

Next-Generation Classrooms: An Overview of Gamification and Game-based Learning in Teaching & Learning

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ABSTRACT

Game-based learning and gamification offer an interactive learning environment for the students to hone their motivation, engagement, and performance by implementing game elements. [1], [2]. The implementation of gamification elements in the education sector made significant improvements in the outcome of students learning. With careful investigation, we examined 15 gamification articles published from the year 2013-2020. The gaps found between the gamification apps and game elements weighed and highlighted. This article offers Insights concerning next-generation learning methodology using game-based learning and gamification.

Keywords

Game-Based Learning, GBL, Gamification, Flow Theory, Intrinsic Motivation, Classroom, Education, Extrinsic Motivation, Game elements, Learning Environment, Self-Determination Theory

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Introduction

Education is a domain where gamification plays an effective way of improving motivation. As per the Self-Determination theory [3], competency, autonomy, and relatedness are the three psychological needs of humans. Self-Determination theory proposes two essential types of motivation, namely intrinsic and extrinsic motivation, where the three needs lead to intrinsic motivation. Gamification induces the learner to learn through extrinsic motivation, where motivation arises from the outside world. In intrinsic motivation, motivation arises from their inner self [36].

In the educational environment, the literature we reviewed does not imply a fixed number of game-based elements. Many researchers used one or two gamification elements in their research to evaluate the learning outcome. Although the existing studies focus on integrating multiple gamification elements, the method of choosing the gamification elements for the study and evaluating their effects on the student outcomes varies within each learning context. Gamification or game-based learning as a comprehensive solution helps users successfully and enjoyably accomplish a task, which results in an improvement in interaction, engagement, motivation, and learning outcome. The gamification components and the Apps used in current experiments ought to be separated. In this paper, we outline the gamification apps, game elements, and the courses it implemented in the educational environment.

1.1 MDA Framework

A familiar framework called MDA (Mechanics, Dynamics, and Aesthetics) [4] explains how a game functions and connects the gap between developers, designers, and users. Gamification relies on the same features as formulated in MDA.

- Mechanics is the rubrics or rules of the game to create enjoyable gameplay.
- Dynamics is the system that acts at run-time when the user interacts with the Mechanics.
- Aesthetics is the emotional response that the learner receives as feedback by playing the gamified course content.

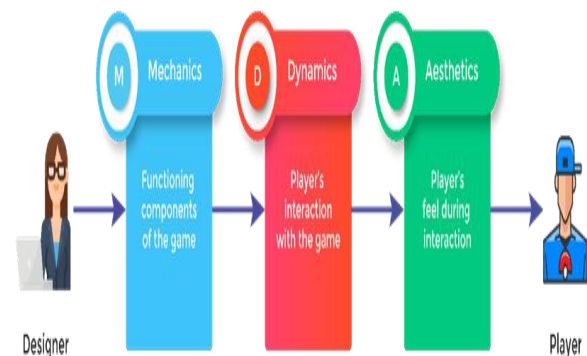


Figure 1. MDA Framework

The designer creates the game with the mechanics to make the player interact with the game as dynamics. The emotional feedback that the player receives from the competition is said to be aesthetics. In the traditional learning system, students often lost interest in the learning activity and get de-motivated. With the novel pedagogical approach of gamification, learning became engaging and interactive with immediate feedbacks [5]. Many studies have proved that gamification as an effective medium improves the learning outcome. Gamification engages the students in a fun way and motivates them to utilize extrinsic rewards such as points, badges, Leader boards, Levels, Achievement system, and Rewards. [6]

Table 1. Game Elements of MDA framework

Game Mechanics	Game Dynamics	Aesthetics
Points	Rewards	Sensation, Fantasy
Leaderboards	Status	Narrative, Challenge
Levels	Competitions	Fellowship, Discovery
Achievement system	Altruism	Expression, Submission

Motivations and Needs

2.1 Maslow's Hierarchy of Needs

To know about the hierarchy of needs and what drives humans, we need to consider the hierarchy of needs by Maslow. [7] Maslow mentioned in his study that some obligations gets fulfilled before other requirements; as per his theory, a human needs to focus on Physiological, safety, and belonging first, then esteem and self-actualization.

