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Gamification in planning education: Impacts on academic achievement

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Abstract
When examining gamification in urban planning education within the existing literature, it becomes evident that numerous studies have been conducted on applied/studio courses. However, there is a notable gap in the literature regarding theoretical courses. The objective of this study is to assess the influence of Game-based Student Response Systems (GSRS) on the academic performance of urban planning students in a theoretical course titled "Introduction to Urban and Regional Planning & Ethics.". Throughout the semester, students participated in four quizzes on the online platform Quizizz and also completed a questionnaire. The study assessed the effect of GSRS on academic success through a correlation analysis of participation rates in quizzes and final exam grades. The findings indicated no significant impact on academic achievement. However, based on the questionnaire responses, students exhibited a positive attitude towards GSRS.

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Keywords
Education, Game-based student response systems, Gamification, Quizizz, Urban planning education.

1. Introduction

The field of education undergoes a continuous transformation in response to evolving technological advancements and the shifting characteristics of the new generation. This transformation entails a shift from traditional pedagogical approaches toward more learner-centred methodologies, wherein students assume a more active role in the learning process. Consequently, a growing discourse surrounds the need for innovative educational systems. Within the domain of planning education, similar discussions have taken place for an extended period, aiming to enhance the ongoing quality improvement of educational practices. 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. 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 on 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 significantly contribute to the acquisition of "skills." The planning education curriculum is meticulously designed and continuously refined to align with the 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 planning education. In his 2006 article that synthesized previous research on planning education, Frank reported that integrating pedagogical methods and techniques 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

Employing 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 COVID-19 pandemic prompted educational institutions worldwide to transition entirely to online learning. Similarly, the devastating earthquake that struck Türkiye in February 2023 necessitated universities to adopt online education partially. Fundamentally, online applications have emerged as essential tools, particularly during extraordinary periods. The pressing need for innovative educational methodologies to deliver resilient education has become evident. One of the methods that can be used in lessons in line with these needs is the gamification approach, which can include multimedia and online learning elements. The term gamification, originally from the digital media industry, generates public debate alongside apps ranging from news and entertainment media on productivity, health, finance, sustainability, and education (Deterding et al., 2011). From an education perspective, gamification is "the concept of applying game mechanics to engage and motivate students in learning" (Mohamad et al., 2018, p. 22). Saleh and Sulaiman make another definition as "adding game elements or gameplay elements in education" (2019, p. 030005-1). According to gamification, the learner is one of the most crucial actors in the learning process. Learners should choose the learning method, and students compete to earn more badges (or points) depending on their intrinsic or extrinsic motivation (Bíró, 2014). Gamification includes games that allow student attendance to support teaching concepts of the course (Creel et al., 2021). Increasing students' motivation is an essential goal of gamified activities. Gamified and innovational interferences should alter the students' academic performances and motivational

atmosphere to maximize their benefit and increase 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 increase, leading to higher student participation; thus, a gamified learning environment occurs. Gamified learning means including gamified design features in the learning environment, resulting 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 essential components in formal and informal education (Arif et al., 2019). Game-based student response systems (GSRS) are examples of incorporating gamification in education. In this context, the study focuses on students' adoption of this new method and its potential impact on academic success in urban planning education.

GSRS practices have been examined in diverse disciplines. However, their application in planning education has yet to be explored, thus highlighting the novelty of this study. Within planning education, research on gamification has predominantly focused on games that emphasize role-playing and simulation elements rather than GSRS specifically. Existing studies have primarily focused on the benefits of gamification approaches in applied studio courses, highlighting the necessity of exploring practical methods that can be used in theoretical classes. The significance of these studies lies in their emphasis on applied studio courses, which have traditionally been the primary domain for gamification interventions. However, exploring effective gamification strategies tailored explicitly for theoretical courses remains a crucial area of inquiry that warrants further discussion in the academic discourse. To fill this gap, the study aims to contribute to the existing literature by exploring the potential application of GSRS in theoretical courses within the planning discipline. Urban planners need to integrate their academic expertise into the educational framework, encompassing not only the dissemination of knowledge to students but also the critical examination of knowledge transfer and its assimilation by students. Unfortunately, the growing number of students enrolled in planning education has posed challenges to effective communication and evaluation, particularly within theoretical courses. The surge in student enrolment has led to overcrowded classrooms, especially in theoretical classes in the initial semesters. These overcrowded classrooms may engender various issues. One of them is the inability of teachers' questions to reach all students, which creates a potential lack of participation in the evaluation process (Ijaiya, 1999). Exploring innovative educational methods within planning education is imperative to address these challenges. This study employs a fieldwork-based approach to observe and analyse one such innovative method in action. This exploration is crucial for refining and advancing pedagogical approaches within planning education, ensuring that theoretical courses become dynamic spaces for active engagement, critical thinking, and effective knowledge transfer.

