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# Gamified flipped classroom in education: a systematic review

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**ABSTRACT**

Nowadays, gamified flipped classrooms (GFC) are a cutting-edge teaching method. Using gamification techniques with flipped classrooms (FC) significantly positively affects teachers and students. This study reviews the impact of GFC research on education methodically. Hence, the study investigated a comprehensive literature review of 52 empirical research publications published between 2018 and 2022 in various electronic databases and on the web. Note that the review established the foundation for the significance of upcoming research projects by critically assessing and evaluating the different inconsistencies in the literature. In addition to examining the contradictory results of previous research, the study offer a framework as well as guidance for future researchers in terms of theoretical models, methodology, game tools or online platforms, game activity, game elements, variables, and the impact of a GFC.

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## 1. INTRODUCTION

The educational landscape is continually evolving in line with the nation's brisk economic growth and development following the advancement of technology. Therefore, the curriculum for excellent education is designed to create a highly educated society capable of overcoming the challenges of modern living. Education is not only changing due to the technological environment but also due to the emergence of new methodologies [1]. The new approach emphasizes student-centered learning to enhance interaction and foster students' creativity and divergent thought. Here, game-based learning (GBL) refers to a teaching method that aids in boosting student engagement, and research on it has advanced over the past ten years.

According to Charlo *et al.* [1], gamification in education has been a quickly growing subject of study since 2013. Additionally, the 2019 e-learning trend report globally by Docebo demonstrates how gamification techniques in the classroom foster a favorable interaction between learning and teaching. The gamified flipped classrooms (GFC) strategy is among the most popular instructional innovations instructors implement worldwide [2]. Other than that, gamification works well to boost student engagement. The gamification of the flipped classrooms (FC) has been implemented to help instructors draw in students [3].

Bergmann and Sams [4] developed the FC teaching strategy to deal with the issue of students missing class. As an alternative to traditional classroom instruction, FC engages students in various learning activities, including independent online or digital learning outside class and task completion. Moreover, FC is a class taught the opposite way it would normally be [5]. Face-to-face instruction was previously used in the classroom, and individual or homework training was replaced with self-learning in the student's own space with multimedia materials available in advance. Meanwhile, gamification resembles the application of game design features for non-game contexts. Note that it is an approach that enhances rather than replaces teaching [5]. Figure 1 illustrates the difference between traditional learning and flipped classroom learning.

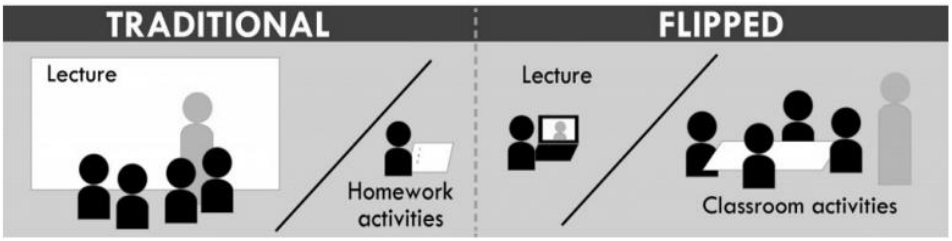



Figure 1. The difference between traditional learning and FC [6]

Nevertheless, the findings of research conducted by Lo and Hew [7] on the cognitive engagement accomplishment with regard to grade 9 students in Hong Kong cannot conclude that GFC learning is better than classrooms that are not gamified. They recommend conducting more research to examine the learning differences when employing the FC technique with GFC. Studies on gamification, specifically in the higher education context, still require a theoretical foundation and adequate design and measurement [5]. Although the data meta-analysis indicates that gamification favors learning and motivation, gamification research is still required to understand its benefits fully. Note that most studies focus on methodological assertiveness, gamification theory application, as well as analysis and assessment pertaining to learning processes, particularly in the setting of higher education [8].

A systematic review with respect to articles published between 2018 and 2022 in Scopus, Science Direct, ERIC, ProQuest, Dimensions, and Google Scholar was conducted using thematic and content analysis. These reviews offer insights into a GFC's trends, research techniques, and effects. In addition, the analysis will address the research questions outlined, namely: i) What theoretical models have been employed in a GFC?; ii) What methodologies were used in a GFC?; iii) What gaming tools or online platforms have been used in a GFC?; iv) What game activities and elements have been used in a GFC?; v) What variables have been explored; and vi) How does gamification in FCs impact students' learning?

## 2. RESESEARCH METHOD

There have been several recent studies on systematic assessments conducted worldwide. However, only a few educational research were conducted in the context of the GFC overview. The necessity for a systemic investigation of the effects of GFC in education is covered in this section. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) approach, a published guideline for performing a systematic literature review (SLR), is employed in this analysis. Subsequently, the four essential sub-sections, comprising identification, screening, eligibility, as well as data abstraction, are also summarized in this section.

### 2.1. Identification

The systematic review process is broken down into three primary stages that helped choose various relevant papers for this study. The initial phase is keyword recognition and searching for connected, related terms using the thesaurus, dictionaries, encyclopedias, and prior research. As a result, search strings have been developed for the databases Scopus, Science Direct, ERIC, ProQuest, Dimensions, and Google Scholar after all pertinent terms had been chosen, as presented in Table 1. Total 144 papers were successfully retrieved from both databases as part of the current study endeavor's first stage with regard to the systematic review process.

