

Applying a new game element called backward grading for student engagement

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Abstract— Student engagement refers to how actively involved and enthusiastic a student is about their learning process. Engaged students are actively involved in their education, show a willingness to learn, and are motivated to achieve their academic goals. Student engagement is important for learning activities and can be achieved via gamification. In this work, a gamification approach was designed that incorporates game elements such as tournament, teams, multidisciplinary challenges, grading, backward grading, badges, points, and leaderboard. Especially the new game element backward grading is designed to achieve student engagement. The game element grading promotes competitions among student teams. On the other hand, the novel game element backward grading promotes contributions to competitions. The designed gamification setting is applied to an emerging technologies course, and the results show that student engagement is achieved.

Keywords— Backward grading, gamification, emerging technologies, learning, game elements.

Recibido: 21 de mayo de 2023. Revisado: 22 de noviembre de 2023. Aceptado: 23 de noviembre de 2023.

Aplicación de un nuevo elemento de juego llamado calificación regresiva para la participación de los estudiantes

Resumen— La participación de los estudiantes se refiere a qué tan activamente involucrado y entusiasta está un estudiante en su proceso de aprendizaje. Los estudiantes comprometidos participan activamente en su educación, muestran voluntad de aprender y están motivados para lograr sus objetivos académicos. La participación de los estudiantes es importante para las actividades de aprendizaje y se puede lograr mediante el uso de elementos de diseño de juegos en contextos ajenos al juego o gamificación. En este trabajo se diseñó un enfoque de gamificación que incorpora elementos del juego como torneo, equipos, desafíos multidisciplinares, calificación, calificación regresiva, insignias, puntos y tabla de clasificación. Especialmente el nuevo elemento del juego de calificación regresiva está diseñado para lograr la participación de los estudiantes. La calificación del elemento del juego promueve competiciones entre equipos de estudiantes. Por otro lado, el novedoso elemento del juego de calificación regresiva promueve la contribución a las competiciones. El entorno de gamificación diseñado se aplica a un curso de tecnologías emergentes y los resultados muestran que se logra la participación de los estudiantes.

Palabras clave — calificación inversa, gamificación, tecnologías emergentes, aprendizaje, elementos de juego.

1 Introduction

Gamification is a powerful tool for enhancing the learning process and improving student engagement in education. In higher education, gamification has been successfully applied to a wide range of courses, with computer-related courses being particularly

well-suited due to their compatibility with gamification elements. The use of gamification in computer-related courses is relatively straightforward, making it easier to apply than in other fields. Nonetheless, gamification has the potential to benefit all areas of education, and with careful design and implementation, it can be applied effectively to enhance learning outcomes and improve student engagement.

In the field of software engineering, student engagement is crucial for effective learning, as it refers to the level of enthusiasm and interest that students show towards their courses. Gamification has emerged as an effective strategy for achieving high student engagement in this field, since it helps to make the learning experience more enjoyable and interactive. This is especially important given that software engineering often involves repetitive and complex tasks, which can easily become tedious and disengaging for students if they lack motivation.

Another computer-related area for gamification is e-learning. Especially, e-learning is a general term for remote education, which is applied through computer-related technologies. Therefore, it is a good area for gamification. Again, the aim of gamification is mostly student engagement because it is more difficult to get interest of the students remotely than in the same location.

In gamification, game elements are used. The mostly used game elements are points, badges, and leaderboard. For many applications of gamification, the game element level is also beneficial for student engagement. In the game element level, students try to complete the current level and reach to the upper levels. Therefore, their engagement is kept high during the gamification. In this paper, new game elements, which are grading and backward grading, are designed to keep student engagement until the end of the course.

Programming is another one of the most used gamification areas. Algorithms can be thought easier with gamification. In particular, complex algorithms can be taught easily by providing student engagement. Programming is also a computer-related area, which can be taught online. Complexity of topics can be softened, and student engagement can be obtained through online programming courses.

In higher education, emerging technologies become important because technologies change so fast today. Following emerging

technologies is difficult because there are many emerging technologies in every area of technology. Once more, student engagement should be obtained in teaching emerging technologies. Using gamification, many different topics can be taught with high interest rate of students in emerging technologies. In this paper, gamification is applied to teaching of emerging technologies.