Additionally, ensuring the retention of information is a critical necessity, contributing significantly to increased success in the course. How information is significantly acquired influences its assimilation and subsequent retention in memory for future utilization. It is insufficient for the present generation to obtain information solely through traditional methods, as such approaches lack both motivational aspects and efficacy in fostering long-term retention and academic performance. This issue is particularly evident within theoretical courses in planning education. Gamification applications have been employed as a potential solution to address this challenge. I aim to investigate the effects of GSRS as a gamification application on students. Specifically, I seek to analyse the impact of GSRS on students' academic achievement and examine its potential to enhance students' learning experiences within the context of planning education. Following this aim, I address two research questions:

1. Does using game-based student response systems enhance students' academic achievement?

2. Do students exhibit a positive inclination towards implementing game-based student response systems?

This gamification experience holds critical significance for planning education, especially considering the rapid increase in the number of planning students in Türkiye in recent years. In this context, swift evaluation and prompt feedback during the course have gained paramount importance. Through this research, I aspire to provide valuable insights contributing to the ongoing evolution of planning education methodologies. This study consists of five sections, including this introduction. Section two presents an introductory literature review for planning education and game-based student response systems. Section three explains the method. Section four provides research results. Finally, section five discusses the results and research questions.

2. Literature review

2.1. An exploration of novel applications in education: Gamification and student response systems

Numerous concepts and theories from past to present are explored in research concerning learning in education. The main ones include behaviourism, social cognitive theory, information processing theory, constructivism, motivation, self-regulation, and development (Schunk, 2012).

- According to behaviourism, the objective is to facilitate learning by implementing a reward-punishment system within educational contexts (Zhou & Brown, 2015).
- Social cognitive theory, which builds upon the principles of social learning theory, suggests that learning occurs through observational processes (Zhou & Brown, 2015).
- Informational processing theory highlights "attention, perception, encoding, storage, and retrieval of knowledge" (Schunk, 2012).
- Constructivism emphasizes that individuals internally construct knowledge, from self-construction to socially mediated constructions, and requires structuring teaching and learning experiences to encourage students to create new knowledge by challenging their thinking (Schunk, 2012).
- Motivation initiates and sustains goal-directed behaviour, and motivated learning theories suggest motivation's role before, during, and after learning (Schunk, 2012).
- Self-regulation involves learners systematically using their thoughts, emotions, and behaviours towards achieving their objectives (Schunk, 2012).
- Development involves changes over time, closely connected with learning, as the development level limits the learning process (Schunk, 2012).

These theories significantly contribute to the education system, defining varying roles and activities for students and teachers. For instance, Bíró (2014) states that while students adopt a reactive attitude in theories like behaviourism and social cognitive theory, they demonstrate an active attitude in constructivism. From this perspective, I can say that students will display an active attitude in approaches such as motivation, self-regulation, and development. Moreover, exploring novel approaches that integrate both reactive and active attitudes is imperative.

Adopting novel educational practices has gained unprecedented significance recently, and technology stands out as a pivotal driver behind this transformative shift. During the Fourth Industrial Revolution, technology usage developed and increased to such an extent that it penetrated the field of education (Idris et al., 2020). The crucial effect of technology on education is undeniable. Thanks to technological improvements, information sharing in electronic environments has become achievable, and thus, educational frameworks can go beyond traditional classrooms (Bolat & Taş, 2022). Traditional methods include general and more standardized approaches. With the help of information and communication technology (ICT), more personalized and motivation-enhancing activities can be produced

(Carrión Candel & Colmenero, 2022), and teachers can complete their exercises more productively and effectively (Zuhriyah & Pratolo, 2020). The education landscape is undergoing a profound transformation, with technology emerging as an indispensable and integral component of the educational paradigm.