Table 1. The search strings

| Database | Keyword |
|---|---|
| Scopus | TITLE-ABS-KEY (game OR gamifi*) AND (flip OR "Flipped-classroom" OR "flipped classroom") AND (learning OR instruction OR education) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018)) AND (LIMIT-TO (LANGUAGE, "English")) |
| Science Direct | "gamified" "gamification" "flipped classroom" |
| ERIC | (gamified OR gamification) AND flipped classroom |
| ProQuest | "Gamified flipped classroom" |
| Dimensions | "Gamified flipped classroom", "gamified" "gamification", "flipped classroom" |
| Google Scholar | "Gamified flipped classroom" OR "gamified" "gamification" OR "gamifying" AND "flipped classroom" |

### 2.2. Screening

The second step refers to the data screening process, in which survey title, accessibility, overlap, year of publication, and unrelated articles were published. Based on what the researchers read in the abstract, only 103 similar publications were established after this approach was established. Table 2 lists the selection criteria for the lookup of pertinent data. The publication year ranges from 2018 to 2022, as well as only article journals are included. Note that the articles are only chosen in English.

Table 2. The selection criterion for searching

| Criterion | Inclusion | Exclusion |
|---|---|---|
| Language | English | Non-English |
| Year | 2022 | <2022 |
| Literature type | Journal (research articles only) | Journal (conference proceeding, book chapter) |

### 2.3. Eligibility

The third step, called eligibility, has 59 items. At this point, all article titles and important content were carefully examined to ensure they met the inclusion criteria and complemented the present research's objectives. Four studies were excluded since they were irrelevant to the GFC. Hence, 52 papers are available for review Figure 2.

### 2.4. Data extraction and analysis

Further analysis of the 52 papers was conducted to present compiled data findings for the study topics. It is crucial to provide the data gleaned from the studies' validity and credibility. Consequently, a triangulation procedure was employed. First, a thorough examination and analysis of the ideas, methodology, goals, outcomes, and linkages between gamified studies and education will be conducted. All studies' information was collected while maintaining the validity of the research through a systematic keyword search. Finally, we finalized our triangulation process by conducting a document analysis to ensure our findings' convergence and verification. The following significant details were taken from each article: i) learning theories/models; ii) methods; iii) game activity; iv) gamification tools/platform; v) game elements; vi) variable; vii) findings. The flow diagram of the four stages involved in the systematic review process using the PRISMA statement is illustrated in Figure 2.

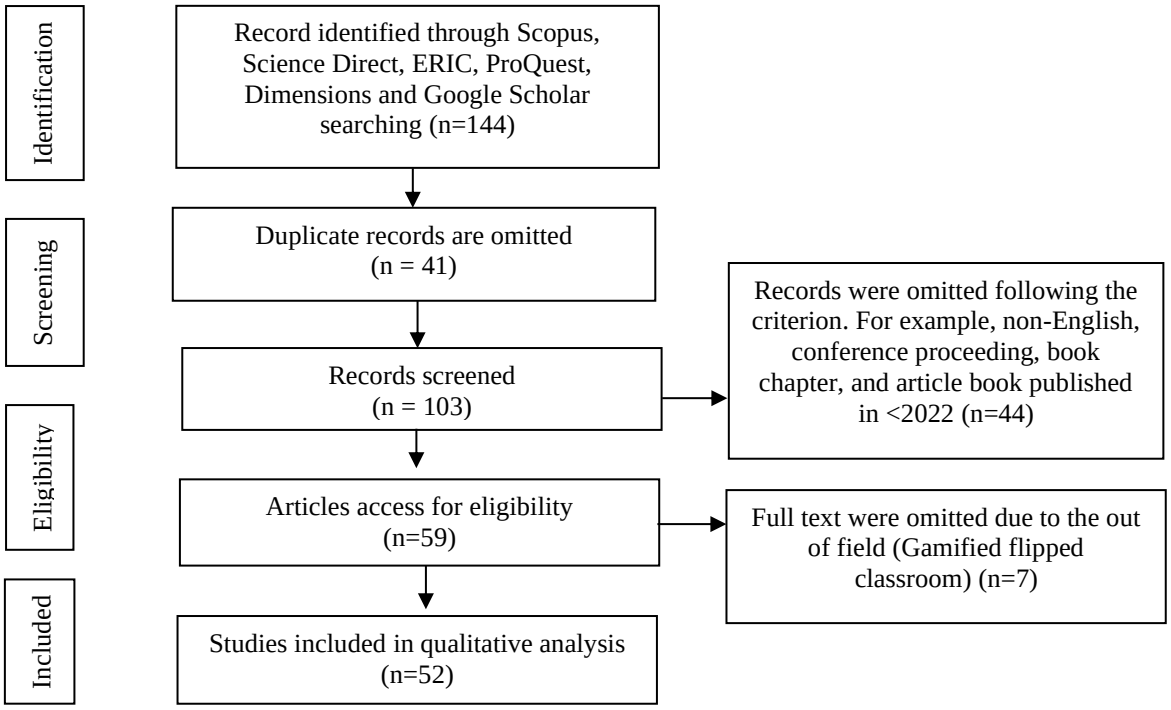



Figure 2. Flow diagram of the proposed search study [9]

## 3. RESULTS AND DISCUSSION

Based on five suggested research questions, the study's results will be discussed in this part. The significant findings are presented in this section regarding the main research goals. To view the major issue discussed and analyzed, we extracted the top three keywords from the 52 papers. Correspondingly, the top three search terms were "gamified," "gamification," and "flipped classroom". Table 3 demonstrates the research article based on year and title. A study conducted between 2018 and 2022 discovered 52 articles about GFC strategies used in multi-level education. As a result, research on GFC has been published more frequently each year. Subsequently, the number of publications published annually is presented in Figure 3.