In higher education, entrepreneurship is supported commonly because higher education provides a good environment for new ideas which can be realized faster through entrepreneurship. As a result, higher education contributes to the economy. Teaching emerging technologies contributes to entrepreneurship. In emerging technologies education, students learn new ideas and they can develop new ideas. These ideas can be implemented, and high value-added outputs can be obtained. Gamification can be applied in emerging technologies to increase learning performance and to maintain student engagement.

Education is a multifaceted field that employs a variety of tools to enhance the learning experience. One effective method of boosting student engagement is gamification. In order to implement gamification in education, existing tools can be expanded to include game-like features that motivate and challenge students. Additionally, entirely new tools can be created with gamification in mind to provide a more immersive and stimulating learning environment. By strategically arranging these tools and incorporating gamification principles, educators can create a dynamic and engaging educational experience that inspires students to learn and succeed.

The next section begins with the related work. Then, the gamification methodology and the applied course are described. After the descriptions, gamification of teaching emerging technologies is explained. The paper ends with discussion and conclusion.

2 Related Work

Games are an enjoyable preparation for real life, so children play games. Moreover, the real life can be made more enjoyable if it is converted to a game. If the conversion is a true game, then it is called game-based process. If the conversion is not a true game but it includes game elements, it is called gamification. Gamification can be applied to many areas to motivate people to complete tasks in those areas willingly. For gamification, one of the most crucial areas is education.

In [1], an umbrella review is conducted by examining published educational gamification review papers. According to the results, six fundamental gamification areas are extracted as the following: design, concept and theoretical knowledge, impact, personalization, development, higher education. Most gamification reviews are conducted in the areas of higher education, design, and impact. Student motivation and engagement are the main concerns of gamification in higher education. In higher education, courses from different fields are corroborated with gamification [2]. The courses are related to technology and law. The results show that students are pleased with gamification whatever field the course is from. In higher education, gamification applications increase in engineering education [3]. The most used area in engineering education is computer

engineering because usage of software tools is easier in that area. Moreover, the most used game elements in computer engineering are points, leaderboards, badges, medals, levels, and iterations. In [4], game elements in e-learning systems are reviewed systematically in higher education. The results show that the most used elements are leaderboards, badges, points, feedback, and levels. Furthermore, gamification approaches indicate a tendency towards customization and personalization.

In [5], gamification is analyzed in software engineering education. In software engineering education, student engagement is the most important aim of gamification. Gamification is applied because the tasks in software engineering is repetitive, frequent, and complicated. Challenges are identified. The challenges are related to which game elements to consider and which approach to follow. In [6], a gamification framework is proposed for e-learning. In the framework, usual e-learning processes are combined with gamification processes. The aim of the framework is to enhance learning by improving motivation, performance, and participation of students. In [7], the idea of programmatic contents is presented in a level-based manner using gamification. The idea is implemented in requirement engineering education by including the game elements such as trading, content locking, progress bar, rewards, points, and as well as levels. In [8], several advantages have been attributed to peer code review for students, such as the enhancement of technical and soft skills. Nevertheless, insufficient motivation has been pinpointed as an obstacle to effective peer code review in programming classes. Gamification is used to surmount obstacles. The study concentrates on two motivation-related behaviors: increasing the quantity of reviews provided by students and urging students to submit those reviews ahead of schedule. Based on the findings, the employment of game elements and mechanics appears to be a hopeful approach to incentivize students in online peer code review activities.

Gamification is easily applied to computer related areas because application of related gamification computer tools is easier. Computer science is the most dominant gamification area in higher education [1]. In [9], new techniques are examined in computer science education. Especially for improving soft skills, gamification can be used as a new technique to motivate students and to promote active learning. Gamification is applied to computer programming in [10], [11], [12], [13]. In [10], a methodology is presented to incorporate game elements in computer programming teaching. In [11], a learning environment including game elements such as badges and leaderboards is presented for programming. In [12], the programming platform, especially the compiler is gamified. In [13], gamification is applied to object-oriented programming. In [23], a gamification framework is proposed for online programming courses. The dimensions of the framework are personality, flow, cognitive absorption, general goals, contents, topics, target audience, gamification, and learning outcomes. In [14], gamification is used in teaching computational algorithms. The results show that the learning process is improved. In [15], gamification is applied to computer science students to teach algorithms, data structures and pointers. In [16], gamification is applied to an object-oriented course using four game elements: interactive content, experience points, local team, and global team. The study shows that the use of gamification enhanced student