2.2 Self Determination Theory (SDT)

Edward Deci & Richard Ryan, after several years of research, have proposed three human needs, which are Relatedness, Autonomy, and Competence [3]

2.2.1 Relatedness

People feel relatedness when they are connected socially in a way, through family and friends. The relatedness desire completes when they communicate and connect. There are tools and social networks where people can talk by creating teams to play multi-player games. Similar collaborative learning is encouraged in gamification through teamwork and competitions. As a step to reduce the unpleasant behavior, team collaborations are proven better than one to one sport.

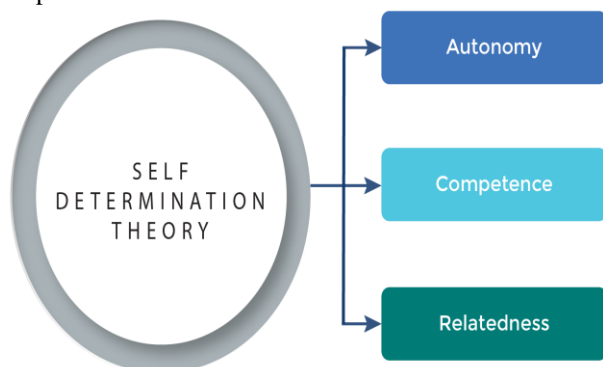


Fig. 2. Edward Deci & Richard Ryan's Self Determination theory

2.2.2 Autonomy

Autonomy is about making independent choices of their own. In gamification, students will be given freedom in making their personal decision, such as choosing their preferred level of the learning environment and their preferred time. One of the best methods is perceived

autonomy. The student can perform a learning activity in gamification because the student is interested in showing it rather than forced by other people.

2.2.3 Competency

Competence is to achieve a master level in a particular subject by overcoming challenges. Any new skill that we acquire for knowledge can fit into mastery. In the gamified classroom setting, after proving their perceived skillset in the subject, mastery could be achieved.

2.3 Flow theory

To create a fun experience in learning through gamification, Challenges for the students increase when their skillset increases. The student will be frustrated if the gamified course content is too easy or too hard. In 1975, [8] Maslow proposed a flow theory, in which he mentioned that flow as an experience where a finite balance is required between challenge and skill. Boredom occurs to students when the challenges they face are easier for their skill set. Frustration occurs to students when the challenges they face are difficult than their perceived skill set.

