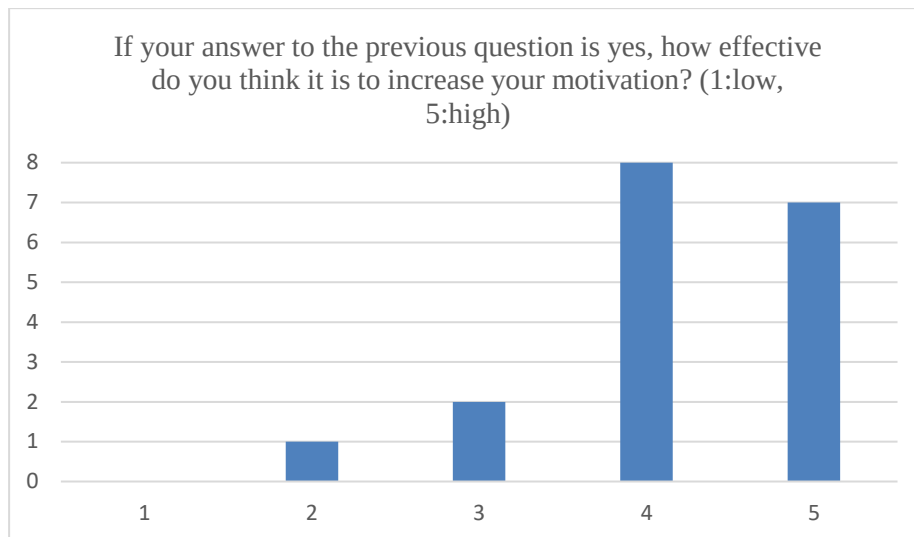


Figure A.8 : Students' responses to question 5.

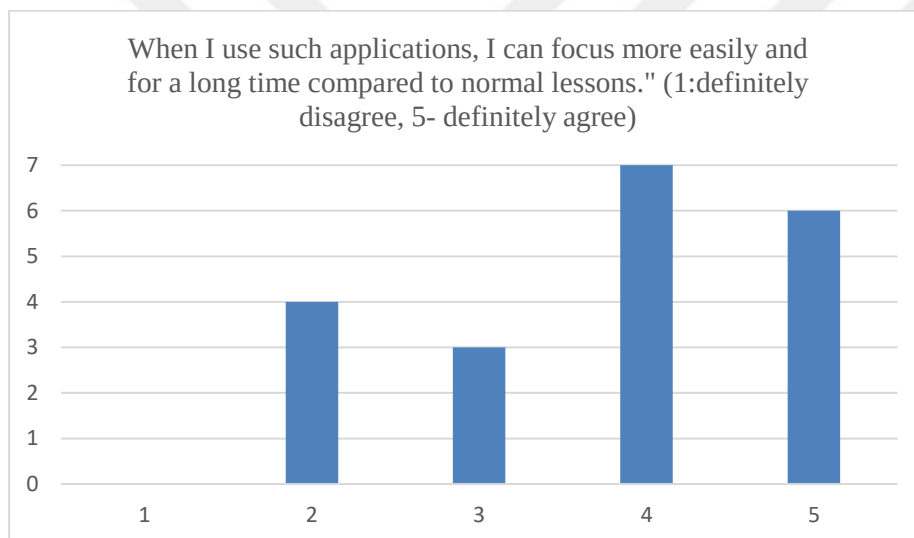


Figure A.9 : Students' responses to question 6.