engagement, with the global team game element having a particularly positive effect on many participating students. In [17], non-conventional game elements such as duels and virtual currency are explored for student engagement and motivation. These game elements are introduced in an introductory class on Python programming, and their impact is evaluated. The findings indicate that incorporating duels alone does not lead to an improvement in student engagement. However, the introduction of both duels and virtual currency resulted in a rise in student intrinsic motivation. Teaching principles and paradigms of computer programming to train future software engineers can be a difficult task [18]. The concepts involved can often be abstract, posing challenges for students. To address this issue, a study is conducted to identify and analyze relevant literature on the use of gamification elements in computer programming education. The study aims to determine the current trends in gamification techniques utilized for teaching computer programming.

Gamification can be applied in emerging technology areas. In [19], online teaching of data science is gamified. A survey of students shows that the impact of gamification is positive. Moreover, expert comments are also positive while considering accuracy, organization, flexibility, and usability of gamification. Blockchain is another emerging technology area. In [20], blockchain concepts are gamified, and presented via a graphical user interface. Blockchain concepts like wallets, blocks, transactions, hashes, and keys can be experimented with through the gamification. In [21], usage of gamification in robotics is analyzed. A concept of combination of simulation and hardware trials is presented. The usage suggestions are presented for teaching mobile robotics and especially swarm robotics. Emerging technologies are related to entrepreneurship because those are firstly selected areas for entrepreneurship. In [22], an entrepreneurship course is gamified using a gamification platform. Students can experience all the stages of entrepreneurship process, which starts from ideas to launching businesses. Student assessments show that student engagement and experience are enhanced using gamification.

Integration of gamification and software tools can be realized in two ways. First, there can be an existing platform, which can be changed for gamification, or which can be extended by adding gamification plugins. In the second way, a new platform or application can be created for gamification. In [15], the Moodle System, which is an open-source learning management system, is gamified by adding developed plugins. The results show that student engagement is attained, and gamification contributes to the learning process significantly. In [19], a cloud-based platform is established for gamification of teaching of data science. In [20], a small Java application is introduced to gamify blockchain technologies. Instead of text-based tutorials, the application generates visual demonstrations to students. In [7], the Moodle System is extended with the gamification plugins, which are implementations of the game elements like blocking systems, progress bars, coins, badges, and leaderboards. In [23], the Moodle System is extended for gamification for online courses. In [24], the SMILE application, which is a mobile classroom response system for quizzes, is gamified with the game elements like leaderboards, badges, scores, and achievements. Gamification keeps student engagement at a high level until the end of the term. In [25], a

gamification framework is proposed to improve student engagement in e-learning. The framework is composed of three parts: learning activities, game elements, and engagement factors. The effectiveness of the framework was evaluated by two experts through a semi-structured interview. The evaluation demonstrated that developers could use the framework to gamify e-learning systems and effectively enhance student engagement and performance.

In online courses, learner engagement is increased by adaptive gamification [26]. In adaptive gamification, gamification is designed according to the learner profiles. This personalized gamification is also compared from two perspectives: static and dynamic. In static adaptive gamification, game elements remain unchanged throughout the course, while in dynamic adaptive gamification, game elements are changed dynamically in accordance with the changes in the learner profiles. The results show that dynamic adaptive gamification attracts learner attention twice as often as the static approach. In [27], the impact of gamification on the behavioral and cognitive engagement of students in online learning settings is examined. The study concludes that gamification can improve student performance by promoting increased interaction with the course content in the online environment. Through gamification, learning tasks that may seem challenging or uninteresting can become more engaging and easier to comprehend.

Gamification is used for different reasons. In [10], the reasons are the diversity of skills of students, the time-consuming character of programming, and the lack of student motivation in learning programming. In this paper, gamification is designed for the students from different engineering departments. In [28], the reasons are the complexity of software development, and unequal task distribution in teams. In this paper, teams and their members are designed to share tasks fairly. In [12]-[13], the difficulty of programming, where are lots of abstract and complex topics, is handled. In [20], the reason for gamification is that a new technology is difficult for beginners. In this paper, emerging technologies are gamified to ease learning. In [21], gamification is applied because working in robotics has many challenges starting from the robotics hardware to the robotics software. In [24], [14], the reason of gamification is that students do not conserve their motivation in learning algorithms. In this paper, gamification is applied to keep student motivation until the end of the term. In [28] [29], the reason is to improve teamwork. In this paper, teams are used as game elements to motivate teamwork. In [30], lack of learner motivation in online learning is examined as a review. In [28], [29], [31], gamification is applied to increase student motivation in software engineering tasks. In this paper, the focusing problem of teaching emerging technologies is facilitated using gamification.