Table 3. The research article finding based on year

| No | Author | Year | No | Author | Year |
|---|---|---|---|---|---|
| 1 | [3] | 2020 | 27 | [32] | 2020 |
| 2 | [5] | 2021 | 28 | [33] | 2021 |
| 3 | [6] | 2020 | 29 | [34] | 2021 |
| 4 | [7] | 2020 | 30 | [35] | 2021 |
| 5 | [10] | 2020 | 31 | [36] | 2021 |
| 6 | [11] | 2020 | 32 | [37] | 2022 |
| 7 | [12] | 2022 | 33 | [38] | 2021 |
| 8 | [13] | 2021 | 34 | [39] | 2021 |
| 9 | [14] | 2019 | 35 | [40] | 2021 |
| 10 | [15] | 2018 | 36 | [41] | 2021 |
| 11 | [16] | 2019 | 37 | [42] | 2021 |
| 12 | [17] | 2018 | 38 | [43] | 2021 |
| 13 | [18] | 2018 | 39 | [44] | 2021 |
| 14 | [19] | 2020 | 40 | [45] | 2021 |
| 15 | [20] | 2020 | 41 | [46] | 2022 |
| 16 | [21] | 2019 | 42 | [47] | 2022 |
| 17 | [22] | 2021 | 43 | [48] | 2022 |
| 18 | [23] | 2019 | 44 | [49] | 2019 |
| 19 | [24] | 2019 | 45 | [50] | 2020 |
| 20 | [25] | 2020 | 46 | [51] | 2018 |
| 21 | [26] | 2021 | 47 | [52] | 2022 |
| 22 | [27] | 2018 | 48 | [53] | 2022 |
| 23 | [28] | 2018 | 49 | [54] | 2022 |
| 24 | [29] | 2019 | 50 | [55] | 2022 |
| 25 | [30] | 2020 | 51 | [56] | 2022 |
| 26 | [31] | 2020 | 52 | [57] | 2019 |

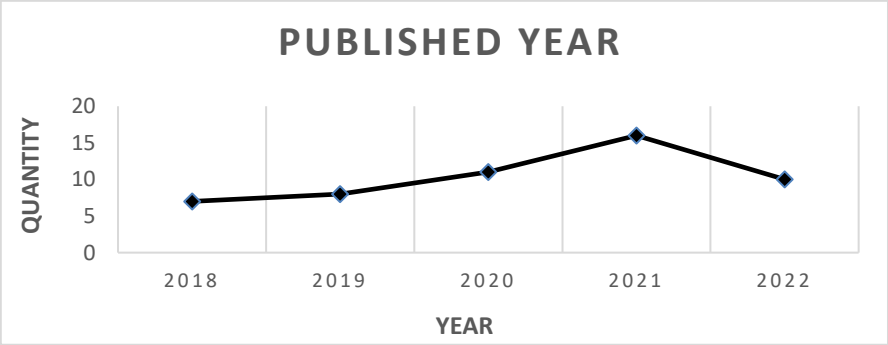



Figure 3. Number of publications each year

### 3.1. Theoretical models

In the 52 papers that were reviewed, more than half of the researchers applied the self-determination theory (SDT) to examine how gamification impacted student motivation by 43%, followed by the ARCS model by 11%, flow theory by 7%, cognitive learning theory, behavioral reinforcement theory, social comparison theory 5% each. Other theories by 9% include active learning theory, constructivism theory, sociocultural learning theory, taxonomy bloom, and trait activation theory (TAT). Note that learner and pedagogical models are among the additional models employed in the research of the GFC of 7%. Figure 4 shows the theories and model use in GFC studies.