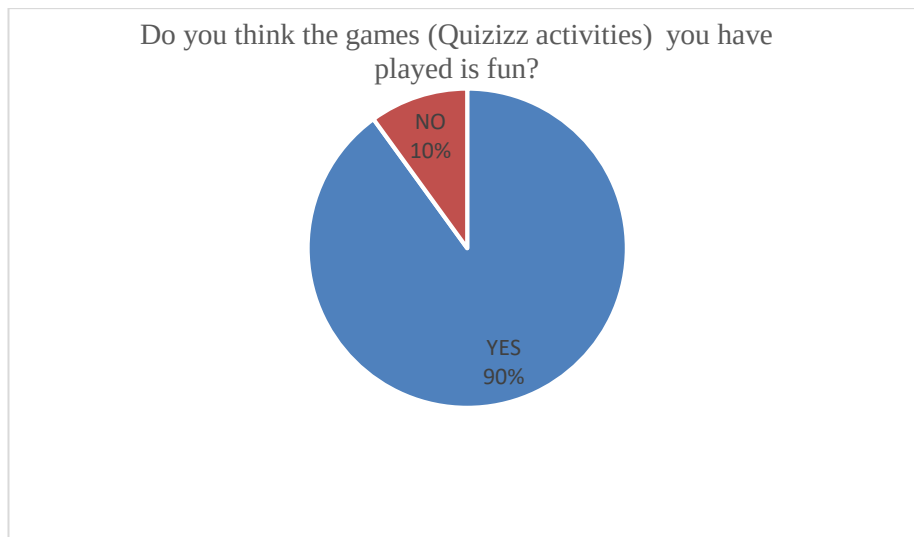


Figure A.10 : Students' responses to question 7.

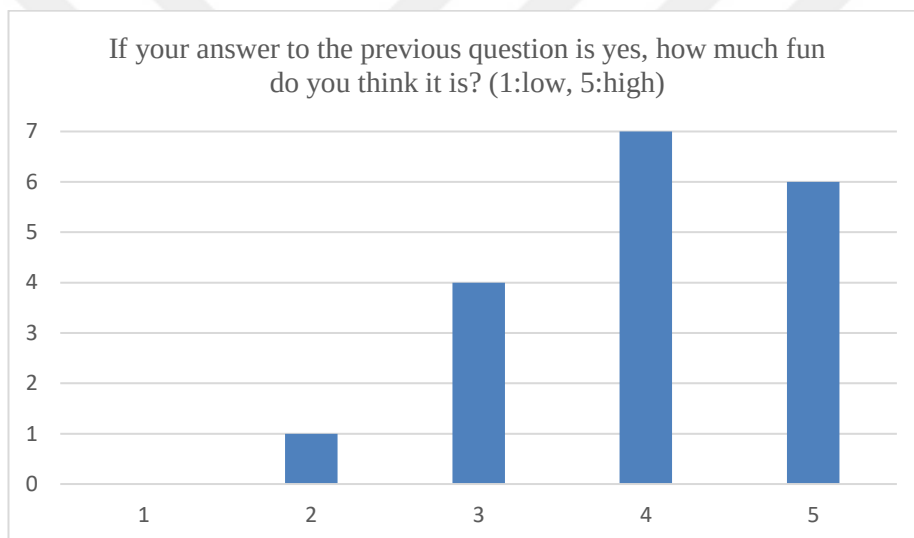


Figure A.11 : Students' responses to question 8.

In your opinion, what are the advantages of using such (Quizizz) applications in the lesson?

- Keeps the student in the class.
- Providing reinforcement at the end of the lesson and enabling us to measure the lesson achievements
- It helps me to learn the subject taught in the lesson better. It is easier for me to remember what is being said.
- Everyone has a say in a small competition
- refresh the information

- Increasing the competition spirit
- I think that students are given the opportunity to learn technologically and innovatively, and the generation born with technology will express themselves more easily with this application.
- You understand the lesson better.
- It allows us to test the knowledge we have learned in a fun and non-stressful way.
- The prepared questions will consist of basic concepts about the lesson, so if there is anything we missed, what has been done makes it easier to follow up.
- Interactive lectures, repetition of topics, and competitive environment.
- I think it is useful in terms of recall because the questions are looked at more carefully and enthusiastically.
- It may be easier to remember for people with a strong visual memory.
- Information is easier to remember.
- It is like coding to see the information in a problem rather than written paragraphs and retain it more easily in our minds.
- It helps me understand the topics better.
- I think it increases focus, interest, and learning levels.
- The class becomes more flowing.
- It makes learning permanent.