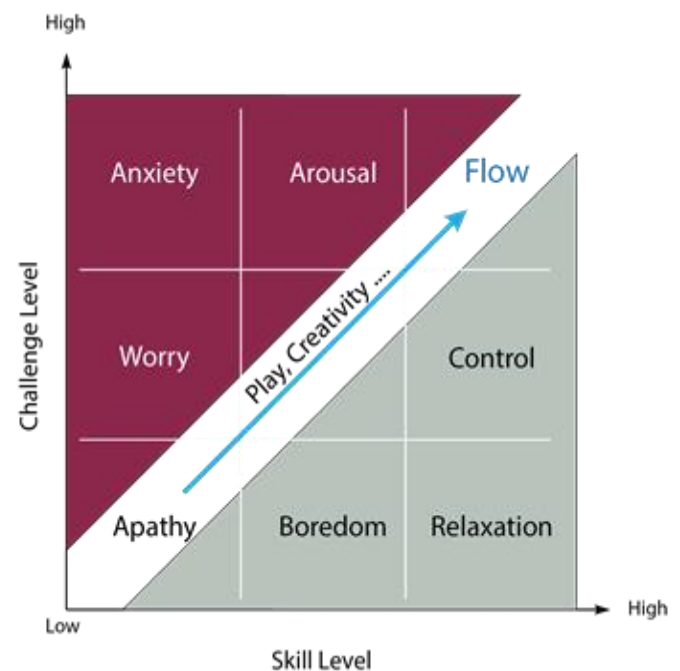


Figure. 3. Mihaly Csikszentmihalyi's Flow Theory

Methodology

Here we have searched, and accessed literature regarding Gamification from Scopus, Sage Journals, Web of Science, IEEE, ACM, Taylor & Francis, and Springer published in the years (2013 – 2020). We identified the relevant terms in the field of gamification by carefully observing the existing literature and identified the keywords to use as a search string in the electronic database. The keywords used were 'Gamification,' 'classroom,' 'education,' and 'learning.' We shortlisted the articles where gamification was applied for the education environment and listed in Table 2.

The majority of papers considered for this survey are journals. To ensure whether the document is apt for the gamification research, we have observed how the keywords used in the article and their relativity with the classroom and education environment. In this review, we framed two research questions as given: 1) why only a few game elements are selected and widely applied for gamification in the education environment? 2) What sort of new gamification tools is essential for the education environment?

Related Work

From all the journals of the year 2013 - 2020, after scrutinizing, we got 15 journals which are selected from various categories. A detailed review is given in Table 3 below. All of these journals were using the MDA framework. We offer existing literature reviews in this section. The core needs which facilitate motivations are Autonomy, Competency, and Relatedness; the gamified classroom learning system fulfilled these needs. [9] conducted a study in an Indonesian school where student's learning performance and their motivation were assessed between gamified and non-gamified flipped classrooms. The findings revealed that the students' performance was improved in the gamified flipped classroom than the non-gamified flipped classroom learning system. Students were motivated by competing with peers and secured badges and points in the gamified flipped classroom. In another research, [10] gamification was used to induce postgraduate students to involve actively in out-class activities rather than in-class flipped classroom learning. Quasi-experimental methods were used to implement the gamification procedure-GAFCC model in the flipped classroom step by step. [11] In a group of 136 undergraduate year students' Personal Professional Development course were facilitated with gamification, Students who used gamified systems were found with improved performance than the students who used non-gamified systems. Online gamification activity was developed using the Institution's VLE- Moodle course with Essential Learning (EL) and Super Learning (SL) methods. In some cases, Game-based learning does not make any impact on students learning outcomes. Its found that game-based learning in a math classroom has not made any significant difference in the students. But it was observed that the students' perception of mathematics improved positively [37].

Table 2: E-database used for survey

Electronic database	Web Link	Years chosen for the survey	Total articles
Scopus	https://www.scopus.com	2013-2020	108
Sage Journals	https://journals.sagepub.com/	2013-2020	16
ACM	https://dl.acm.org/	2013-2020	123
Taylor & Francis Online	https://www.tandfonline.com/	2013-2020	272
Springer	https://link.springer.com/	2013-2020	156
IEEE	https://ieeexplore.ieee.org/	2013-2020	57
Web of Science	https://mjl.clarivate.com/	2013-2020	0

Game elements are used to motivate students in an educational environment. [12] Students from an Asian university were divided into two groups, namely Experiment and control groups who have undergone an education-

related course, wherein one group used game mechanics and another without game mechanics through a quasi-experiment method. The study proved that the students who used game mechanics had contributed much to the discussion forums with increased motivations. To make the learning process more comfortable and an enjoyable one, gamification is widely used in Language learning courses, Mathematics and science courses of universities and schools. [13] In game-based learning, prize-only reward and forfeit-or-prize patterns considerably improved learning performance. In research findings, 180 adult e-learners who enrolled for an English course in Beijing were involved in this study, and the results proved that the implementation of gamification generates active and productive learning and improves performance among the students. Focusing on game strategies are essential than focusing on advanced tools.