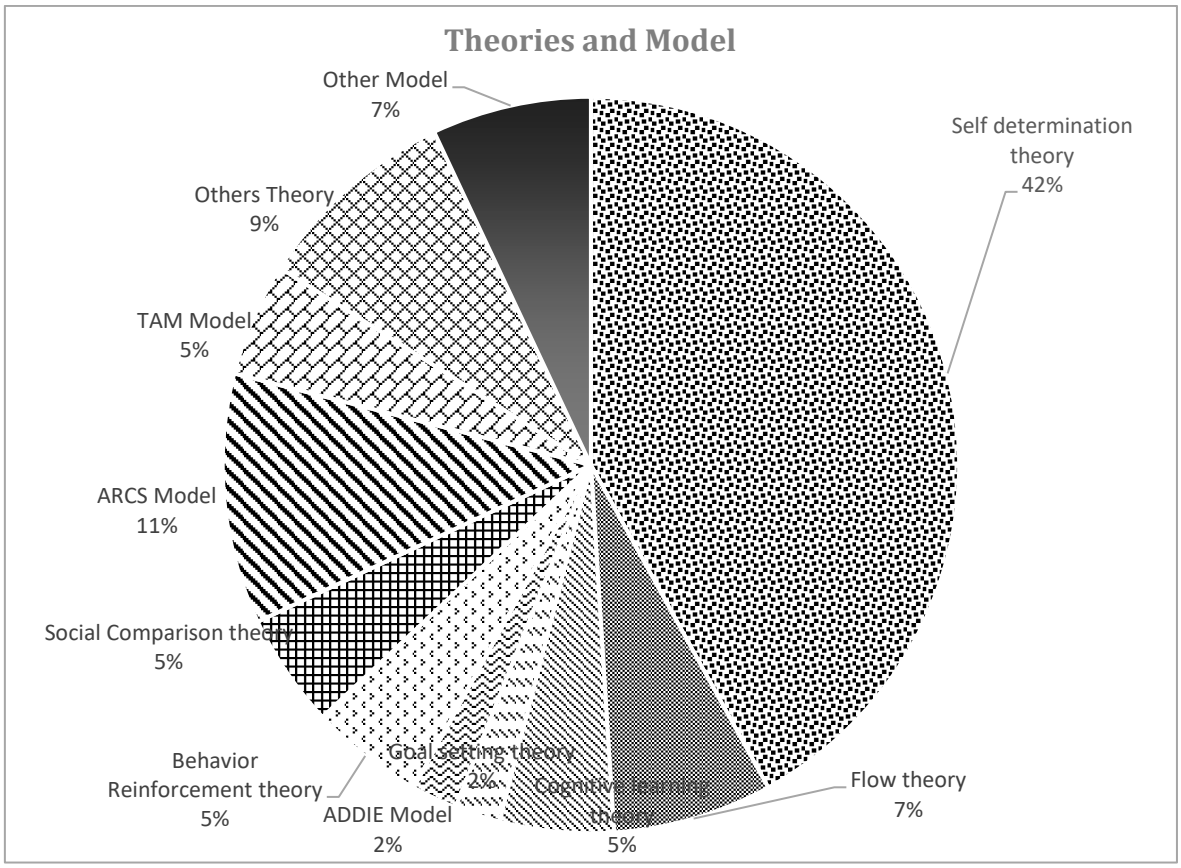



Figure 4. Theory and model use in GFC studies

### 3.2. Methodology approach

The quantitative methodology was discovered to be applied by most studies, followed by the mixed-method approach. Meanwhile, the quantitative method was utilized in 32 studies using various data collection techniques, including experimental tests, assessments, and questionnaire surveys as shown in Figure 5. An analysis of the publications reveals that only one study employed a qualitative method and that 19 employed mixed-method to collect data utilizing various methodologies. Observations, surveys, interviews, and assessments are a few of these.

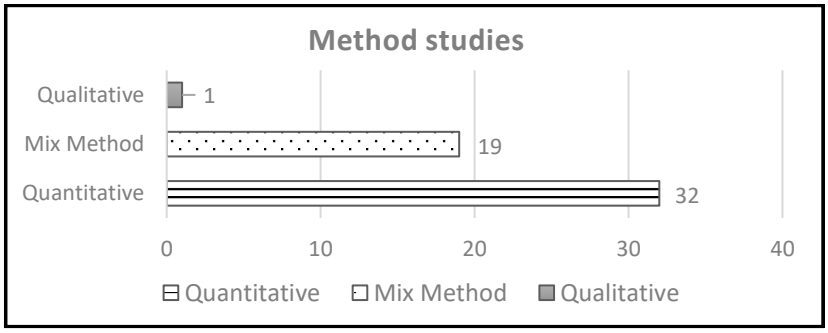



Figure 5. Method used in gamification studies

### 3.3. Gaming tools or online platform

The survey's findings revealed that different platforms and tools were used to conduct teaching and learning activities through GFC. The platforms used in GFC are listed in Table 4. Nevertheless, some studies miss specifying the platforms and technologies employed for teaching and learning.