In your opinion, what are the disadvantages of using such (Quizizz) applications in the lesson?

- It can be frustrating because the ranking is visible.
- It is negative that the questions and answers cannot be reached again after the quiz. However, if the questions and answers are uploaded as a file, it may be easier to learn.
- Not knowing whether a grade is given or not.
- I would guess that it would have the disadvantage of not being an effective learning tool if every lesson or something was done if the quizzes were too long, and if no questions were based on comments. But I don't think it has any disadvantages as it is used in our lessons.

- Non-interpretive questions can get boring after a while.
- Because it is in the form of a game, students may not take it very seriously.
- Being in the race stressed me out.
- Creates a highly competitive environment.
- Of course, it takes some time to connect and to wait for everyone.
- Having too many questions gets distracting after a while.
- Cheating and helping each other.

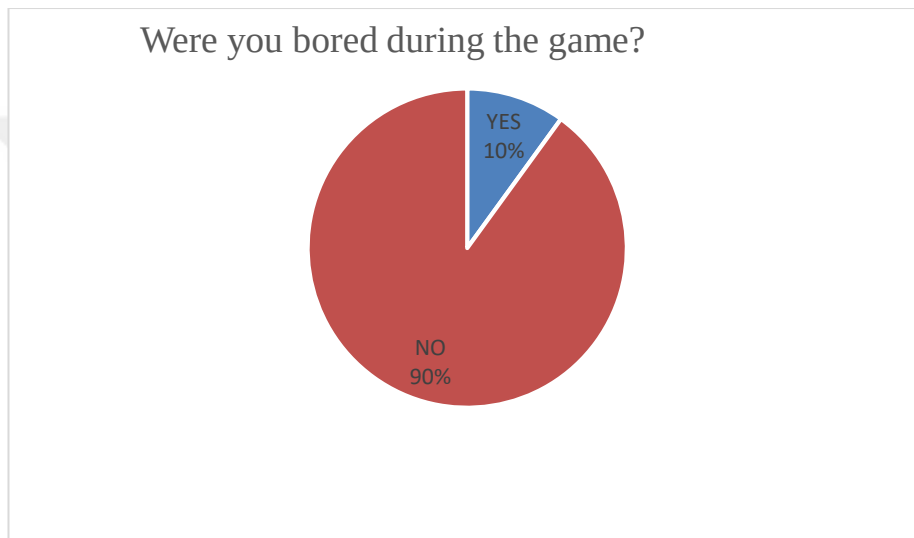


Figure A.12 : Students' responses to question 11.

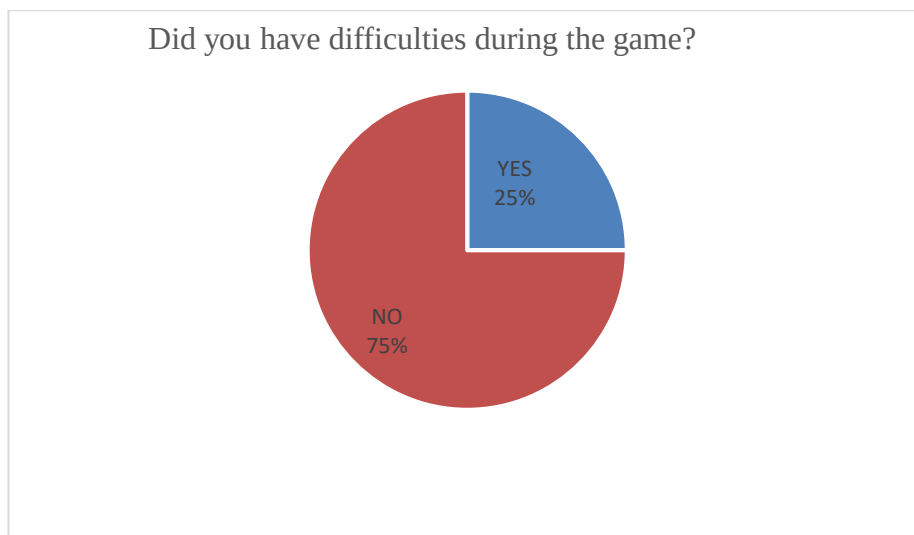


Figure A.13 : Students' responses to question 12.