We can also use a mixture of game elements to keep the students engaged in the gamified learning. [14] gamification learning activities were introduced in primary mathematics class students. The students' performance was not only improved by the result of the single-game element but also by the amalgamation of game elements. It's evident from the research that the students found motivated after seeing their contribution in a gamified collaborative learning environment. [15]. Performance and cooperative annotating behaviors of elementary school students were studied using gamified WCRAS in north-eastern Taiwanese Elementary school. The findings stated that students were motivated, and their performance was enhanced.

There are few cases where the game elements couldn't make any possible motivation with students, A study conducted on higher education students [16] using Badges as a game element resulted in low motivation and less performance. Students who keep their badges to themselves rather than sharing with others have shown significant improvement in performance and motivated more than the students who share their badges with other students and the students without Badges. The Badges have shown no significant increase in students' grades and quiz.

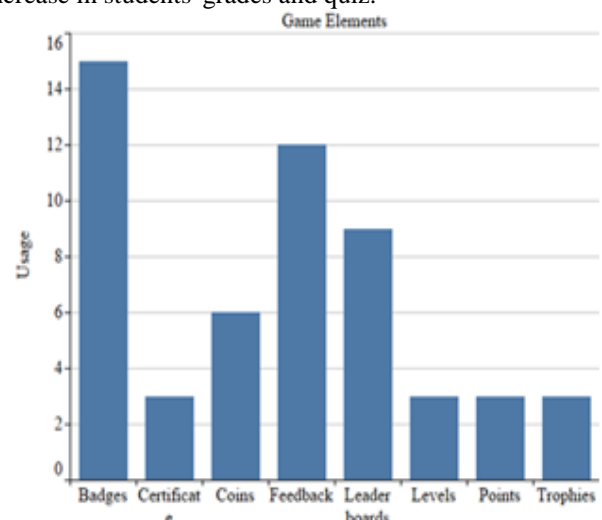


Figure 4. Game elements in the reviewed journals

The use of educational games has many advantages, and many game design mechanics have shown effectiveness in education settings [9]. Usually, the games allow users to replay an infinite number of times; the mistakes that the

users commit could be recoverable. The learners here get the liberty to fail; thus, it strengthens their engagement in the learning content and paves a way to explore more. In the traditional classroom setup, the students cannot get feedback from their teachers regarding the students' performance right after each class [11]. In the traditional classroom teaching method, the education content would be in general to all, so preparing the content pertaining to each students' cognition level in the classroom is quite difficult. Whereas in the game-based learning environment, the student can be allowed to move to the next level only after mastering the current education content. So that all the students could master the learning content [12], student encouragement and involvement are found improved when they master each education content at their own pace [20]. Each game element demonstrates different features. Leader boards give instant feedback and thus facilitate competition within the students [26]. As different gamification environment necessitates different game elements. In a study, it showed that students felt competitive and performed more effectively than the rest of the students and also reduced their failure rates in the successive classes [38]. Implementing Game-based learning with the competition, leader boards, and batches enhanced passion for business and management courses [39].

Gamification elements trophies, leaderboards, [40] prizes improved students' performance and engagement when learned through a gamified course, but it also noted that they perform less in the class activities and in the writing assignments. [41] To demonstrate competence in the classroom, leaderboards used widely with awards and trophies as a mode of appreciation. The researchers reported that learners using social networking platforms were also found active and demonstrated the social connectivity among the students. Usage of both social networking platforms and game-based learning in the classrooms made the students perform much efficient than the students in the controlled group, whereas this group outperformed the game-based learning group in the written exam. The participation rate of the gamification students was notably reduced in the final exams. However, the increased interaction only took place with the badge involved game-based learning environment. It was ineffective to construct a gamified framework to cause a rise in students' behavior; the

usage of game elements was selective as per the course requirement [42]. Since gamification is a novelty, most of the researchers engaged in this study and founded very few impacts on the learning, which are motivation and engagement, and their interest diminishes in time [43]. A holistic approach to implementing gamification and game-based learning in the classroom would open many research possibilities; hence which game element apt for the different classroom environments is a concern.

