

# The Impact of Generative Artificial Intelligence Support in Innovative Teaching Approaches: GenAI-Powered Gamified Flipped Learning Approach

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**Abstract:** *The study aims to examine the effects of the planned use of generative artificial intelligence (GenAI) support in the gamified flipped learning approach, one of the innovative teaching approaches, and its self-directed use by students. A mixed-methods approach combining quantitative and qualitative data was chosen to enable a multidimensional examination of the study's objective. A total of 47 students participated in the quantitative phase of the research, with 21 in the experimental group and 26 in the control group. A total of 40 students participated in the qualitative data collection process, with 14 from the experimental group and 26 from the control group. The quantitative data of the study consists of students' academic achievement grades and information and communication technology (ICT) proficiency scores. The qualitative data of the study was collected using a semi-structured interview form consisting of open-ended questions. According to the quantitative data, the results of the study showed that there was no significant difference in academic achievement and ICT proficiency between students who received planned support from generative AI and students who used generative AI on their own in the course conducted with the gamified flipped learning approach. In the qualitative findings, students who received planned support from GenAI were more likely to report effective and lasting learning experiences compared to students who used on their own. Qualitative findings indicate that students in the experimental group had a more positive view of ICT competency development compared to the control group.*

**Keywords:** *gamification in education; flipped learning approach; generative artificial intelligence; ICT competencies.*

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## Introduction

Digital transformation, particularly with the widespread use of GenAI tools in recent years, is reshaping teaching and learning processes in higher education. The tools used in these transformation processes bring about remarkable changes in both teachers' instructional design processes and students' learning experiences (Chan & Colloton, 2024). When designing their teaching processes, teachers can use GenAI tools to plan lessons, develop content, prepare exam questions, etc., more easily, effectively, and in a shorter time (Matthew et al., 2023; Siiman, 2024). At the same time, these tools support teachers in providing materials that can address different needs, enabling the personalization of learning processes and efficiency in teaching (Shahzad et al., 2024).

AI-powered applications not only support teachers in their teaching processes but also increase students' levels of engagement and motivate them to actively participate in the learning process (Robledo-Rella et al., 2024). Research conducted in this direction shows that the use of genAI-based tools in learning processes increases students' self-efficacy, creativity, motivation to participate in class, and attention spans (Aghaee et al., 2024; Shahzad et al., 2024), and improve text production and, in particular, academic writing skills (Sarker et al., 2023; Tseng et al., 2025). However, concerns are also being raised that the unconscious use of these tools can lead to negative consequences such as ethical issues and excessive dependence (Williams, 2024), and that unquestioning trust in them can cause a decline in students' critical thinking and problem-solving skills (Aghaee et al., 2024). Therefore, it can be said that genAI tools and digital transformation present both opportunities and risks in higher education. In this regard, it is considered important to design new types of learning experiences alongside research that examines the ethical, pedagogical, and technological impacts of this digital transformation across all disciplines, based on the conscious and ethical use of AI tools.

## Flipped learning and gamification as pedagogical frameworks

The flipped learning model is a student-centered pedagogical approach that transforms traditional learning processes in schools, where knowledge transfer takes place outside the classroom, while the processes of applying and discussing what has been learned are carried out in the classroom (Flores et al., 2016). With this approach, students learn by taking an active role in the learning process, discovering and constructing knowledge, rather than passively receiving information (Nugraheni et al.,

2024). Teachers, on the other hand, play a guiding role and facilitate this learning process (Long et al., 2017). Research shows that the flipped learning model enables students to take responsibility for their own learning, develops their self-regulation and time management skills, and increases their motivation to learn (Aidoo et al., 2022; Samaila et al., 2024; Al & Gökçe, 2025). Furthermore, as students are able to be more active in classroom activities, it has been observed that their skills in social learning, communication, critical thinking, and problem solving also improve (Wang et al., 2019; Aidoo et al., 2022).

One of the innovative teaching approaches that aims to stimulate students' motivation by using game mechanics in educational processes and thus increase their active participation is gamification (Dicheva et al., 2015; Deci & Ryan, 2000). In this approach, game mechanics such as points, badges, leaderboards, etc. are used in various educational activities to stimulate students' feelings of competition, cooperation, and reward. Thus, by making the educational process more interactive, the development of students' cognitive, affective, and social skills is supported (Guerrero-Quiñonez et al., 2023). Studies show that the gamification approach increases students' interest and participation in learning processes (Subhash & Cudney, 2018) and positively affects their self-efficacy perceptions, problem-solving skills, and cognitive achievements (Hamari et al., 2014; Priyaadharshini & Maiti, 2023).

The use of the gamification approach in conjunction with the flipped learning model can increase students' motivation, particularly during the knowledge acquisition stages. This, in turn, enriches the learning experience by facilitating participation and interaction in classroom activities (Zainuddin, 2018; Ng, & Lo, 2022; Husain, Al-Shayeb & Khazalah, 2023). Studies indicate that gamified flipped learning processes develop students' self-directed learning skills, increase their interest in learning, and significantly improve their academic achievement and problem-solving skills (Lo & Hew, 2019; Zainuddin et al., 2020; Gündüz & Akkoyunlu, 2020; Priyaadharshini & Maiti, 2023). Therefore, it can be said that gamified flipped learning processes are more enjoyable and motivating for students.

### **Artificial intelligence as a learning support in flipped and gamified contexts**

In educational environments where flipped learning and gamification approaches are used, generative AI support can increase the applicability and effectiveness of these approaches. Research in this area indicates that using generative AI as a support tool in the flipped learning process can improve

the learning experience by facilitating personalization, learner analysis, instant feedback, and content creation (López-Villanueva et al., 2024). For example, Wang et al., (2025) and Zhang (2024) state in their studies that when the flipped learning approach is supported by AI, students' performance can be analyzed to develop more personalized content and teaching strategies can be improved according to student behavior. Similarly, a study conducted by Lawan et al. (2023) indicates that GenAI is supportive in providing individualized materials for students, while a study conducted by Shan & Liu (2021) states that this reduces teachers' workload and thus allows for more efficient implementation of extracurricular activities. While AI plays a facilitating role for teachers in the flipped learning process, it is also stated that students can progress at their own pace and according to their interests, and that their self-regulation skills develop (Bui, 2024). Similarly, supporting the gamification approach in education with AI can have positive effects for both students and teachers. It can facilitate students' analysis processes by enabling the selection of more appropriate reward types or tasks (Erbaşı et al., 2023). It can offer suggestions on providing appropriate feedback and determining the level of difficulty according to students' progress levels during the process (Gao, 2024; Figueroa & Rivera-Loaiza, 2023). This support allows teachers to conduct the process more easily, while faster and personalized feedback and rewards can also increase student motivation.