Education, when guided by high-quality standards, should continually evolve by incorporating innovative techniques. Recent views on students' technology usage preferences and the effects of technology on learning have revealed that using technology and tools increases learning capacity (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, given the evolving nature of students in the new century, they will prefer technology-supported learning (Sani-Bozkurt, 2021). In adapting to this paradigm shift, educational methods that leverage the opportunities and advancements provided by technology are relevant and indispensable for meeting today's students' heightened expectations. Integrating technology into education aligns with the evolving needs of learners, ensuring that educational practices remain responsive and engaging in the face of contemporary challenges and preferences.

With the increasing pressure of technology in classrooms, educators must think about all the opportunities and benefits they could obtain from the use of various resources that they would use in their lessons (Arif et al., 2019). Moreover, motivation is essential in teaching-learning (López Carrillo et al., 2019). As a result, the teacher is responsible for promoting a learning process with higher participation whilst influencing the students' intrinsic motivation (Bíró, 2014). Necessarily, students cannot have a successful learning experience if their motivation is low, and it may be a challenging effort for educators to find appropriate tools or techniques which are appealing and can develop learning (López-Martínez et al., 2022). The imperative for innovations within the education system arises due to the formidable challenge of enhancing students' motivation and participation, as traditional methods often fall short in addressing the evolving dynamics and diverse preferences of contemporary learners.

Maintaining the interest and engagement of students becomes a challenge and dilemma for educators (Raju et al., 2021). The reason for this challenging situation is the nature of traditional education techniques. Traditional learning methods are viewed as not student-oriented, and educators use them less (Raju et al., 2021). On the other hand, 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 they take on a more active role in shaping and controlling their learning trajectories. In the literature on student response systems (SRS), also called electronic response systems (ERS), gamification is counted among the innovative approaches in modern education systems.

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 allow students 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". 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 student's answers (Judson & Sawada, 2002). However, providing this under normal condi-

tions may be challenging 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, the teachers can communicate easily with the students through instant assessments, creating a more problem-free learning environment for the students.

Additionally, in his article discussing the factors affecting attention in lessons, Bradbury (2016) highlighted clickers as one of the tools facilitating student engagement. From the 1960s to the present, students have consistently supported using ERS 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 ERS facilitates learning, increasing student participation, and it is thought that ERS 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 using ERS and academic achievement, according to studies conducted in the 1960s and 1970s (Judson & Sawada, 2002). In this case, one can comment that although ERS facilitates and accelerates the learning process, it does not severely affect grade evaluation.

Gamification is another newly developed method where the student can play a more active role in learning. Gamification is defined as "using game design elements in non-game contexts" (Deterding et al., 2011, p. 10). Gamification differs from games as a concept; the central axis of gamification is not games but game elements such as badges, leader boards, and levels are included (Bolat & Taş, 2022). Notably, gamification does not represent a direct emulation of a game; instead, it encapsulates select game features. Bíró (2014) suggests that gamification should be considered a new learning theory alongside previous learning approaches. In the 21st century, it is critical to adopt gamification in education to build more robust experiences in learning and teaching (Anak Yunus & Hua, 2021).

Advancements in technology have provided opportunities for integrating various educational methods, including SRS and gamification. These approaches can be combined and implemented to enhance the learning experience. Currently, SRS has been revived and augmented with novel add-ons. Including gamification as an additional layer has conferred a new dimension to SRS. In this regard, novel SRS alternatives that incorporate gamification elements have emerged. Such a combination of gamification and SRS is called "Game-based SRS" in the literature. Game-based SRS increases student motivation more than standard SRS (Wang, 2015). Many applications have been developed to engage students, such as Kahoot!, Socrative, Quizizz, and Quizalize. These online platforms present great activity alternatives which develop the participation and motivation of the students (Raju et al., 2021). Quizizz is a technological design game platform for more than one-player classroom activities (Zuhriyah & Pratolo, 2020). Another platform, 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 class (Creel et al., 2021).