As a contradiction, there is a study that comprises game-based learning with badge and reward systems that impacted a negative motivation [45]. Cognitive assessment theory elaborated that the experiences we face externally would shape one's intelligence, processing the experience into knowledge or power depends upon the learner. The learner will feel intrinsically motivated if he considers the reward is for the knowledge. Studies have shown that offering incentives for a task end up damaging the incentive to perform the task [46]. Thus, while there may be advantages to gamification, it is also necessary to explore possible risks as this may hinder the encouragement educators are seeking to build. Reward system, competition, and social comparison in the long-term may harm the learners. Game element such as Leaderboard usually highlights the top list of performers, which will make some negative effects on the learners. Similarly, there are cases where each game element has a positive and negative impact on learners' cognition level and their outcomes. Learners sometimes felt using game-based learning as a pressure to score rewards and points; in the context of social learning, their low score may create a negative impact on their social life. They will be in a position to earn trophies and awards as rewards for their learning, will lead to distracting them from the very objective of the learning outcome. Autonomy is one of the vital psychological behavior that gamification has to offer, whereas the pressure on earning the rewards and awards form a negative effect on the learner. Competency, autonomy, and relatedness all to be met to make the learner stay motivated and engaged throughout the process of gamified learning to build a successful learning environment. Here we list out the various courses and the gamification tools used for the researchers to figure out the need and limitation of using the gamification elements in the respective courses.

Table 3: Descriptive Analysis of articles used in this study

Author	Institution	Gamified course	App used	Users	The outcome of the research	Game Elements used
[23]	Indonesian school students	Science Class	Socrative Quizizz, ispring Learn LMS	94 students	To assess the performance of the students, the game quiz is found to be useful.	Badges, points, leader board, and certificate.
[24]	City of Calgary school	English & Mathematics	Game-based system	126 students	Students' learning skills were increased, and their mastery of skills and relevant knowledge were identified using the gamified feedback system.	Feedback system
[25]	Calamba City college	Physics class	G-Class	27 students	Students were encouraged and felt competent by the gamified e-learning material.	G-Exp and G-Coins (Rewards)
[26]	European university	Geospatial	Moodle-open source.	215	MOOC course with gamification proved as an	Challenges and Rewards

		informatio n course	(Computer App)	student s	effective learning method.	
[27]	U.S College	Spanish course	Mobile- assisted language learning.	82 student s	The motivational engagement of students' learning has increased.	Feedback system
[21]	University of Spain	TCP / IP network	Gamified framework	25 student s	Students' efforts increased in gamified learning.	rewards
[28]	University of Alcala	Android programm ing class	The gamified platform using Elgg engine	27 student s	Gamification is an effective method to improve the learning outcome of the student.	Points, leader boards.
[29]	Universidad Carlos III de Madrid (Spain)	C Programm ing Language	Q-Learning-G Platform (Computer App)	22 student s	Gamification has good outcomes in terms of Knowledge acquisition and cognitive engagement	Badges
[16]	German university	computer- mediated communic ation	Moodle-open source. (Computer app)	324 student s	Badges neither motivates nor de-motivates the students. In the time it's found that the students are less motivated.	Badges
[30]	Public School	Geometric Designs	Computer App	61 student s	Gamification has positive results on improving the engagement level of the students.	Badges
[31]	Health Professions Education	OPEN	Social website	100 student s	Implementation of Gamification in OPEN was expected to increase in learning and might produce valuable outcomes.	Feedback mechanism (point system, social feedbacks, modules)
[32]	Mid-western university	Communi cation course	Computer App	80 student s	Students used gamification are less motivated than the non- gamified learning students over time.	Badges, coins, leader boards harms motivation
[33]	Sul Ross State University	Mathemat ics	Math Dungeon (Computer App)	30 Student s	Learner's confidence level increased using gamification and an Intelligent tutoring system.	Rewards, Levels and feedback system
[34]	App tested in Brant skills center, Brantford, Ontario	Adult Literacy	Homophone, Comma, punctuation. (Tablet App)	27 student s	Learner's engagement is found to be improved by implementing Gamification Adult literacy	Rewards (short, medium and Long)
[35]	K6 learning environment	Social Learning	Schooooools.co m. (Social networking Website)	K6- student s.	Applied social gamification in education and also assessed.	Rewards and Trophies.