As a result, GenAI support enables the more effective implementation of the flipped learning approach and the gamification approach in education. A review of the literature reveals that while there are studies examining the effects of GenAI support in each approach separately, there is a need for research examining GenAI support in the gamified flipped learning process. Considering that it is impossible to prevent students from benefiting from GenAI in their learning processes today, it is important to ask what effect the planned integration of GenAI into educational processes by teachers will have on students. In this regard, this study aims to examine the effects of the planned use of GenAI support and its self-directed use by students in the gamified flipped learning approach, one of the innovative teaching approaches, and seeks to answer the following research questions:

1. Is there a significant difference in academic achievement between students who receive support from planned GenAI and students who utilize GenAI independently?
2. Is there a significant difference in information and communication technology (ICT) competencies between students who receive

- planned support from GenAI and students who utilize GenAI independently?
3. What are the students' views on the impact of receiving support from GenAI on learning and skill development processes?
  4. What are the students' views on the effect of receiving support from GenAI on the gamification process?
  5. What are the general views of students who receive support from GenAI in a planned manner and students who utilize GenAI independently regarding the gamified flipped learning approach?
  6. What are the views of students who receive support from GenAI in a planned manner and students who utilize GenAI independently regarding the effect of the gamified flipped learning approach on the learning process and motivation?
  7. What are the views of students who receive support from GenAI in a planned manner and students who utilize GenAI independently regarding the development of ICT competencies?
  8. What are the suggestions of students who receive planned support from GenAI and students who utilize GenAI independently regarding the implementation of the gamified flipped learning approach?

## **Methodology**

### ***Research design***

In this study, a mixed-methods approach was chosen to conduct a multidimensional analysis aligned with the research objectives, combining quantitative and qualitative data. The mixed-methods research approach enables a more in-depth examination of the research problem by systematically integrating quantitative and qualitative data within a holistic framework (Creswell & Plano Clark, 2018). Since equal importance is given to the quantitative and qualitative stages carried out sequentially, this study is structured as an equal-priority sequential mixed design. Although data are collected sequentially in an equal-priority sequential mixed design, both data types are interpreted through an integrative analysis, contributing to the results in a balanced manner (Lopez-Fernandez & Molina-Azorin, 2011; Creswell & Plano Clark, 2018).

The quantitative dimension of the study was structured using a quasi-experimental design with control and experimental groups to compare students' academic achievements and ICT competencies (Creswell, 2009). Accordingly, to answer the first research question, students' academic

achievements were measured by evaluating their performance assignments at the end of the implementation process. Data on students' ICT competencies, within the scope of the second research question, were collected at the end of the implementation process using the “Information and Communication Technology Competencies Scale for Teacher Candidates.”

In the qualitative phase of the research, data regarding students' perceptions, experiences, and evaluations of the process were collected using a semi-structured interview form presented at the end of the implementation process. The data obtained in this context were analyzed using a holistic approach to answer research questions 3-8 and to interpret the quantitative findings in depth.

### ***Participants***

The research was conducted during the 2024-2025 academic year at a state university in Turkey, within the scope of the “Information Technologies” course of the Turkish language teaching undergraduate program. All participants were first-year students. A total of 47 students participated in the quantitative phase of the research, with 21 in the experimental group and 26 in the control group. Students were randomly assigned to the experimental and control groups. A total of 40 students participated in the qualitative data collection process, including 14 from the experimental group and 26 from the control group. Written consent was obtained from all participants stating that they agreed to participate in the study and could withdraw from the study at any time, and participation was entirely voluntary.

### ***Implementation***

The “Information Technologies” course conducted as part of the research implementation process was structured based on innovative teaching approaches such as the flipped learning model and gamification approach, and was conducted by the researcher. The research implementation process lasted 7 weeks. During this process, all students learned Microsoft Office programs such as Word, Excel, and PowerPoint, as well as Google Forms and Canva applications, in line with the Information Technologies course curriculum.

Students in the experimental group used ChatGPT as a generative artificial intelligence (GenAI) tool during classroom activities to complete course-related tasks. As part of the experimental intervention, ChatGPT (OpenAI; GPT-3.5 version available during the implementation period) was

integrated as a pedagogical support tool within the gamified flipped learning process. The experimental group students were guided to use ChatGPT in a structured and planned manner to support task completion, idea generation, and problem-solving related to course activities. In the first week, the instructor introduced GenAI, ChatGPT, and its educational use. Throughout the implementation, the instructor provided example prompts and explicit guidance on appropriate and ethical use, emphasizing that ChatGPT should function as a supportive tool rather than a substitute for students' own cognitive processes. ChatGPT was used exclusively by the experimental group as part of the instructional design. No AI tools were used for data analysis, assessment, or evaluation processes within the study. Students in the control group, however, were not told anything about GenAI and were asked to complete the activities on their own. At the end of the process, data collected from the students showed that, when asked whether they had used GenAI during the course, students in the control group had also sought support from GenAI on their own. Accordingly, the study compared how teacher candidates used GenAI in a planned manner and on their own during the gamified flipped learning process.

Within the gamified flipped learning approach, gamification strategies such as “Nicknames, Point System, Badges, and Leaderboard” were used. The use of nicknames in gamified learning environments allows students to participate in the process more comfortably, helping to increase their motivation (Guevara & Flores, 2020). The point system allows students to track their own progress and positively influences their goal-oriented behavior (Jun & Lucas, 2024), while leaderboards create a competitive environment that increases students' motivation and participation in the process (Wijaya et al., 2024; Wu, 2023). Badges are frequently used in the gamification process as visual representations that allow students to see their own achievements concretely and showcase their achievements among their peers (Larrosa et al., 2023). During the implementation process, it was stated that +1 point would be added to those in the top 5 on the leaderboard each week, +3 points to those with 2 badges by the end of the term, +5 points to those with three badges, and +7 points to those with four badges. The badge winners and leaderboard were prepared using the students' nicknames and shared both via Google Classroom and in the classroom environment. The badges were designed in Canva with visuals that would attract students' attention, tailored to each week's activity topic.

Within the scope of flipped learning, all students carried out the application process in two stages: Pre-class Learning Activities and In-class Learning Activities. In the first stage, students watched videos related to the

course content before coming to the classroom. The videos were prepared by the instructor and shared with students on a weekly basis. Apart from face-to-face classroom activities, course follow-up (sharing materials and assignments, providing feedback, making necessary announcements, etc.) was conducted via Google Classroom. In the second phase, as an in-class activity, teacher candidates were given a general problem situation related to their field, and each week they were given interrelated tasks to solve this problem. To solve this general problem situation, students carried out various activities each week using the relevant IT tool taught.