Studies in the literature examining the use of gamification tools have revealed several key findings. Notable studies indicate that a game-based SRS enhances student motivation (Lin et al., 2018; Taspinar et al., 2016). This heightened motivation, in turn, contributes to an improved learning experience (Lin et al., 2018). Another benefit lies in "fun," particularly in theory-intensive contexts (Taspinar et al., 2016). Additionally, another study emphasizes the effectiveness of gamification in improving short-term information retention (Putz et al., 2018). Given that information attention is a critical component of learning, the positive impact of gamification in this regard holds significance in education.

2.2. The implementation of gamified activities in planning education

When exploring gamification in planning education through literature review, I encountered notable instances where city-related games were directly integrated into educational settings. Therefore, this section provides a concise overview of the objectives and methodologies employed in utilizing games within planning education.

The use of games within planning education has been widely deliberated within scholarly discourse. Central to this debate is the critique of excessive reliance on conventional methodologies in planning education. Traditional education typically combines theoretical instruction and hands-on projects for 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. Games can provide significant value as an additional component to conventional courses (Dodig & Groat, 2019). The values introduced by games have been duly acknowledged and incorporated within the domain of planning education, particularly in experiential learning, motivation and memory.

A significant aspect of incorporating games should be to encourage role-playing, which can effectively deepen students' comprehension of the various societal groups' contributions to shaping the human-built world, particularly our cities, towns, and villages (Robinson et al., 2021). They emerged with an emphasis on experiential learning digital and board games. In specific case-study investigations, digital games such as Cities: Skylines and SimCity have been used as examples (Robinson et al., 2021; Li et al., 2022; Khan & Zhao, 2021; Minnery & Searle, 2014). In addition to these digital games, planning education utilizes board games such as Participology and Geopoly. Each category of games presents distinct advantages and disadvantages. Digital games excel in 3D visualization capabilities, but challenges like cost and computer proficiency may arise (Li et al., 2022). Board games may also entail associated fees, while free options can be incorporated into the lesson through the extra efforts and opportunities teachers and students provide. 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 current literature has extensively explored the implementation of gamification within planning education, primarily focusing on planning practice and applied courses (Robinson et al., 2021; Li et al., 2022; Khan & Zhao, 2021; Minnery & Searle, 2014). However, the literature reveals a need for more attention to information retention and student motivation within theoretical classes. Nevertheless, the knowledge acquired through theoretical lessons significantly supports the applied studio courses. Therefore, expanding research efforts to investigate gamification methods suitable for theoretical classes is necessary. In addition to board games and video games, which offer simulation and role-playing experiences in planning practice, the game-based SRS discussed earlier should be critically evaluated as an alternative approach for theoretical courses.

3. Method

3.1. Participants and data collection

Participants in this study were students enrolled in the "Introduction to Urban and Regional Planning and Ethics" course, which is part of the first-year curriculum of the ITU Urban and Regional Planning department. The primary reason for selecting this particular course for the study is its classification as a theoretical course within the curriculum. Additionally, it holds significance as a compulsory course for first-year students. Given

that all students enrolled in the program are required to take this course, it inherently possesses a large class size, aligning with this study's objective of reaching broader student population. A total of 86 students participated in the course and the final examination. The quizzes were administered to those present in class on the respective quiz days, resulting in varying participant numbers for each quiz. This case study was performed during the 2022-2023 fall academic year. After online education was applied during and following the pandemic, this study was implemented when a complete shift to face-to-face education took place.

In alignment with this transition, the quizzes for this case study were administered in the physical classroom setting, thereby embracing the return to traditional in-person educational practices. Concurrently, the post-quiz questionnaire, designed to gauge students' attitudes and perceptions, was conducted online to leverage the advantages of digital data collection. Over the semester, students engaged in four quizzes facilitated through Quizizz, an online GSRS platform. This dynamic approach aimed to explore the efficacy of GSRS in enhancing student engagement and comprehension in the context of theoretical planning courses.