Findings & Discussions

The selected journal articles with their elaborate discussions are listed in Table 3. The data in the table contained that the students of various domains were subjected to gamification,

and both genders were benefitted from it, which helps us to answer our Research Questions.

RQ1: why only a few game elements are selected and widely applied for gamification in the education environment.

The usage of game elements, as per our review, is listed in Figure 4. Badges have been widely used and recorded as in the chart. Badges are an indicator of skill, the accomplishment of a particular event or action. [17] Even though Badges are short term rewards, it acts as a massive motivation for the students. After getting rewards for every successful event, the students stay motivated and engaged in learning the gamified content. [18] Through an extrinsic reward, there is a possibility that the student can be intrinsically motivated.

Next to badges, Feedbacks has reached 12 in the usage chart. [19] Feedbacks are an essential system that allows the students to know their performance in the education setting. It's also a kind of self-assessment tool. Unlike the badges, where the students receive it only when accomplishing a task, feedback will be shown to students either he accomplished the task or not.

Leader boards stand next to the feedback. Leaderboards are a social engagement tool to present the rank and position of the player online. [20] Leaderboards in such a gamification environment lists all the players' positions in an activity with their name on it. Unlike feedback, Leaderboards show the full ranking of students to all the students. So, everyone can see others' positions in the rank list. On a positive note, students feel competent and try to achieve a better score or perform well to achieve the highest rank.

In our survey, Coins have reached 6 in the usage of game elements in the chart. [21] Coins are like rewards for short term goal achievements. By offering coins to the student to answer every correct question, the student will remain motivated and engaged in gamification. Coins keep the learner engaged in the gamified learning content, and at the end of one event, the learner will earn a badge. There's one advantage in coin which is not available in other reward is, user can earn and also spend it in the gamified learning system. So, students have the liberty to spend in different ways in the gamification system.

Points, Level, Trophies, and certificates have secured low in the graph. There's a choice of using the game elements, where some gamification tools preferred Points, some preferred coins, some preferred batches. [22] Levels, Trophies, and certificates usually are given when they complete the first stage or level. The mixture of game elements were not addressed because of the limitations in targeted platforms and gamification tools.

RQ2: What sort of new gamification tools is essential for the education environment?

For science classes, Socrative Quizizz, ispring Learning LMS, G-class Apps were used based on their requirements and the education setup. When it comes to language learning applications, Mobile Assisted language learning App is used.

To gamify students in computer language courses, Gamified platform made of Elgg Engine; Q-Learning-G platform apps were used. Schooooooos.com and OPEN apps were used for social learning and healthcare learning.

Most of the gamification tools are computer Apps, and they are all online-based. The education institutions prefer the existing gamification computer Apps and social apps, because of the difficulty involved in designing their own gamification Apps. To tailor the needs of different students, gamification tools with custom features and more autonomy, such as extended reality has to integrate.

Conclusion

From the detailed review conducted with 15 journals of education domain, gamification elements found to be motivational among university and higher education students. The game elements used in the institutions are limited because of using the existing gamification tools, where most of them target on the computer platforms rather than smartphones. Immersive and interactive next-generation technologies can be used to increase engagement in the classroom with gamification. Future studies may focus on increasing autonomy for the students with the use of Extended reality technologies and customize the gamification tool as per the need of each student with the help of Artificial intelligence.

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