3 The Methodology

A methodology for the gamification of emerging technologies is proposed. The following steps outline the application of this methodology:

- Narrow the emerging technology space by determining a few emerging technology areas.

- Implement the chosen emerging technology areas in a multi-step competition environment.
- Use or design additional game elements to enhance the quality of the learning experience.
- Use or design additional game elements to manage the wide scope of the emerging technologies course.
- Use commonly used game elements to further improve the effectiveness of gamification.

The proposed methodology relies on gamification to boost student engagement, where game elements play a pivotal role in creating an effective gamification setting. Consequently, it is crucial to carefully select or design suitable game elements for this purpose. Enrolled students in the course naturally become participants in the gamification setting.

One of the primary challenges in teaching emerging technologies is the vast range of areas to cover within a limited time. To address this issue, a feasible set of areas should be selected based on popularity and influence.

Since the selected areas may be diverse, a virtual connection can be established among them to maintain students' attention. Each area can represent a step in the gamification process, ensuring sustained student engagement.

In each step of the gamification, there should be a focus on improving the quality of students' work. Presenting their work can be a solution, as it encourages students to put effort into creating high-quality presentations. Teamwork can further enhance the quality of work, promoting collaboration.

To increase the effectiveness of learning emerging technologies, students should be familiar with all the works produced. An assessment mechanism, where students evaluate each other's work and earn points, can motivate students to engage with and learn from diverse perspectives.

To keep students' attention high throughout the gamification process, a game element promoting effective listening can be introduced. This element ensures that students engage with a wide scope of content within the selected areas.

Once the basic infrastructure of gamification is established, popular game elements such as Points-Badges-Leaderboards (PBL) can be incorporated to further strengthen the gamification.

To evaluate the methodology's effectiveness, a comparison between gamified and non-gamified situations can be conducted. Collecting and evaluating students' feedback, measuring learning performance through a questionnaire, and tracking student attendance are essential components of the evaluation process.

4 Course Description

Gamification is applied to the SE426 Emerging Technologies course, which is taught at the Engineering Faculty of Atilim University. This is a senior-level technical elective course. Moreover, it is a multidisciplinary course, i.e., all engineering students can take it.

The SE426 Emerging Technologies course has several aims. Firstly, it aims to help students learn about and keep up with emerging technologies. Secondly, it aims to encourage students to view the world through a visionary perspective. Finally, the course

aims to inspire students and motivate them towards entrepreneurship.

The evaluation for the SE426 Emerging Technologies course is composed of several components. The midterm exam accounts for 20% of the final grade, the final exam accounts for 30%, the project makes up 30% of the final grade, and the assignment portion accounts for the remaining 20%.

The course is structured into two main parts. The first part focuses on the theoretical aspects of technology as a science. In other words, the content is centered on the science behind technology. The second part of the course is focused on the practical applications of current and future emerging technologies.

According to the SE426 Emerging Technologies course, an emerging technology is defined as a new and rapidly growing technology that has the potential to become a foundational element of future technologies. Therefore, an emerging technology is characterized by three main properties:

- Novelty: It is a new technology that has recently emerged.
- Growth: It is growing rapidly and has the potential for significant future development.
- Future Orientation: It is related to or has the potential to be a building block of future technologies.

Due to the extensive range of emerging technologies, it is not feasible to cover all of them within a single course. Therefore, the course focuses on eight of the most popular and influential emerging technology areas:

- 3D Printing
- Health
- Virtual Reality
- Transportation
- Internet of Things
- Security
- Wearable Technologies
- Artificial Intelligence

There are still many emerging technologies with varying characteristics even with the reduction in the scope of the emerging technology space. The greatest challenge in covering emerging technologies is their vast diversity, which can make it difficult to focus on each topic in sufficient depth. This issue is commonly referred to as the focusing problem. To address the focusing problem, the course applies gamification as a solution.

The practical part of the course is handled in the assignment part. Therefore, gamification is applied to the assignment part of the course.