### ***Data collection***

The quantitative data of the study consists of students' academic achievement scores and information and communication technology (ICT) proficiency scores. Academic achievement scores were obtained by taking the average of the assessment scores of the performance assignments completed by students on a weekly basis. The performance assignments were evaluated using assessment tables prepared by the researcher, which consisted of different criteria depending on each week's activity. This assessment was carried out using the same criteria for all students and was also used as the students' end-of-term grades.

Participants' ICT competency data were collected using the "Information and Communication Technology Competencies Scale for Teacher Candidates" developed by Tondeur et al. (2017) and adapted to Turkish culture by Alkan & Emmioğlu Sarıkaya (2018). Since the participants in this study were teacher candidates, this scale was chosen for assessing ICT proficiency. The scale consists of 19 items and two factors: "ICT competencies in supporting students' ICT use" and "ICT competencies in instructional design." The first factor measures how competent teacher candidates feel about teaching their own students to use ICT. The second factor measures how competent they feel about using ICT in instructional design processes. The 19-item scale is rated on a 5-point Likert scale ranging from "Strongly disagree" to "Strongly agree," with a minimum possible score of 19 and a maximum possible score of 95. A score between 1 and 35 on the scale is considered low ICT competence, a score between 36 and 70 is considered medium ICT competence, and a score between 71 and 95 is considered high ICT competence (Alkan & Emmioğlu Sarıkaya, 2018). In this study, Cronbach's alpha reliability coefficient was calculated as .983 for the internal consistency of the scale.

The qualitative data for the study were collected using a semi-structured interview form consisting of open-ended questions. The interview

form was developed by the researcher and reviewed by two different experts working in the field of instructional technologies at the university to finalize it. The developed interview form was prepared using Google Forms, and the data were collected online from participants after the implementation process.

### ***Data analysis***

In order to decide on the statistical method to be used in the analysis of quantitative data, the normality of the data distribution was examined. To determine the distribution status of the data, the Shapiro-Wilk ( $3 < n < 30$ ) and Kolmogorov-Smirnov normality tests can be applied depending on the sample size (Hanusz & Tarasińska, 2015). In test analysis results, if the p-value is greater than .05, the data is considered to be normally distributed (Kalaycı, 2010). The normality analysis results are presented in Table 1. According to the Shapiro-Wilk test results, academic achievement scores show a normal distribution in the control group ( $p = .651$ ), while the experimental group shows a deviation from normality ( $p = .001$ ). In terms of ICT proficiency scores, the data are normally distributed for both groups (Experimental:  $p = .210$ ; Control:  $p = .253$ ). Based on these findings, it was decided to use parametric tests for analyzing normally distributed data and non-parametric tests for analyzing data that do not meet the normality assumption.

**Table 1.** Normality test results for the experimental and control groups

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	p	Statistic	df	p
Academic achievement score	Experimental	,174	25	,048	,821	25	,001
	Control	,131	21	,200	,966	21	,651
ICT competencies score	Experimental	,151	25	,144	,947	25	,210
	Control	,104	21	,200	,943	21	,253

Accordingly, within the scope of the first research question, the Mann–Whitney U test, one of the non-parametric tests, was applied to examine whether there was a significant difference between the experimental and control groups in terms of academic achievement. Within the scope of the second research question, the independent samples t-test was applied to examine whether there was a significant difference between the experimental and control groups in terms of information and communication technology (ICT) competencies.

The qualitative data obtained in the study were analyzed using content analysis. Content analysis, one of the most frequently used analysis methods in qualitative research, involves the systematic coding of data and the classification of the codes created under themes. Thus, the researcher discovers recurring patterns, relationships, and meanings in the data and makes interpretations based on findings related to the research questions (Elo & Kyngäs, 2008; Miles, Huberman, & Saldaña, 2014). In this study, all qualitative data collected from participants in the experimental and control groups were first examined to identify common and distinct codes. Themes were created to classify the identified codes, and the frequency of codes in the experimental and control groups for each theme was calculated. Since the number of students who completed the qualitative interview form was not equal in the experimental and control groups, code frequency was reported as a percentage rather than absolute frequency.

### **Results**

In this section, the quantitative and qualitative data analyzed are first presented in sequence corresponding to each research question and then evaluated using a comprehensive approach.

#### **Academic achievement levels of experimental and control groups**

A Mann-Whitney U test was conducted to determine whether there was a significant difference in academic achievement between students who received planned support from GenAI in the gamified flipped learning process and students who benefited from GenAI on their own.

**Table 2.** Academic Achievement Levels of the Experimental and Control Groups

Group	N	Mean Rank	Sum of Ranks	U	p
Experimental	25	20.86	521.50	196.500	0.144
Control	21	26.64	559.50		

According to the test results, no statistically significant difference was observed between the students in the experimental group (Mdn: 77) and those in the control group (Mdn: 81) ( $U=196.500$ ,  $p>0.05$ ). Accordingly, it can be said that receiving planned support from GenAI does not have a significant effect on academic achievement.

### ICT proficiency levels of the experimental and control groups

An independent samples t-test was applied to examine whether there were significant differences in information and communication technology (ICT) competencies between students who received support from GenAI in a gamified flipped learning process and students who benefited from GenAI on their own. The test examined the ICT competency levels of the experimental and control groups in terms of the scale's overall score and two sub-factors (competencies in supporting student ICT use and instructional design competencies).

**Table 3.** ICT Proficiency Levels of the Experimental and Control Groups

Group	N	Mean	Std. Deviation	df	t	p
General ICT Proficiency Levels						
<b>Experimental</b>	25	66.12	20.53	44	-0.353	0.726
<b>Control</b>	21	68.28	20.91			
ICT Competencies for Supporting Student ICT Use						
<b>Experimental</b>	25	39.76	12.42	44	0.185	0.854
<b>Control</b>	21	39.09	11.78			
ICT Competencies for Instructional Design						
<b>Experimental</b>	25	27.96	9.19	44	0.258	0.798
<b>Control</b>	21	27.28	8.39			

According to the test results, there was no significant difference between the overall ICT proficiency levels of the students in the experimental group (Mean=66.12, SD=20.53) and the overall ICT proficiency levels of the students in the control group (Mean=68.28, SD=20.91) [ $t(44) = -0.353, p > 0.05$ ]. In this case, it can be said that the planned use of GenAI in the gamified flipped learning approach did not have a significant effect on students' overall ICT competency levels. Looking at the ICT Competencies for Supporting Student ICT Use sub-factor, no significant difference was observed between the experimental group students (Mean=39.76, SD=12.42) and the control group students (Mean=39.09, SD=11.78) [ $t(44)=0.185, p > 0.05$ ]. Similarly, when looking at the ICT Competencies for Instructional Design sub-factor measurements, no significant difference was observed between the scores of the experimental

group students (Mean=27.96, SD=9.19) and the control group students (Mean=27.28, SD=8.39) [ $t(44)=0.258, p>0.05$ ].