Table 4. Gaming tools or online platforms used in GFC

| No | Author | Year | Tools/Platform |
|---|---|---|---|
| 1 | [3] | 2020 | Ed puzzle, Kahoot! Nearpod, Socrative, Quizlet, and Padlet |
| 2 | [5] | 2021 | Kahoot! Quizalize and Quizizz |
| 3 | [6] | 2020 | ioEduc and Kahoot! |
| 4 | [7] | 2020 | Learning management system (Moodle) |
| 5 | [10] | 2020 | Gamified learning course |
| 6 | [11] | 2020 | LMS (Moodle) and YouTube |
| 7 | [12] | 2022 | Kahoot or Socrative, or CrossQuestion educational game. |
| 8 | [13] | 2021 | Edmodo App |
| 9 | [14] | 2019 | Educaplay |
| 10 | [15] | 2018 | YouTube, Moodle, Kahoot! |
| 11 | [16] | 2019 | The iSpring Quiz Maker |
| 12 | [17] | 2018 | The Protégé designed by Playware Studios |
| 13 | [18] | 2018 | Moodle |
| 14 | [19] | 2020 | Socrative |
| 15 | [20] | 2020 | Gymkhana room for education and evaluation in nursing studies (GREENS©) |
| 16 | [21] | 2019 | Socrative |
| 17 | [22] | 2021 | The online University platform, Moodle |
| 18 | [23] | 2019 | Kahoot! |
| 19 | [24] | 2019 | TabooTM or Time's up!TM, KahootTM, SocrativeTM, QuizzizTM, Collaborative Problems Jigsaw |
| 20 | [25] | 2020 | Socrative and Kahoot |
| 21 | [26] | 2021 | Socrative, Kahoot, Moodle and Blackboard Collaborate. |
| 22 | [27] | 2018 | Moodle |
| 23 | [28] | 2018 | Cisco and Secure Volunteer |
| 24 | [29] | 2019 | Unity3d video game engine |
| 25 | [30] | 2020 | Game immersion questionnaire (GIQ) |
| 26 | [31] | 2020 | Jigsaw, Kahoot, Socrative |
| 27 | [32] | 2020 | TipOn |
| 28 | [33] | 2021 | Kahoot! Quizlet, and Prodigy |
| 29 | [34] | 2021 | Self-develop gamification project |
| 30 | [35] | 2021 | Computer-assisted games |
| 31 | [36] | 2021 | AI-enabled gamified web-based online learning application |
| 32 | [37] | 2022 | Kahoot! |
| 33 | [38] | 2021 | Gamified interactive e-book |
| 34 | [39] | 2021 | Self-develop gamification learning |
| 35 | [40] | 2021 | Econplus champions league and Kahoot! |
| 36 | [41] | 2021 | Vocabulary games from Khate-Sefied |
| 37 | [42] | 2021 | Kahoot! |
| 38 | [43] | 2021 | Moodle |
| 39 | [44] | 2021 | Zoom |
| 40 | [45] | 2021 | CrossQuestion |
| 41 | [46] | 2022 | CrossQuestion multiplayer game |
| 42 | [47] | 2022 | Moodle, Quiz |
| 43 | [48] | 2022 | Educaplay |
| 44 | [49] | 2019 | Moodle |
| 45 | [50] | 2020 | Ed Puzzle, LMS Moodle platform |
| 46 | [51] | 2018 | iSpring Learn, LMS |
| 47 | [52] | 2022 | Moodles |
| 48 | [53] | 2022 | Saudi national online learning |
| 49 | [54] | 2022 | Self-develop gamification learning |
| 50 | [55] | 2022 | Kahoot! And LearningApps |
| 51 | [56] | 2022 | Kahoot! |
| 52 | [57] | 2019 | Trivia quiz game |

### 3.4. Game activity and game element

The teaching and learning process is delivered through GFC techniques, with varied activities based on the data gathered. Figure 6 depicts the proportion of classroom activities that utilize the GFC technique. According to the survey results, quizzes (41%) and learning activities (21%) were the areas where gamification was most prevalent. Meanwhile, the percentage for group projects (14%), formative assessment (11%), exercise (7%) and assessment (6%) accordingly.

Gamification contains various elements that might boost students' engagement and motivation in the classroom. According to the analysis done on the 52 articles, several gamification elements are applied. For example, according to the literature review, researchers preferred employing points and badges over other factors when rewarding winners. The gamification elements employed by the researchers in the GFC study are demonstrated in Figure 7.