If your answer to the previous question is yes, you can state the reason:

- There are very few technical difficulties.
- Sometimes there is a problem with the internet connection.
- Stress.
- Sure there were some connection issues, but they were negligible.

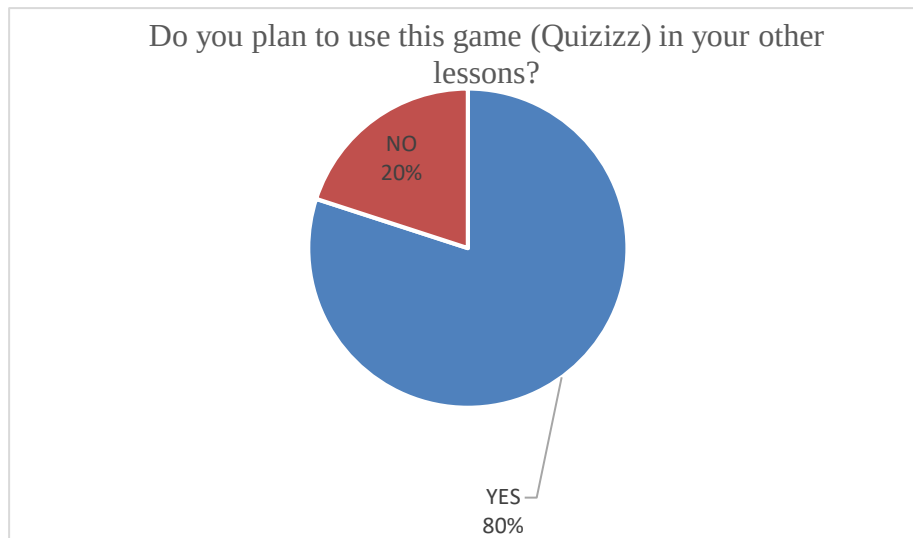


Figure A.14 : Students' responses to question 14.

What thoughts would you like to add about your gaming experience in this lesson?

- I can say that I remember the information from the games.
- I think it is a useful and enjoyable experience.
- Sometimes even if I give wrong answers to the questions, the answers stay in my mind more.
- It should be applied in every lesson.
- It was a very enjoyable and innovative process.
- I think it should be played more often.
- It was a nice experience.
- In general, if the questions were more visual, video, or colorful, they might have been more interesting.
- I think the game experience creates a different atmosphere for the students and increases their interest in the lesson.
- I think it's a nice app, but the existence of the leaderboard sometimes causes a lot of stress.

- In fact, it was strange to implement such a game-style activity in university and one of the department courses, but why not? It is quite feasible; after all, there is no limit to learning by having fun.
- It helps me focus on the lesson and allows me to grasp the topics.
- Many thanks to our teachers for their efforts for us.
- More quizzes can be done with fewer questions.
- If it can be developed further, I do not know how it will be developed, but it may be better, but I think that even this version is helpful.





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PUBLICATIONS, PRESENTATIONS AND PATENTS ON THE THESIS:

- **Yaşlak B., and Gülümser A.A.** Incorporating Games into Turkish Urban Planning Education: Preliminary Results. International Conference of Educational Technology and Online Learning, June 20-23, 2023 Balıkesir, Türkiye.
- **Yaşlak B., and Gülümser A. A.** A Playful Tool for a Planful Sustainability: Sustainability in Urban Games. 62nd ERSA Congress - Urban Challenges and Sustainable Technological Revolution, August 28 – September 1, 2023 Alicante, Spain.
- **Yaşlak, B.** 2024. Gamification in Planning Education: Impacts on Academic Achievement, *A|Z ITU Journal of the Faculty of Architecture*, 21(3), 671-685.
- **Yaşlak, B., Gülümser, A.A.** 2024. Categorising Urban Games from a Sustainability Perspective, *Megaron*, 19(4), 435-445.