Throughout the academic term four quizzes were administered as integral class activities. These quizzes were sequentially conducted, introducing new questions as a new subject matter was covered. In the first quiz, questions centred on fundamental planning concepts such as migration, sustainability, garden city, and radiant city, along with their respective definitions, content, and founders. The second quiz encompassed inquiries regarding the plans, works, and concepts advanced by prominent figures in the planning field. In the third quiz, questions delved into topics such as system definition, the planning process, the concept of regions, and the management of local-central administrative units. As for the fourth and final quiz, it revisited questions that had received the lowest correct response rates in the preceding three quizzes. Notably, these quizzes did not contribute to the student's final grading; instead, their primary objective was to gauge the extent of students' knowledge retention and recall while maintaining their engagement. 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 quiz: 71 students
- Second quiz: 70 students
- Third quiz: 46 students
- Fourth quiz: 55 students

These quizzes, administered via the Quizizz platform, facilitate the practical application of gamification elements during the course, enhancing participation, fostering a competitive environment, and increasing engagement and entertainment. In this GSRS experience, students can access the online platform via mobile devices and internet connectivity. Examining this system's components reveals that each student engages individually in activities pertinent to the course simultaneously, fostering a participatory environment. Moreover, the scoring mechanisms, where students ascend rankings based on their performance, promote a competitive environment. Additionally, the point-based competition enhances the lesson's entertainment value. Particularly, in multiple-choice questions, the system highlights the correct answer on-screen even if a student responds incorrectly, thereby aiding retention in visual memory. Furthermore, instructors promptly assess the accuracy rate of responses displayed on the screen, providing insights into the level of understanding among students regarding the topics covered.

After completing all class activities (quizzes), the students were asked to participate in a questionnaire examining their ideas and perspectives about this experiment. The questionnaire, prepared using Google Forms, was

distributed to the students. Participation in the questionnaire was voluntary. The questionnaire consisted of two demographic questions, six yes/no questions, five Likert scale questions, and four open-ended questions. The questionnaire content focused on how students felt during this gamification experience, their positive and opposing 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, various forms of data were acquired. 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 for assessing academic achievement comprises the final exam scores. The course instructor provided this dataset.

3.2. Data analyses

The data analysis approach employed in this study is correlation analysis. The first step was to evaluate the effect of gamification on students' academic achievement. The correlation coefficient was initially computed between the students' final examination grades and the number of quizzes they attended. Then, to further elucidate the findings, the correlation coefficient was calculated between students' success rate in all four quizzes and their performance in the final examination. This analysis aimed to determine if achieving favourable quiz results corresponded to a successful outcome in the final exam. The subsequent phase entails descriptively elucidating the responses to the questionnaire questions, categorizing them into fundamental themes, and quantifying the correlation coefficient among these responses. This process aims to ascertain the interconnectedness and associations between the questionnaire responses based on distinct categories.

4. Results

Traditional educational methods, prioritizing teacher-centred approaches, might be insufficient for the contemporary generation. This situation arises because these methods are perceived to lack motivation and effectiveness in promoting long-term retention and academic performance. Furthermore, participation has emerged as a crucial aspect. Ensuring student engagement within traditional methods presents challenges. This is especially evident in theoretical courses in planning education. To address this challenge, gamification applications, such as Game-based Student Response Systems (GSRS), have been used as a potential solution. This study aims to investigate the impact of GSRS on students by analysing its effects on academic achievement and exploring its potential to enhance learning experiences in planning education.

Within the scope of this case study, four different quizzes were applied. As quiz participation is voluntary and only includes those present in class on the given day, participation rates- and consequently the total number of quizzes each student completes by the end of the semester-vary. Sixteen students participated in all four quizzes, 41 students participated in three quizzes, 20 students participated in two quizzes, and six students participated in only one quiz (Table 1).

Table 1. *The number of activities that students participated in.*

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

First, the relationship between the number of activities students participated in and final term grades is evaluated to measure whether gamification activities affect student academic achievement. According to the results, the correlation coefficient was determined to be 0.22 (95% Confidence Interval: 0.016 - 0.424) based on an actual sample size of 84. In contrast, the estimated sample size for this analysis was initially set at 160. While a positive relationship exists between the number of activities students participate in and the final term grade, it is weak. In other words, this gamification