4.1 Gamification

Gamification is applied to the assignment part of the course, which involves selecting 8 emerging technology areas to narrow the wide scope of the course. Each area is handled separately, and the first game element used to accomplish this is the tournament game element. In other words, each area is a step in the tournament and is handled during a separate week of the term. The goal of this game element is to motivate students throughout the tournament and maintain their interest until the end. Along with the

tournament, other game elements used in gamification include teams, multidisciplinary challenges, grading, backward grading, badges, points, and leaderboards. This combination of game elements effectively promotes student engagement, motivation, and interest in the course.

For each step in the assignment, the same assignment template is used. The assignment template for each step is as follows:

- Based emerging technology: Choose an emerging technology from the current emerging technology area. The selected technology should be unique and different from the ones selected by other teams.
- Proposed future technology: Propose a future technology that can be derived from the selected emerging technology. The proposed future technology should be novel, distinct from others, and should not have been implemented before.
- 10-minute presentation: Prepare and deliver a 10-minute presentation on the selected emerging technology and the proposed future technology.

The first part of the assignment template is designed to encourage students to conduct extensive research and find a unique emerging technology within the selected technology area.

In the theoretical part of the course, the evolution of technology is analyzed. The second part of the assignment template is designed to challenge students to apply their understanding of the technological evolution and predict a future technology that can be derived from the identified emerging technology.

In the course, teamwork is encouraged, and therefore, the game element "teams" is embedded in the assignment. As a

multidisciplinary course, students from various engineering fields can take it. To foster this multidisciplinary aspect, the game element "multidisciplinary challenges" is also added. Accordingly, teams are formed from different engineering fields as much as possible, with a team size of 3 members. This team size is chosen based on past experiences, as it is suitable for functional teams in class activities. With 31 students registered for the course, 10 teams are formed in a multidisciplinary manner. One of the teams has 4 members, while the others have 3 members.

In each step of the tournament, teams present their assignments. To ensure the quality of the presentations, the grading game element is implemented. Each team is responsible for grading the other teams' presentations, and they have 10 grading points to distribute based on their performance. The grading formula is as follows:

$$\begin{aligned}
 &T_i : \text{Team } i, \text{ where } 1 \leq i \leq 10 \\
 &GP_{ij} : \text{The grading points which are given by } T_i \text{ to } T_j \\
 &\sum_{j=1}^{10} GP_{ij} = 10, \text{ where } i \neq j \quad (1) \\
 &TGP_i : \text{The total grading points of } T_i \\
 &TGP_i = \sum_{j=1}^{10} GP_{ji}, \text{ where } i \neq j
 \end{aligned}$$

After grading, the teams are ordered to form the grading rank according to their total grading points. Table 1 shows grading in step 2 in the tournament. The rows in the table show the teams which grades the other teams. The last row shows the total grading points of the related team.

Table 1
Grading in step 2

	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Team 8	Team 9	Team 10
Team 1		1	0	0	0	3	0	1	0	5
Team 2	0		0	10	0	0	0	0	0	0
Team 3	0	0		0	4	0	0	0	2	4
Team 4	0	0	0		0	4	0	0	5	1
Team 5	0	0	5	0		0	5	0	0	0
Team 6	0	1	5	0	0		0	0	0	4
Team 7	0	0	0	6	0	0		0	0	4
Team 8	3	0	0	3	0	0	4		0	0
Team 9	3	0	0	2	0	3	2	0		0
Team 10	5	0	4	1	0	0	0	0	0	
Total	11	2	14	22	4	10	11	1	7	18

Table 2
Backward grading in step 2

	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Team 8	Team 9	Team 10	Total
Team 1		2	0	0	0	30	0	1	0	90	123
Team 2	0		0	220	0	0	0	0	0	0	220
Team 3	0	0		0	16	0	0	0	14	72	102
Team 4	0	0	0		0	40	0	0	35	18	93
Team 5	0	0	70	0		0	55	0	0	0	125
Team 6	0	2	70	0	0		0	0	0	72	144
Team 7	0	0	0	132	0	0		0	0	72	204
Team 8	33	0	0	66	0	0	44		0	0	143
Team 9	33	0	0	44	0	30	22	0		0	129
Team 10	55	0	56	22	0	0	0	0	0		133

The game element grading is strengthened with another game element. To motivate students to listen attentively to other presentations, the game element backward grading is designed. The teams are also ordered to form the backward grading rank according to their contribution in the determination of the grading rank. The formulation of backward grading is as follows:

$$BGP_i : \text{The backward grading points of } T_i$$

$$BGP_i = \sum_{j=1}^{10} GP_{ji} * TGP_j, \text{ where } i \neq j \quad (2)$$

The purpose of the game element backward grading is to encourage students to pay close attention to other presentations in order to identify the best ones, and to learn about emerging technologies. In other words, backward grading is used to manage the wide scope of the course. Table 2 shows backward grading in step 2. The last column shows the backward grading points of the related teams.