### Students' views on the impact of GenAI support on learning and skill development processes

Within the scope of this study, only students in the experimental group benefited from GenAI in a planned manner during the gamified flipped learning process. Therefore, this section presents the views of students in the experimental group who voluntarily completed the interview form regarding the impact of receiving support from GenAI on their own learning and skill development processes. The codes created from the students' interview data have been classified under specific themes and are presented in Table 4.

**Table 4.** Students' views on the impact of GenAI support on learning and skill development processes

Themes	Codes	Code frequency
The Impact of GenAI on the Learning and Development Process	• Acceleration in the learning process	20%
	• Helps skill development	10%
	• Provides convenience	40%
	• Successful	10%
The Impact of GenAI on the Production Process	• Helpful in the homework preparation process	10%
	• Enabled faster and more systematic completion of assignments	10%
	• Provided a different perspective and new ideas	20%
The Individual Support Dimension of GenAI	• Offered personalized suggestions	10%
	• Assisted with unclear and intriguing matters	10%
	• Felt great to be guided away from dead ends	10%

As shown in Table 4, students' views on the impact of generative AI support on learning and skill development processes have been categorized under three themes. Under the theme “Impact of generative AI on the learning and development process,” the codes “Providing convenience” and “Accelerating the learning process” were repeated most frequently. Under the theme of “The impact of GenAI on the production process,” the code

“Different perspective and new ideas” was repeated most frequently. In addition, students found GenAI useful in the assignment preparation process, expressing that it enabled them to complete assignments faster and more systematically. The third theme regarding the impact of generative AI support on learning and skill development processes was “The Individual Support Dimension of Generative AI.” Students expressed views that generative AI provided personalized recommendations, helped with things they didn't understand or were curious about, and made them feel very good by removing obstacles. Students expressed their views on this topic with the following statements:

‘Using artificial intelligence as a support tool has greatly simplified my learning process.’ (E14)

‘It allowed me to look at things from a different perspective.’ (E1)

‘ChatGPT’ offered personalized recommendations.’ (E14)

‘It helped us with everything we didn't understand or were curious about.’ (E9)

### Students' opinions on the impact of GenAI support on the gamification process

The codes obtained from students' views on the impact of GenAI support on the gamification process have been classified under 4 themes, as indicated in Table 5.

**Table 5.** Students' views on the impact of GenAI support on the gamification process

Themes	Codes	Code frequency
An Overview of Productive AI-Powered Gamification	• It was effective	50%
	• It was highly effective	30%
The Impact of Gamification on the Entertainment Dimension	• It made things easier	10%
	• An enjoyable training process	10%
The Impact of Gamification on the Active Participation Dimension	• Encouraged participation in activities	10%
	• Helped personalize activities	10%
	• Increased participation	10%
The Effect of Gamification on the Self-Regulation Dimension	• Supported creative thinking	10%
	• Provided guidance	10%

Under the theme “An Overview of Gamification Supported by GenAI” most students expressed the view that GenAI is effective in the gamification process, with some stating that it is particularly effective.

Other themes related to the impact of generative AI support on the gamification process consisted of opinions regarding which dimension of gamification it affected. Under the theme “Impact on the Entertainment Dimension of Gamification,” students expressed that it facilitated the process and made the educational process enjoyable. Under the theme of ‘The Effect of Gamification on the Active Participation Dimension’, students' views that GenAI encouraged them to participate in activities, helped personalize activities, and increased participation were classified. Students' views on how generative AI supports creative thinking and provides guidance in the gamification process have been classified under the theme “The Impact of Gamification on Self-Regulation.” Students expressed their views on this topic with the following statements:

'The process became more effective with artificial intelligence, and we received education without getting bored.' (E9)

'ChatGPT allowed tasks to be adapted to students' specific needs, which increased understanding and participation.' (E14)

### Students' general opinions on the gamified flipped learning approach

The opinions of students in the experimental and control groups regarding the gamified flipped learning approach were analyzed, and the identified codes were classified to form six common themes, as shown in Table 6.

**Table 6.** Themes related to student opinions on the gamified flipped learning approach

	Themes
Experimental & Control Groups	1. Overall Satisfaction Level
	2. Learning Experience with High Participation and Motivation
	3. Effective and Permanent Learning Experience
	4. Innovative Teaching Approach
	5. Learning Experience Supported by Positive Emotions
	6. Perceived Difficulties

The opinions of students in the experimental and control groups regarding the gamified flipped learning approach are presented comparatively for each theme in Tables 7-12.

**Table 7.** Students' overall satisfaction level with the gamified flipped learning approach

Theme 1	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Overall Satisfaction Level	• Satisfied	90%	• Satisfied	90%
			• Not Satisfied	4%

Regarding the overall satisfaction level of students with the gamified flipped learning approach, the majority of students in the experimental group stated that they were satisfied, and none expressed dissatisfaction. The majority of students in the control group also expressed satisfaction, with only 4% expressing dissatisfaction.

**Table 8.** Student opinions on the theme of “A learning experience with high participation and motivation”

Theme 2	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
A learning experience with high participation and motivation	• Ensured active participation	10%	• Ensured active participation	10%
	• Increased motivation to participate in class	20%	• Increased motivation to participate in class	4%
	• Ensured fluency in class	10%	• Ensured fluency in class	4%
	• Increased focus	10%	• Increased focus	10%
	• No difficulties were encountered during the process	10%	• No difficulties were encountered during the process	10%
	• Activity durations were sufficient	10%	• The homework preparation process was more careful and enthusiastic	4%

The second theme regarding students' views on the gamified flipped learning approach was “A learning experience with high participation and motivation.” In this context, students in both the experimental and control

groups shared the common view that the gamified flipped learning approach enabled active participation, increased motivation to participate in class, ensured fluency in class, increased focus, and did not cause any difficulties during the process.

When comparing the experimental and control groups, it is noteworthy that opinions regarding increased motivation to participate in class and improved fluency in class were repeated more often in the experimental group than in the control group. In addition, it was observed that students in the experimental group, unlike those in the control group, stated that the duration of the activities was sufficient. Students in the control group, on the other hand, expressed the view that the homework preparation process was more careful and enthusiastic.