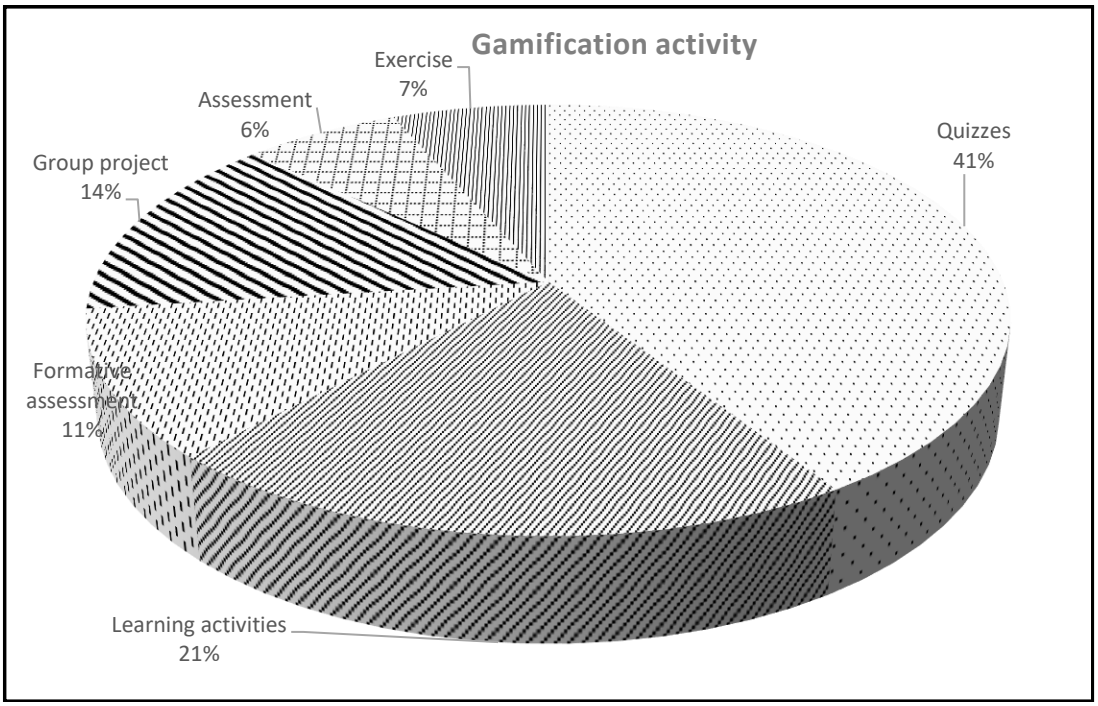



Figure 6. Percentage of activities using gamification that was carried out

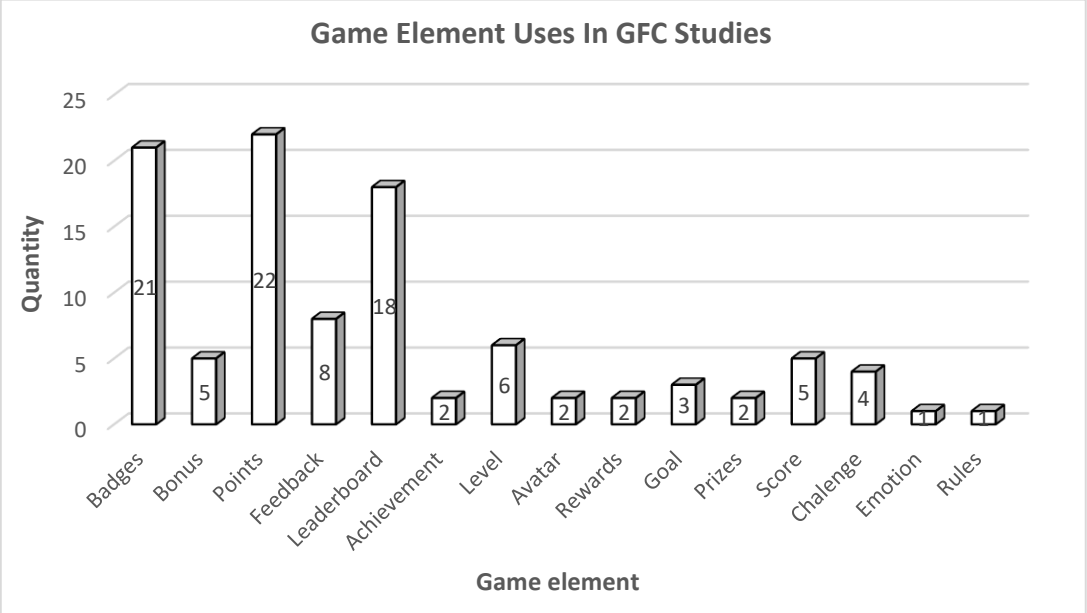



Figure 7. Game element use in GFC studies

### 3.5. Variables and impact on students' learning

Various variable was utilized in earlier investigations. However, most studies examined how gamification in FC impacted student performance, motivation, perception, and engagement. The variables examined alongside the GFC are listed in Table 5.

Table 5. Independent variables involved and their impact on the GFC study

| No | Ref. | Variable | A gamified flipped classroom impact |
|---|---|---|---|
| 1 | [3] | Students' and teachers' perceptions | Gamified classroom benefits comprise improved learning performance and outcomes, developed learning abilities and confidence, as well as enhanced learning motivation and engagement, which both students and teachers acknowledged. |
| 2 | [5] | Intrinsic motivation, social relatedness, competence need satisfaction. | Gamified in-class activities have favorable benefits on intrinsic motivation as well as social connectedness. Nevertheless, they possess no discernible impact on meeting competence needs. |
| 3 | [6] | Student's engagement | With TechTeach, learning and enjoyment are possible in the classroom whether students are physically present. |
| 4 | [7] | Achievement and cognitive engagement | GFC enhanced students' cognitive engagement. |
| 5 | [10] | Students' motivation | The GFC strategy has a beneficial effect on students' motivation. |
| 6 | [11] | Study habits | The students liked the gamified CS1, team-based, flipped course and were inspired to enhance their study habits. |
| 7 | [12] | Student engagement, students' task orientation, students' satisfaction, students' attitude regarding the technique's complexity, students' general skills, students' knowledge, students' motivation, students' course learning outcomes. | Regarding technical difficulty, task orientation, student participation, satisfaction, knowledge, as well as learning motivation, the GFC learning technique performs better. |
| 8 | [13] | Students' achievement and perceptions | The use of digital game-based (DGB) as well as play curricular activity reflection discussion (PCARD) flipped learning considerably increases the grammar abilities of English as a Foreign Language (EFL) learners over the control group. |
| 9 | [14] | Achievement (vocab) | Students may benefit from utilized the gamified flipped classroom application (GFCA) to enhance vocabulary proficiency. |
| 10 | [15] | Motivation | Students' motivation and competitiveness in class increased due to the gamification-enhanced activities that encouraged flipped learning. |
| 11 | [16] | Learner performance and need satisfaction | Because the GFC satisfies their intrinsic psychological requirements for competence, autonomy, and relatedness, participants have attained high motivation. |
| 12 | [17] | Students' motivation | When used effectively, gamification can encourage students and assist them in scaffolding reading assignments before lectures. |
| 13 | [18] | Students' motivation, perception | The goal-access-feedback-challenge-collaboration (GAFCC) style of gamification favors engaging learners because it provides students with the impression that the game benefits their learning. |
| 14 | [19] | Students' Perception | Applying gamification tactics also helped boost the program's favorable evaluation. |
| 15 | [20] | Students' perception | Over 60% of students agreed or strongly stated that GREENS helped enhance assessment, fun, learning, teamwork, as well as motivation. |
| 16 | [21] | Motivation and perception | The program received a very positive rating regarding motivation and sense of learning. |
| 17 | [22] | Attitudes, self-efficacy and emotions | Analysis of attitudes and self-efficacy reveals that most items exhibit higher self-efficacy and more favorable opinions following the intervention. |
| 18 | [23] | Student's perceived usefulness, engagement intention, and satisfaction | These strategies successfully alter students' perceived value and intended level of participation. From the participants' perspectives, gamification produces better results than an FC. |
| 19 | [24] | Students' perception and motivation | The findings presented increased student recognition and motivation with regard to effective teaching techniques, as well as a demonstrable enhancement in good feelings toward scientific topics and science education. |
| 20 | [25] | Students' engagement, effectiveness, the complexity of the GFC, student satisfaction, and task orientation | The GFC method has improved their experience for a better outcome. Additionally, it has aided their development as independent learners fiercely motivated to outperform their peers in class and on other GFC tasks. |
| 21 | [26] | Students' motivation | Based on the ARCS model, method, and tactics, students' motivation has been boosted and/or maintained by blended teaching methodologies (BTM), ultimately improving their learning. |
| 22 | [27] | Students' motivation, learning achievements and perception | Compared to the students participated in the control group, the experimental group's students exhibited a much higher motivation for academic performance. |
| 23 | [28] | Learning process | According to the statistics, the midterm tests, quizzes, lab work, average attendance, as well as final exams increased by almost 20% compared to the traditional classroom approach. |
| 24 | [29] | Student competencies | Compared to those who study the subject using conventional methods, the average grades in the evaluations significantly increased. |
| 25 | [30] | Students' behaviors, immersion experience, reading comprehension performance, as well as collaborative interaction relationship | This study addresses the need to encourage high-quality annotations in gamification methods, which can significantly improve students' reading comprehension. |
| 26 | [31] | Interaction data, students' participation, and achievement | The experimental group received greater involvement, achievement ratings, as well as interaction data than the control group. |