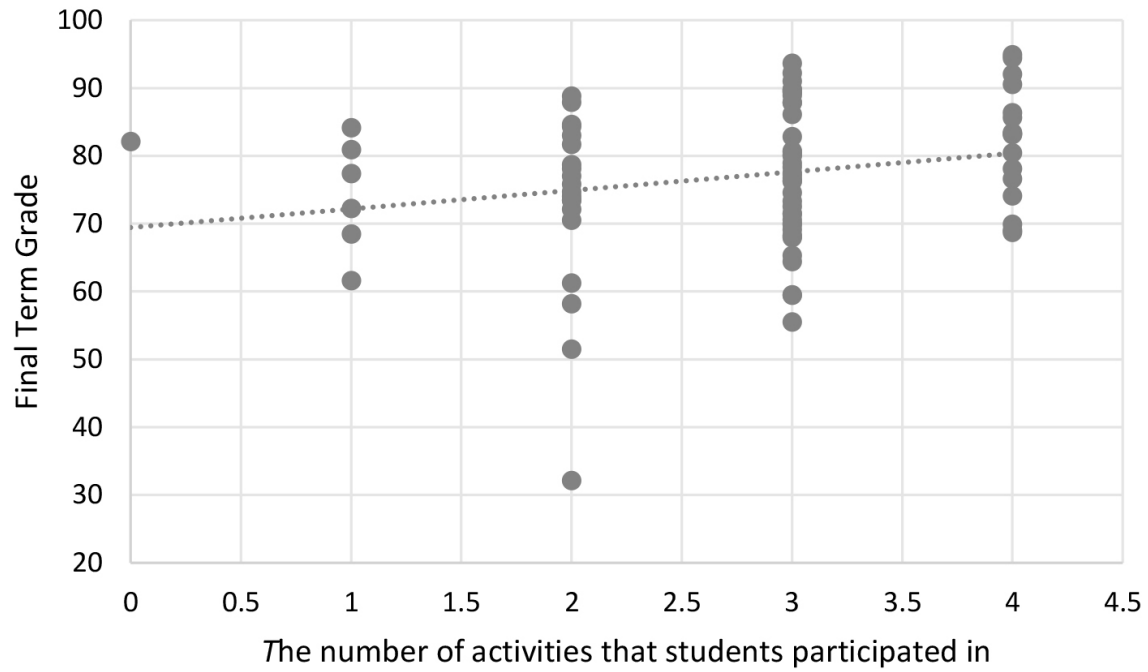

Figure 1. *Correlation between final term grade and the number of activities that students participated in.*

activity did not significantly affect academic achievement (Figure 1).

The number of activities the students participated in did not substantially affect the final grade. In other words, if students participate in all the quizzes or only one, they can achieve successful results. Of course, this shows that the student can improve their motivation and learning with different methods. Despite the absence of a significant correlation between the frequency of quiz participation by students and their academic performance, I sought to evaluate whether a correlation existed among the examination grades of the 16 students who participated in all quizzes. The students' mean performance of class activities and final term grades are presented in Table 2. According to this table, the class activity performance mean represents the average score of the four quizzes each student participated in. The lowest average quiz score is 37, while the highest is 80. The final term grade column in the table reflects the grades assigned by the course instructor at the end of the semester, with scores ranging from 68.7 to 95.

When the correlation value between the quiz success averages and the end-of-term grade point averages of the students who participated in all quizzes was calculated, the correlation coefficient was determined to be 0.54 (95% Confidence Interval: 0.18 - 0.9) based on an actual sample size of 16. At the same time, the estimated sample size for this analysis was initially set at 25 (Figure 2). This means these two variables have a positive and moderately significant solid relationship.

Table 2. *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

While measuring the students' approach to this gamification experience

(Quizziz in this case), first, a Yes (positive)/no (negative) question is asked. Then, if the answer is yes, a Likert scale (1-low, 5-high) was used to assess the effectiveness (Table 3). Table 3 shows that the highest mean value is 4.25, which belongs to the question about remembering. Students think that the gamification experience will help them remember the information they learned in the lesson more quickly in the future. The lowest mean value of 3.75 belongs to the question about focusing. Based on these two results, the students think that the effect of this gamification experience will be