Students expressed their views on this subject with the following statements:

"It made me more motivated and participatory. The elements of competition and reward enabled me to participate more actively in the class." (C25)

"It enabled me to focus much better on the class." (E10)

"It pushed me to do my homework more carefully." (C4)

**Table 9.** Student opinions on the theme of "Effective and lasting learning experience"

Theme 3	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Effective and lasting learning experience	• More effective and lasting learning	20%	• More effective and lasting learning	10%
	• A productive/ useful/effective experience	20%	• A productive/ useful/effective experience	20%
	• Provided an opportunity to gain experience	10%	• Provided an opportunity to gain experience	4%
	• Was consistent with the course objective	10%	• Doing activities individually and taking on more responsibility was developmental	4%
			• Learning by doing, not by memorization	10%

Within the theme of “effective and lasting learning experience,” students in both the experimental and control groups shared the common view that it provided more effective and lasting learning, was a productive/beneficial/effective experience, and enabled them to gain experience.

When comparing the experimental and control groups, it is noteworthy that opinions regarding more effective and lasting learning and gaining experience were repeated more often in the experimental group than in the control group. In addition, it was observed that students in the experimental group, unlike those in the control group, stated that the gamified flipped learning approach was consistent with the course objectives. In contrast, students in the control group stated that doing activities individually and taking on more responsibility was beneficial, and they also expressed the view that they learned by doing, not by memorizing.

Students expressed their views on this topic with the following statements:

“At the end of the day, I feel more developed and learned compared to how I was on the first day.” (C21)

“Thanks to this course, I gained a lot of knowledge and learned to use the computer more effectively.” (E9)

‘Because we learned in a current and efficient way by applying what we learned, not by memorizing.’ (C22)

**Table 10.** Student opinions on the theme of “Innovative teaching approach”

Theme 4	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Innovative teaching approach	• Different experience	30%	• Different experience	4%
			• A method I experienced for the first time	4%
			• A method that can be preferred when becoming a teacher	4%

The fourth theme, “Innovative teaching approach,” was developed based on the opinions of students in the experimental and control groups regarding the gamified flipped learning approach. As shown in Table 10, within this theme, both groups shared the common view that the gamified flipped learning approach was a different experience. However, it is noteworthy that the view of a different experience was repeated more often

in the experimental group than in the control group. In contrast, students in the control group stated that it was a method they experienced for the first time and that it was a method that could be preferred when they became teachers. The students' views on this theme are as follows:

'I aim to share what I have learned with my students' (C13)

**Table 11.** Student opinions on the theme of "A learning experience supported by positive emotions"

Theme 5	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
A learning experience supported by positive emotions	• A pleasant/good experience	20%	• A pleasant/good experience	30%
	• Enjoyable/fun	50%	• Enjoyable/fun	70%
	• Unique and interesting	10%	• Unique and interesting	4%

The fifth theme, developed in line with views on the gamified flipped learning approach, is "Learning experience supported by positive emotions." Within this theme, it was observed that students in both the experimental and control groups experienced positive emotions such as pleasant/good, enjoyable/fun, unique, and interesting in relation to their learning experience. As shown in Table 11, it is noteworthy that expressions of positive emotions were repeated more frequently in the control group students' views, albeit by a small margin. The students' views on this theme are as follows:

'A way to learn without getting bored' (C22)

'Gamified lessons were a unique and interesting experience for me' (E14)

**Table 12.** "Student opinions on the theme of "Perceived Difficulties"

Theme 6	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Perceived Difficulties	• Challenging until it becomes routine	10%	• Challenging until it becomes routine	4%
	• Delivering course content through videos	20%	• Delivering course content through videos	4%
	• Students managing their own learning process	10%	• Sometimes distracting	4%

			• An exhausting experience	8%
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The final theme developed in line with their views on the gamified flipped learning approach is the “Perceived difficulties” theme. Within this theme, students in both the experimental and control groups shared the common view that the process was challenging until they got used to it and that the delivery of course content via videos caused difficulties. It is noteworthy that these views were repeated more frequently in the experimental group.

When comparing the experimental and control groups, statements were found in the experimental group's student opinions regarding the difficulty of managing their own learning process. In contrast, in the control group, statements were found regarding it being a tiring experience and sometimes distracting.

Students expressed their views on this topic as follows:

‘It would have been more effective for learning if our teacher had explained it directly in class rather than through videos. Most people came to class without watching the videos and tried to do their homework without knowing anything.’ (E12)

”Doing a different activity for each lesson was sometimes difficult, depending on the activity“ (C11)

### Students' opinions on the effect of the gamified flipped learning approach on the learning process and motivation

The opinions of students in the experimental and control groups regarding the effect of the gamified flipped learning approach on the learning process and motivation were analyzed, and the identified codes were classified to form two themes, as shown in Table 13.

**Table 13.** Themes of opinions regarding the impact of the gamified flipped learning approach on learning and motivation

	Themes
Experimental & Control Groups	1. Sustainability and Positive Impact in Learning
	2. Impact on Motivation and Active Participation

The opinions of students in the experimental and control groups regarding the effect of the gamified flipped learning approach on the

learning process and motivation are presented comparatively for each theme in Tables 14-15.

**Table 14.** “Student opinions on the theme of “Permanence and Positive Impact in Learning”

Theme 1	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Permanence and Positive Impact in Learning	• Memorable	10%	• Memorable	10%
	• Provided effective learning	10%	• Provided effective learning	10%
	• Had a positive/good impact	40%	• Had a positive/good impact	30%
	• Increased effort	10%	• It made doing homework easier.	4%

As shown in Table 14, under the theme of “Sustainability and positive impact in learning,” there was a common view among students in both the experimental and control groups that the program was memorable, provided effective learning, and had a positive/good impact.

When comparing the experimental and control groups, it was observed that students in the experimental group, unlike those in the control group, stated that the gamified flipped learning approach increased their effort. Students in the control group, on the other hand, stated that it made doing homework easier.

Students expressed their views on this topic with the following statements:

“It helped me learn the material better thanks to the game elements.”  
(E14)

‘Doing my homework is now easier’ (C14)

**Table 15.** “Student opinions on the theme of “Motivation and active participation”

Theme 2	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Motivation and active participation	• More interactive and enjoyable lessons	10%	• More interactive and enjoyable lessons	10%
	• Engaging	10%	• Engaging	10%
	• Increased motivation	20%	• Increased motivation	40%
	• Increased active participation in the process	10%	• Increased active participation in the process	10%
	• A more relaxed and stress-free learning process	10%		
	• Added a different flavor	10%		

The second theme, “Impact on Motivation and Active Participation,” is based on student opinions regarding the effect of the gamified flipped learning approach on the learning process and motivation. Within this theme, students in both the experimental and control groups shared common views that the lessons were more interactive and enjoyable, interesting, increased motivation, and increased active participation in the process.