Table 5. Independent variables involved and their impact on the GFC study (*continued*)

| No | Ref. | Variable | A gamified flipped classroom impact |
|---|---|---|---|
| 27 | [32] | Curiosity and language anxiety | First, the two varieties mentioned earlier of epistemic curiosity negatively affect English learning anxiety. Second, deprivation-type epistemic curiosity (DEC) was positively correlated with attitude towards gamification (ATG), but interest-type epistemic curiosity (IEC) had no discernible effect on ATG. Third, ATG could accurately forecast how much students will learn. |
| 28 | [33] | Students' attitudes concerning competition, online collaboration, as well as learning gamification | The gamified learning experience positively impacted the attitudes of participants toward learning gamification. |
| 29 | [34] | Creative Thinking Skills | The research established no changes in the learning environment. Rather, the activity type as well as the interaction between teams, most significantly impacted critical thinking skills. |
| 30 | [35] | Students' learning in Chemistry | The experimental groups' learning activities and outcomes have attained classical completeness, according to the post- as well as pre-tests results. |
| 31 | [36] | Students' perception | In general, students possess positive opinions concerning the application as well as the added features. Other than that, 75% of students believe that the application can motivate students to stay participated in the physics course. |
| 32 | [37] | students' engagement | According to the findings of a semester-long study, there is no difference between poll- as well as point-based gamification. Nevertheless, point-based gamification in quiz mode increases reported student engagement more than in traditional lectures. |
| 33 | [38] | Learning performance, motivation, and meta-cognition tendency | Students from the gamified interactive e-book in the mathematical flipped classroom (GIEBFL) did much better than those from traditional instruction (TI) as well as conventional flipped learning (CFL). Other than that, the survey of students' motivation for learning revealed that GIEBFL students were more motivated than TI and CFL students. Here, GIEBFL students considerably outperformed TI students in terms of metacognition propensity. |
| 34 | [39] | Students' engagement and motivation | The various gamification tactics utilized to increase engagement received excellent feedback from students. In addition, students said they progressed in their writing, presentations, and comprehension throughout the course. |
| 35 | [40] | Students' achievement and satisfaction | A satisfying active learning environment is produced by constructing an empowered as well as co-creative gaming experience that supports students to establish value in general. |
| 36 | [41] | Vocabulary learning | The flipped context's use of gamification may substantially impact vocabulary development. |
| 37 | [42] | Students' perceptions | The students believed that using 'Kahoot!' boosted their knowledge of subjects, increased engagement, drove them to learn, and created a positive learning atmosphere. |
| 38 | [43] | Behavioral Engagement and Achievement | Students' involvement in the pre-class activities of the FC increased significantly while using the GFC mode of instruction compared to the control group. |
| 39 | [44] | Motivation, interest and fun | Happiness, pleasure, and enjoyment are three good emotions that dramatically rise following the intervention. |
| 40 | [45] | Student motivation | Gamification can increase student motivation and engagement in beneficial ways. In addition, it can improve students' grades. |
| 41 | [46] | Students' motivation | Learning effectiveness and learning motivating elements are significantly correlated. The game has a great effect on the motivation of the students as well. |
| 42 | [47] | Students' achievement and engagement | Traditional classes that have been gamified encourage student accomplishment, and FC that has been gamified encourage student engagement. |
| 43 | [48] | English oral communication ability | The students' oral communication skills in English could be enhanced by integrating task-based language training, flipped learning, as well as game-based learning. |
| 44 | [49] | Student engagement | Students in the gamification-enhanced flipped learning group performed the post- as well as pre-class tasks more frequently, produced artefacts of higher quality, and achieved considerably greater post-course test scores compared to their non-gamified counterparts. |
| 45 | [50] | Motivation, autonomy and self-regulation | When these techniques were tilized, students' motivation, autonomy, and self-control increased as they interacted with the subject's material. |
| 46 | [51] | Students' learning performance and perceived motivation | The students' perception of competence, autonomy, and relatedness was positive. They also performed better and achieved high exam scores. |
| 47 | [52] | Student skills competency and learning motivation. | Gamified flipped classrooms enhance students' self-confidence, skills knowledge, intensity of preparation, as well as motivation, in comparison to the traditional flipped classrooms. |
| 48 | [53] | Student achievement, motivations, and satisfaction | An e-learning gamification increases students' motivation and satisfaction in computer science online courses but has no effect on their achievement. |
| 49 | [54] | Student engagement and satisfaction | Comparing a conventional flipped classroom, the escape box format is well-liked by students. It presents enhanced ratings in appropriate levels with regard to effective learning materials as well as complexity. |
| 50 | [55] | Student achievement | Students in gamification and flipped learning methods are more successful compared to students in the traditional method. |
| 51 | [56] | Student engagement | Students scored better in gamified quizzes when they prepared in advance in flipped learning sessions. |
| 52 | [57] | Students 'motivation | High levels of student motivation, increased class participation, and improved subject achievements (marks). |