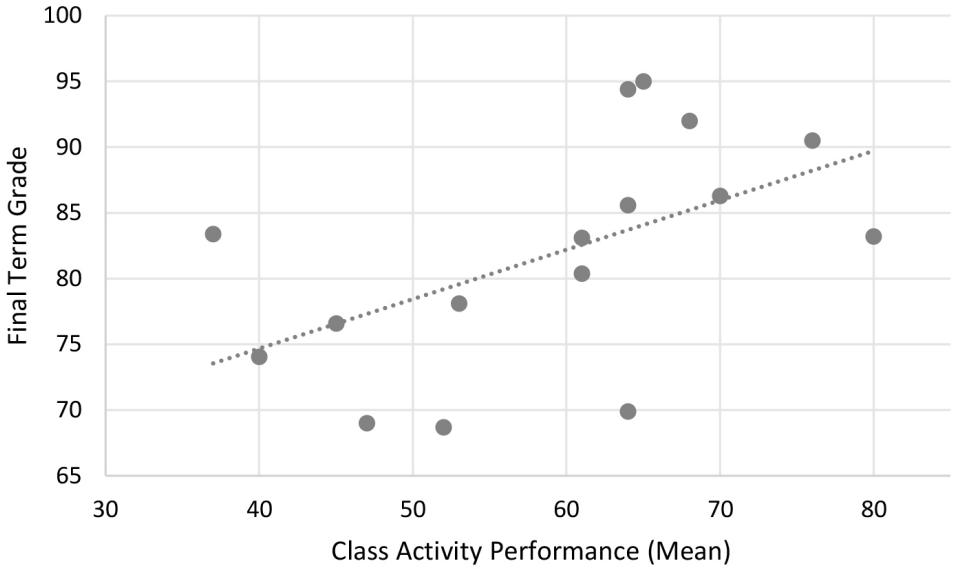

Figure 2. *Correlation between class activity performance and final term grade.*

Table 3. *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 **remembe**r 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**

more effective in the future rather than during the classes.

After evaluating the main themes separately (learning, remembering, motivation, focus, and fun), I calculated the correlation values to examine their relationships (Table 4). According to these values, the most vital relationship is between learning-remembering, learning-focus, and motivation-fun. Therefore, the students who participated in this study stated that remembering information and focusing during the lesson substantially affect learning, and entertainment and motivation are two essential elements that support each other.

Open-ended questions were incorporated into the questionnaire, with two distinct questions to gather students' positive and negative views. Upon analysing word frequency, I observed that students predominantly highlighted aspects such as "learn", "remember," and "easy" in their positive responses (Figure 3). Conversely, the frequency of negative views was lower compared to positive ones, resulting in no prominent recurring words. Nevertheless, the primary aspects students mentioned are shown in Figure 4.

The findings derived from the study were examined within two distinct categories, focusing on the impact of GSRS as a gamification application on academic achievement and students' attitudes towards the subject. Firstly, no significant effect on academic achievement was observed. Secondly, students exhibited positive attitudes. The analysis of student perspectives encompassed several key dimensions, including learning, motivation, remembering, focus, and fun. Notably, the students responded favourably, particularly for "remembering".