One of the most used game element badges is added to further motivate students in the tournament. There are 2 types of badges: “Best Team” and “Best Selector Team”. After grading, the first 3 teams in the grading rank are rewarded with the “Best Team”

badges. Moreover, the first 3 teams in the backward grading rank are rewarded with “Best Selector Team” badges. Table 3 shows the Best Teams and Best Selector Teams in step 2.

Table 3
Badges in step 2

	First	Second	Third
Best Teams	Team 4	Team 10	Team 3
Best Selector Teams	Team 2	Team 7	Team 6

One of the most used game element points is also added to the tournament. Each team can get points according to the grading rank and the backward grading rank. First teams in the ranks get 3 points. The second teams in the ranks get 2 points. Third teams in the ranks get 1 point.

One of the most used game element leaderboards is added to expose leaders. After each step in the tournament, the teams are ordered according to their total points. In other words, leaders in the tournament are displayed to all the teams. Table 4 shows the last state of the leaderboard in the tournament.

Table 4
Leaderboard of the tournament

	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Week 7		Week 8		Total
	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	
Team 1	2				2		1		2	3					1		14
Team 2		2		3		3		3		2	3		1				17
Team 3			1		1						2					3	7
Team 4	3		3				3										9
Team 5	1						2		3		1		3		2		12
Team 6				1					1							2	4
Team 7		1		2		2		2		1						1	9
Team 8						1		1				2		2			6
Team 9						3						3		2		3	11
Team 10		3	2									1		1			7

Table 5
Attendance of students

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Attendance number	14	16	30	26	28	27	Midterm Exam	24	29	26	24	11	7	6
Gamified	No	No	Yes	Yes	Yes	Yes	Midterm Exam	Yes	Yes	Yes	Yes	No	No	No

5 Discussion

Gamification was advocated by the students, who prepared high-quality presentations and presented them in a professional manner. Table 5 shows the attendance of the students for each week of the term. The first row shows the week number in the term, whereas the second row shows the number of students in attendance for each week. The third row in the table shows whether the week is gamified. In other words, in the tournament weeks 3, 4, 5, 6, 8, 9, 10, 11 are gamified. In week 7, the midterm exam was arranged.

In the term, 8 weeks were gamified, whereas 5 weeks were not and 1 week was used for the midterm. The total number of students

was 31. For the gamified weeks, the average attendance is 27. For the non-gamified weeks, the average attendance is 10. Even if attendance was not mandatory, there was 1.7 times increase in the attendance in the gamified weeks. Although one team member presentation was enough, all the teams did presentations with nearly all their members. In other words, high quality teamwork was performed.

Students were delighted with gamification. Some comments from the students are listed below:

- It was a dense course but equally distributed to the term.
- I am happy because I learned and followed current technologies.

- The course gave me valuable information about the future.
- The course decreased my presentation fear.
- In the course, I developed an idea and I want to realize it after graduation.

At the end of the term, to measure learning performance, a learning outcomes questionnaire was performed. The result, which was 4.5 over 5, showed that the learning performance was highly satisfactory.

6 Conclusion

Gamification has been implemented in an emerging technologies course to address the challenge of teaching a wide range of materials. The use of game elements such as points, badges, and leaderboards has been effective in motivating students and enhancing their learning performance. Through gamification, students have invested significant time and effort into learning about a multitude of emerging technologies, even going so far as to predict future trends in the field. Moreover, the newly designed game element grading has further increased student motivation. However, the most significant impact has been achieved through the introduction of the game element backward grading, which has resolved the focusing problem by encouraging students to pay closer attention to other presentations and learn about emerging technologies studied by their peers. As a result, the game element backward grading has significantly improved student engagement and learning outcomes in the course with a broad scope of learning materials. This is evidenced by the attendance numbers, which demonstrate increased student motivation and participation in the course. Overall, the gamification design with the game element backward grading has proven to be a highly effective approach for managing the wide scope of the course, enhancing student learning, and achieving student engagement.

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