## 4. DISCUSSION

This systematic analysis's findings are concentrated on studies that examine the impact of gamification strategies and flipped classrooms on education. Other than that, this study fills the gaps in the research mentioned earlier and provides valuable suggestions and recommendations for future studies on gamified flipped classrooms. Apart from that, SDT [5], [17]–[19], [22], [32], [34], [39], [40], [44], [48], [50]–[55] became the basis of the majority of gamified flipped classrooms study.

However, most articles fail to clarify how the study's underlying theory and the real gamification activities relate. For example, 21 of the 52 articles do not mention any theory or model employed to implement their research. In addition, most scholars applied the Attention, Relevance, Confidence and Satisfaction model to examine how GFC impacted students' motivation [10], [26], [33], [45], [46].

Consequently, most researchers conducted investigations utilizing experimental quasi-studies as their primary methodology Figure 5. Both treatment and control groups of students were established, having the treatment group undergoing interventions. Students will take pre-test exams before learning about GFC. Consequently, after the intervention, a post-test exam will be conducted to observe how successful the interventions were. In addition to experiments, the mixed-method study included information gathered through monitoring, interviews, and open-ended surveys. In comparison, different study [33] employed a qualitative research approach.

As a result, the systematic review analysis's findings revealed a variety of online tools and platforms that researchers utilized to examine the efficiency and influence of GFC on student learning. Besides that, the researchers are more enthusiastic about utilizing the Socrative, Kahoot!, and Moodle learning management systems. In addition, several academicians have developed unique and inventive gamification programs to conduct their GFC investigations. One is Triviachis, a hybrid of the Spanish board game Parchis and the trivia quiz game [57]. To determine the effectiveness of gamified questions in English grammar, [32] created the TipOn quiz, an artificial intelligence (AI)-enabled, web-based online learning tool to examine students' physics perceptions [36]. Note that gamification activities encourage activity completion, improve learning, and address issues [58]. Quizzes, formative assessments [3], [26], [31], [42], [46], learning activities, in-class instruction and assessment, as well as group projects [12], [34] were some of the gamification techniques employed in the researchers' study.

We established that the most often utilized game mechanics in GFC in education were points, badges, feedback, levels, and leaderboards. This aligns with previous research [12], who opined that the most frequently utilized game mechanics are levels, badges, trophies, achievements, competitions, and point systems. According to our study's findings, most research articles reveal favorable attitudes and learning outcomes, which is consistent with other studies findings.

Consequently, this review offers a thorough assessment of the relevant empirical evidence. Gamified flipped classrooms generally produce favorable academic outcomes. Apart from that, the majority of the research that were evaluated stated that gamification encourages enhancements in student achievement [5], [7], [13], [14], [27], [40], [43], [47], [53], [55], motivation [5], [10], [13], [16], [18], [19], [22], [23], [25], [27], [28], [39], [40], [46], [51]–[53], and engagement [6], [7], [57], [13], [24], [26], [38], [40], [44], [48], [56]. Furthermore, numerous studies have already established the effectiveness of gamified flipped classrooms over conventional teaching and learning.

## 5. CONCLUSION

Gamification uses game-based components or mechanics to boost motivation and interest through competition, such as leaderboards, leader scores, points and badges. Besides that, gamification components can encourage students to set more focused objectives, be more persistent, learn by repetition through teamwork, and engage in enjoyable competition with their peers. Moreover, gamification also encourages competitiveness and maintains student motivation in the classroom for longer. Students who use the gamification strategy to learn become more confident, active, and involved in classroom activities. Other than that, they develop better problem-solving, communication, and thinking skills. Gamification is thought to enhance fundamental knowledge while also raising student achievement. Additionally, gamification fosters collaborative learning, student-centered learning, and positive learning possibilities while providing an opportunity to incorporate students' thoughts, feelings, and behaviors. It is proven that instructors can transform classrooms into pleasant environments. By incorporating gamification elements such as giving assessments, applying gamification rules, time constraints, and accuracy, they can encourage action, motivate the students and gain positive feedback.

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