When comparing the experimental and control groups, it is noteworthy that opinions regarding increased motivation were repeated more often in the control group than in the experimental group. In addition, it was observed that students in the experimental group, unlike those in the control group, stated that the learning process was more relaxed and stress-free and that it added a different flavor.

Students expressed their views on this topic with the following statements:

“Receiving a badge at the end of the assignment made me more interested in the lesson.” (C13)

“I went through my learning process in a more relaxed and stress-free way.” (E9)

### Students' opinions on the development of ICT competencies

The opinions of students in the experimental and control groups regarding the development of their ICT competencies were analyzed, and the identified codes were classified to form five themes common to both the experimental and control groups, as shown in Table 16.

**Table 16.** Themes related to students' views on the development of ICT competencies

	Themes
Experimental & Control Groups	1. General Situation
	2. Support of the teaching approach for ICT development
	3. Perceived level of ICT development
	4. Reflections of ICT Development
	5. Recommendations to support ICT Development

The opinions of students in the experimental and control groups regarding the development of ICT competencies are presented comparatively for each theme in Tables 17-21.

**Table 17.** “Student opinions on the theme of “General Situation”

Theme 1	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
General Situation	• Progress made	90%	• Progress made	90%
			• No progress made	4%

Regarding the development of ICT competencies under the theme of “General Situation,” the majority of students in both the experimental and control groups expressed the view that there had been development. Only in the control group, unlike the experimental group, were views expressed that there had been no development. Students expressed their views on this subject with the following statements:

‘My ability to use basic information technologies has improved’ (C20)

‘Compared to someone who previously had poor or even very poor information technology skills, I think I have improved my skills’ (E13)

**Table 18.** “Student opinions on the theme of “Support for the teaching approach for ICT development”

Theme 2	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Support of the teaching approach for ICT development	<ul style="list-style-type: none"> <li>• The process was sufficient for development</li> </ul>	30%	<ul style="list-style-type: none"> <li>• The process was sufficient for development</li> </ul>	30%
	<ul style="list-style-type: none"> <li>• Homeworks supported development</li> </ul>	10%		

The second theme formed from students' views on the development of ICT competencies is “Support of the teaching approach for ICT development.” Within this theme, both the experimental and control group students expressed similar views that the process was equally sufficient for development. In addition, unlike the control group, the experimental group expressed that the assignments supported development. Students expressed their views on this subject with the following statements:

“Developing through playing games was a very good and sufficient teaching method for me.” (C23)

“I think everything that needs to be done has been done.” (E9)

**Table 19.** Student opinions on the theme of “Perceived level of ICT development”

Theme 3	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Perceived level of ICT development	<ul style="list-style-type: none"> <li>• Using technology faster, more effectively, and more creatively</li> </ul>	10%	<ul style="list-style-type: none"> <li>• Using technology faster, more effectively, and more creatively</li> </ul>	20%
	<ul style="list-style-type: none"> <li>• Discovering useful features</li> </ul>	10%		

Within the theme of “Perceived level of BIT development,” students in both the experimental and control groups shared common views on using technology more quickly, effectively, and creatively. Unlike the control group, the experimental group expressed opinions about discovering useful features. Students expressed their views on this subject with the following statements:

'I learned to access information, process data, and integrate technology into the problem-solving process more quickly and effectively, especially with the platforms and tools used in gamification activities.' (C25)

'I frequently use these technologies in my daily life, and this course helped me learn how to use them more efficiently, quickly, and effectively.' (C22)

**Table 20.** Student opinions on the theme of “Reflections of ICT Development”

Theme 4	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Reflections of ICT Development	• Awareness of the necessity of ICT	10%	• Awareness of the necessity of ICT	10%
	• The positive impact of developing ICT skills on self-confidence	20%		
	• Making life easier	10%		

The fourth theme, “Reflections of ICT Development,” was created based on students' views regarding the development of their ICT competencies. Within this theme, it was found that students in both the experimental and control groups shared the common view that they had developed awareness regarding the necessity of ICT. However, students in the experimental group also expressed the view that the development of their ICT skills had a positive effect on their self-confidence and made their lives easier. Students expressed their views on this subject with the following statements:

'I learned to use useful information and applications about information technology that I can use in my profession and in my life.' (C23)

“Compared to someone who previously had poor or even very poor IT skills, I think I have improved my skills. And this has given me self-confidence.” (E13)

**Table 21.** Student opinions on the theme of “Recommendations to Support ICT Development”

Theme 5	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Recommendations to support ICT Development	• More in-depth development with more complex projects	10%	• More in-depth development with more complex projects	10%
	• Different software can also be used	40%	• Different software can also be used	10%
	• Requires better hardware capabilities	10%	• Requires more individual attention	4%

The final theme, “Recommendations to support ICT development,” was created based on students' views regarding the development of their ICT competencies. Within this theme, students in both the experimental and control groups shared the common view that more complex projects could enable deeper development and that different software could be incorporated.

When comparing the students in the experimental and control groups, opinions on the possibility of including different software were more common in the experimental group. In addition, different opinions were found in the experimental group regarding the need for better hardware facilities, and in the control group regarding the need for more individual attention.

Students expressed their views on this topic as follows:

‘Different current programs could be tried.’ (E5)

“More importance could have been given to the individual.” (C1)

### **Students' suggestions for implementing the gamified flipped learning approach**

The suggestions of the students in the experimental and control groups regarding the implementation of the gamified flipped learning approach were analyzed, and the identified codes were classified, resulting in 4 themes in the experimental group and 5 themes in the control group, as shown in Table 22.

**Table 22.** Themes of opinions regarding the implementation of the gamified flipped learning approach

	Themes	
Experimental Group	1. Satisfaction with the current application format	Control Group
	2. Suggestions regarding course content	
	3. Suggestions regarding in-class learning activities	
	4. Suggestions regarding the pre-class learning activities	
	5. Artificial intelligence suggestions	

The suggestions of students in the experimental and control groups regarding the implementation of the gamified flipped learning approach are presented comparatively for each theme in Tables 23-27.

**Table 23.** Student opinions on the theme of “Satisfaction with the current application format”

Theme 1	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Satisfaction with the current application format	• No change is needed	60%	• No change is needed	30%

Within the theme of “satisfaction with the current application method,” 60% of the experimental group and 30% of the control group expressed the view that no change was necessary.