Table 4. *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	

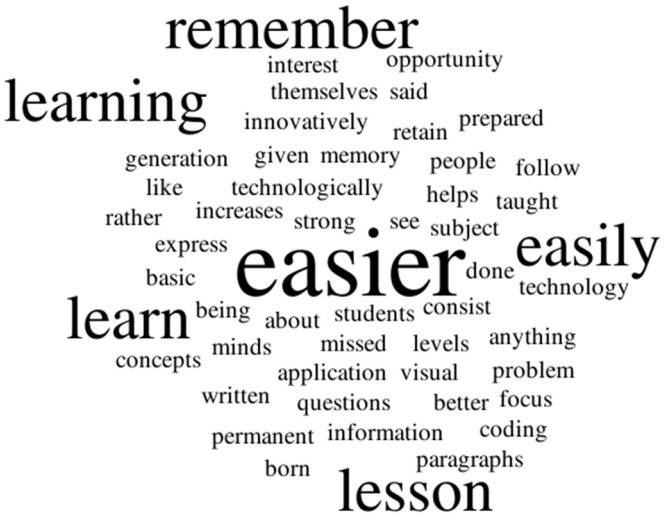

Figure 3. *Students' positive views.*

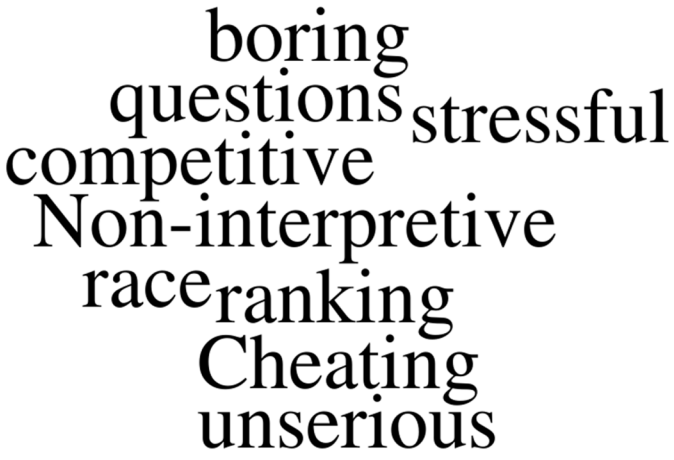

Figure 4. *Students' opposing views.*

5. Conclusion

Urban planning education has consistently employed gamification methodologies throughout history, notably simulations and role-playing. Existing literature predominantly reflects the application of these approaches in the context of applied studio courses. This study explores the impact of incorporating gamification into theoretical urban planning courses, an area underexplored in current literature. The GSRS, a gamified iteration of SRS, has been selected as the focal point of inquiry to investigate. I sought to explore the potential impact of GSRS on student motivation and overall course performance.

This study did not observe a substantial effect on students' academic achievement. In the examination conducted by Judson and Sawada (2002), the findings suggested that SRS did not exhibit a notable influence on ac-

ademic success. The results obtained from this study echoed the outcomes of the earlier investigation, indicating a parallel lack of substantial effect on academic success.

Another facet explored in this research delved into students' attitudes toward GSRS implementation, encompassing five fundamental concepts of evaluation: remembering, motivation, focus, fun, and learning. Previous studies have asserted that GSRS experience enhances motivation, which, in turn, contributes to learning (Lin et al., 2018; Taspinar et al., 2016). Moreover, this application is noted for its entertainment factor, particularly in theory-based courses, and has positively impacted short-term memory (Taspinar et al., 2016; Putz et al., 2018). This study yielded similar findings, where the concept of "focus" was also assessed in addition to these four concepts. Despite students expressing positive opinions across all these dimensions, the highest positive evaluation was attributed to the concept of remembering. Diverging from existing literature, I investigated the interrelationship among these concepts based on student responses, which unveiled intriguing correlations. A strong correlation exists between learning, remembering, and focus, alongside a notable association between motivation and fun. These two fundamental groups could be instrumental in fortifying the educational process, with fun linked to motivation, while focus and remembering are closely associated with learning.

These findings suggest that GSRS does not directly correlate with academic success. However, while quantitative evidence supporting the direct impact of gamification applications on academic achievement remains inconclusive, students maintain a favourable disposition toward gamification. This implies that gamification can function as a means to enhance student involvement in classroom activities. Essentially, the student's active engagement with this approach can boost participation. Heightened participation may, in turn, indirectly influence success in future periods. Consequently, gamification, although not a standalone tool for educational development, holds promise as a supplementary model in theoretical courses within planning education.

The method employed for theoretical courses in the study can be extended to other research contexts. The primary requirement is creating questions tailored to the course content. These questions can be developed by the researcher based on the course material or sourced from the course instructor. An appropriate GSRS platform can then be selected to administer the quizzes according to the researcher's preference. To evaluate the impact of this gamified quiz experience on academic success, analysing its relationship with students' course grades at the end of the semester provides quantitative data. Additionally, assessing students' attitudes through questionnaires is crucial for determining the influence of this new educational method on their preferences for future courses.

This study contributes novelty by exploring gamification within theoretical planning education courses. However, it is subject to limitations concerning time constraints and the number of students involved. Expanding the case studies across courses from the first to last year could provide more comprehensive insights. With the increasing research in planning education, there exists potential for expanding and diversifying gamification activities.

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