**Table 24.** Student opinions on the theme of “Suggestions regarding course content”

Theme 2	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Suggestions regarding course content	• Inclusion of different software	20%	• Inclusion of different software	4%

The second theme created regarding students' suggestions for the implementation of the gamified flipped learning approach is the “Suggestions regarding course content” theme. Within this theme, the common view expressed by students was the suggestion to include different software. This

opinion was repeated more frequently in the experimental group. Students expressed their views on this subject with the following statements:

“Different programs could be tried. Especially newly released programs.” (E5)

**Table 25.** Student opinions on the theme of “Suggestions regarding in-class learning activities”

Theme 3	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
Suggestions regarding in-class learning activities	• Collaborative work could have been done	10%	• Collaborative work could have been done	10%
	• More examples from real life	10%	• More examples from real life	10%
	• More narration and examples in class	10%	• More narration and examples in class	10%
	• Better equipment facilities	10%	• Better equipment facilities	4%
	• More and different activities	10%	• More and different activities	10%
	• More time for feedback and discussion	10%	• More time for feedback and discussion	4%
	• Gamification should be increased	10%	• Gamification should be increased	4%
			• Extension of assignment deadlines	30%

Within the theme of “Suggestions for in-class learning activities,” the common suggestions from students in both the experimental and control groups were to engage in collaborative work, provide more real-life examples, increase the amount of explanation and exemplification in class, improve equipment facilities, allocate more time for feedback and discussion, and make greater use of gamification elements.

When comparing the experimental and control groups, it is noteworthy that the control group included a suggestion to extend the assignment deadlines, unlike the experimental group.

Students expressed their views on this topic as follows:

'I would increase group projects and opportunities for collaboration.'  
(C15)

'I would suggest that the assignment deadlines be a little longer' (C6)

**Table 26.** Student opinions on the theme of "Suggestions regarding pre-class learning activities"

Theme 4	Experimental		Control	
	Codes	Code frequency	Codes	Code frequency
	• Increasing interaction	20%	• Increasing interaction	24%
Suggestions regarding the pre-class learning activities	• Need for more examples in videos	10%	• I wouldn't use the video method	4%
	• Encouraging students to research rather than directly transferring information during the learning process	10%		

The fourth theme created regarding students' suggestions for the implementation of the gamified flipped learning approach is the "Suggestions regarding course content" theme. As seen in Table 26, within the scope of this theme, common views regarding increasing interaction were found among students in both the experimental and control groups.

When comparing the experimental and control groups, it was observed that, unlike in the experimental group, it was suggested that more examples be given in the videos and that students conduct research instead of direct information transfer during the learning process. In contrast to the experimental group, the control group suggested not using the video method.

Students expressed their views on this subject with the following statements:

"Interactive and gamified platforms suitable for individual learning speeds could have been used" (C18)

"It may be more effective to give students the opportunity to research and discover things themselves rather than providing direct information during the learning period." (E8)

**Table 27.** Student opinions on the theme of “Artificial intelligence recommendations”

Theme 5	Control	
	Codes	Code frequency
Artificial intelligence recommendations	• Integration of artificial intelligence into daily life	4%
	• Conscious use of artificial intelligence	10%

The theme of “artificial intelligence suggestions” created regarding recommendations for the implementation of the gamified flipped learning approach emerged solely based on the views found in the control group. Among the suggestions of the students in the control group, it is noteworthy that there were views on how artificial intelligence could be integrated into daily life and used consciously. Students expressed their views on this subject as follows:

‘Rather than distancing students from artificial intelligence, I believe it should be integrated into the curriculum so that it can be incorporated into human life and work without violating ethical rules. No matter how many restrictions authorities impose, students will use artificial intelligence; this is a fact. The focus should be on educating students on the proper and efficient use of artificial intelligence.’ (C21)

According to the quantitative data of the study, there was no significant difference in academic achievement and ICT proficiency between students who received support from planned generative artificial intelligence and students who benefited from self-generated artificial intelligence in a course conducted with a gamified flipped learning approach. However, it cannot be said that the data collected in the qualitative phase of the study fully supports the quantitative findings. Although no significant difference was observed in academic achievement in the quantitative findings, when the students' views on their learning experiences were examined, more statements were found in the experimental group compared to the control group under the themes of “effective and lasting learning experience” and “lasting and positive impact on learning.” Similarly, it is noteworthy that students in the experimental group expressed more opinions under the theme of “learning experience with high participation and motivation.”

In terms of ICT competencies, while no significant difference was observed in the quantitative findings, it cannot be said that the qualitative findings fully support this result. Specifically, within the theme of “the teaching approach's support for ICT development,” it was observed that positive opinions were repeated more frequently in the experimental group

compared to the control group. Similarly, it is noteworthy that positive opinions classified under the theme of “reflections of ICT development” were also repeated more frequently in the experimental group compared to the control group.

### **Discussion and conclusion**

In this study, it is aimed to examine the effects of the planned use of GenAI support and its independently use by students in the gamified flipped learning approach, which is one of the innovative teaching approaches. When reviewing the literature, although there are studies examining the effects of GenAI support separately in both approaches, no research examining GenAI support in the gamified flipped learning process has been found. Therefore, this study is expected to contribute to the literature on the effects of supporting innovative teaching approaches with GenAI.

In this study, a mixed-methods approach combining quantitative and qualitative data was chosen to enable a multidimensional examination of the research objectives. According to quantitative data within the scope of the first research question, there was no significant difference in academic achievement between students who received planned support from GenAI and students who used GenAI on their own in a course conducted with a gamified flipped learning approach. These findings are similar to the studies by Fan & Deng (2025), Bancoro (2024), and Al-Tayar et al. (2025), which examined the relationship between GenAI and academic achievement in higher education. However, it cannot be said that the data collected in the qualitative phase of the research fully supports the quantitative findings. In the qualitative findings, students who received planned support from generative AI were more likely to report effective and lasting learning experiences compared to students who used generative AI independently.

In terms of ICT competencies, no significant difference was found between students who received planned support from generative AI in the gamified flipped learning process and students who used generative AI on their own in terms of information and communication technology (ICT) competencies. Although this finding is similar to the study by Román et al. (2023), which concluded that generative AI is not effective in developing students' ICT competencies, it differs from many studies reporting that using generative AI develops digital competencies (Wu & Zhang, 2025; Huang et al., 2025; Fahrurrozi et al., 2024; Dewi, 2025). Within the scope of this study, it cannot be said that the qualitative findings fully support this result. Specifically, positive views classified under the theme of “the teaching approach's support for ICT development” were repeated more frequently in

the experimental group than in the control group. Similarly, it is noteworthy that positive views classified under the theme of “reflections of ICT development” were also repeated more frequently in the experimental group than in the control group.

When examining the views of students in the experimental group who received planned support from GenAI, statements were found regarding the “Impact of GenAI on the Learning and Development Process,” particularly that it facilitates and accelerates the learning process. Similarly, regarding the impact of generative AI on the production process, opinions were expressed that it accelerated the homework preparation process and was beneficial. The study conducted by López-Villanueva et al. (2024) also stated that using generative AI as a support tool in the flipped learning process could enhance the learning experience by providing convenience in situations such as content production. However, it has been observed that students find GenAI particularly useful in terms of offering different perspectives and new ideas. Opinions such as its ability to offer personalized suggestions, assist with unclear and intriguing topics, and steer students away from dead ends may suggest that students experience a more comfortable and stress-free learning experience. These views are consistent with research findings indicating that the use of GenAI-based tools in learning processes increases students' creativity and motivation to participate in class (Aghaee et al., 2024; Shahzad et al., 2024). Within the scope of the study, the views that students evaluate GenAI as an individual support tool are also noteworthy. These findings are similar to the study findings that indicate that artificial intelligence helps develop self-regulation skills (Bui, 2024).

When examining students' views on the impact of generative AI support on the gamification process, it was found to be quite effective, facilitating, increasing participation, helping with personalization, being instructive, and supporting creative thinking. Different studies examining the use of AI to support gamification in education also indicate that it provides opportunities such as helping with personalization, similar to the findings of this study (Gao, 2024; Figueroa & Rivera-Loaiza, 2023). In this regard, it can be said that innovative teaching approaches such as gamification can be made even more effective and efficient when supported by GenAI.

When examining students' views on the gamified flipped learning approach, it was found that the majority were satisfied with this learning process. Students stated that this teaching approach is an effective and engaging method that enhances active participation, motivation, and focus, leading to effective and lasting learning. These findings are consistent with the literature, which indicates that gamification increases students' interest

and participation in learning processes and positively affects their cognitive achievements (Subhash & Cudney, 2018; Priyaadharshini & Maiti, 2023; Zainuddin et al., 2020; Gündüz & Akkoyunlu, 2020), and consistent with study findings indicating that gamification, when used in conjunction with the flipped learning approach, increases motivation and facilitates participation and interaction in classroom activities (Zainuddin, 2018; Ng, & Lo, 2022; Husain et al., 2023; Tseng et al., 2025). However, when looking at the difficulties students experienced in the gamified flipped learning process, they stated that the process was challenging until they got used to it and that they struggled particularly with the presentation of course content as video material. Therefore, it can be said that students are too accustomed to traditional teaching approaches and, as a result, may struggle to adapt to new teaching processes. Supporting this, one of the difficulties expressed by students was the challenge of managing their own learning processes.

Finally, when examining the students' suggestions regarding the implementation of the gamified flipped learning approach, the students in the experimental group offered suggestions specifically related to course content and the out-of-class learning process, while the students in the control group offered suggestions more related to in-class activities. This situation can be interpreted as students who received planned support from generative AI in classroom activities being satisfied with the process because they completed the activities more easily and quickly, and therefore made fewer suggestions. The suggestions from the experimental group regarding diversifying course content and teaching new software support the view that this group did not struggle with classroom activities. In contrast to the experimental group, the control group's suggestions particularly focused on extending assignment deadlines. This can be interpreted as indicating that students who used generative AI independently did not find this process very comfortable and experienced difficulties completing activities within the given time. Supporting this situation, the control group's suggestions regarding the process included the theme of "AI suggestions," which was not present in the experimental group. In this context, the control group's views that students who use AI independently need guidance, especially regarding conscious use, were noteworthy.

## **Limitations**

This study has certain limitations, and the findings should be evaluated within the scope of these limitations. First, the sample size in the quantitative dimension of the study is limited to 47 participants. This limits the generalizability of the quantitative results of the study. Furthermore, the

sample in the study is limited to students taking the “Information Technologies” course in the Turkish language teaching undergraduate program at a state university in Turkey. This limits the direct generalizability of the results to different higher education institutions and different disciplines, especially considering that cultural, institutional, and disciplinary differences may be influential. However, a review of the literature reveals no studies examining artificial intelligence support in gamified flipped learning processes. Therefore, this study is expected to contribute to the literature on the effects of supporting innovative teaching approaches with generative artificial intelligence. It can be said that the study is significant in that the methods and approaches used and the findings presented are adaptable to different contexts and disciplines. The results of the study can be compared with studies conducted in different countries and at different educational levels.

This study compared students who used generative artificial intelligence in a guided/planned manner with those who used it independently on their own. The study was structured this way because students in the control group indicated that they used artificial intelligence on their own initiative. In this context, the study does not present results comparing students who used GenAI with those who did not. Future studies may consider comparing students who use AI with those who do not. In such studies, it will be important to ensure that control groups genuinely do not use AI, which may require implementing stricter monitoring mechanisms.

The study results only cover assessments related to a 7-week period. In this context, the lack of data on long-term effects can be noted as a limitation of the study. It can be said that this period is limited, especially in terms of skills that require longer-term development, such as IT proficiency or problem solving, and therefore this situation may have made it difficult for meaningful changes to emerge. Future studies may examine the impact of long-term use of generative artificial intelligence on academic achievement or the development of ICT competencies. However, in this study, the planned use of generative artificial intelligence was limited to in-class activities within the flipped learning process. In this regard, future studies could ensure that students consciously utilize generative AI in their pre-class learning processes and compare the results.

In the quantitative dimension of the study, it can be noted as a limitation that ICT competencies were examined only in relation to academic achievement and learning content. In this context, future studies could evaluate the effects of utilizing generative artificial intelligence in the gamified flipped learning approach on different variables. Furthermore, this study is limited to the impact of generative artificial intelligence in the

gamified flipped learning process solely from the students' perspective. It may also be recommended that studies be conducted examining how teachers using the gamified flipped learning approach utilize generative artificial intelligence in this process.

Finally, the fact that the application process of the study was conducted by the researcher, who also served as a faculty member, may have indirectly influenced the students' responses or performance. This situation can also be stated as one of the limitations of the study.

**Statement on the Use of AI Tools** | *Generative AI tools were used only during the manuscript writing process. Specifically, ChatGPT was used to improve the clarity, readability, and linguistic quality of the text, and Consensus AI was used to assist in categorizing, summarizing, and organizing the related literature. No AI tools were used for data collection, data analysis, coding, interpretation, or any scientific decision-making throughout the research process. All analyses, methodological decisions, and interpretations were conducted solely by the authors.*

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