

## PAPER

# Gamification in Mobile Applications: The Regulation of Children's Course Games by Commensurability Education System

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## ABSTRACT

The nation's education-related information reform is making slow progress in light of the recent significant advancements in information technology. Early childhood education informatization has become a crucial part of the national education informatization building, serving as the first link in the chain of lifelong learning. This paper analyzes the significance of using children's games in the classroom and the significance of incorporating new media resources into children's course games by fusing the benefits of new media resources for teaching in a real-world educational setting. The goal is to realize the gamification of early childhood education courses and strengthen the management and deepening of course resources. The study also shows that customer involvement serves as a mediator between a better brand experience and a consumer's desire to make another purchase from the business. Subsequent interviews demonstrated that the following factors accounted for users' motivations for using the app: rewards, competition, feeling of accomplishment, and knowledge acquisition; engagement and identity clarified how using the gamified application affected users' attitude and loyalty towards the main service. In summary, our contribution advances the understanding of how gamified affordances can enhance consumer experiences by adding value to the focus brand that is facilitated by a third-party app as well as the gamified consuming experiences themselves.

## KEYWORDS

gamification, mobile applications, commensurate and incommensurate, self-expression

## 1 INTRODUCTION

For hundreds of years, humans have utilized games as a way to solve issues and motivate others to accomplish a variety of objectives. Previously, these were mostly mental exercises for military strategy, known as strategic war simulations.

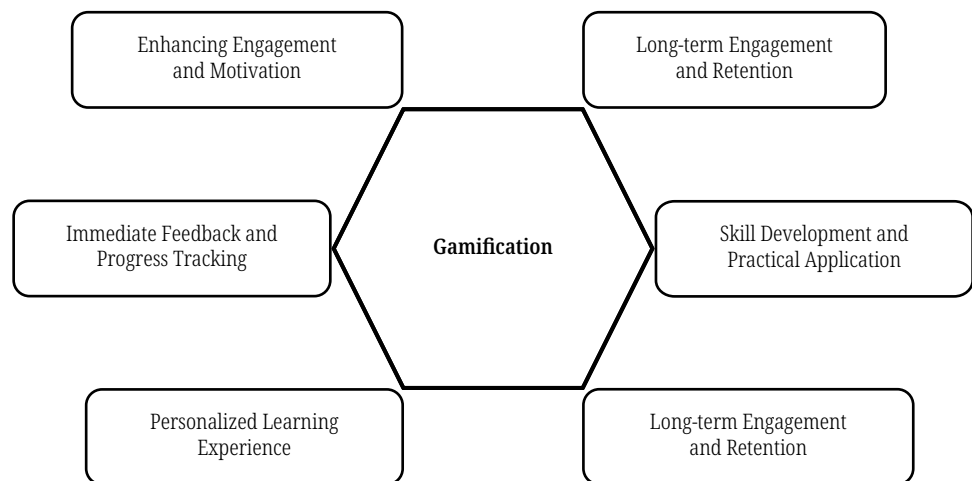
Song, P., Qi, G., Zhang, L., Li, P., Chen, Z. (2024). Gamification in Mobile Applications: The Regulation of Children's Course Games by Commensurability Education System. *International Journal of Interactive Mobile Technologies (IJIM)*, 18(17), pp. 4–16. <https://doi.org/10.3991/ijim.v18i17.50789>

Article submitted 2024-05-18. Revision uploaded 2024-06-23. Final acceptance 2024-06-29.

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These days, with the help of mathematical instruments, they have developed into game theory, which is a tool for interpreting human behavior. Examples of this include the idea of cooperative behaviors and the quest for information regarding the efficiency of managing resources from the common pool. Recognizing how games influence a community's culture is a further topic of study in games. Johan Huizinga investigated the impact of play on the evolution of diverse cultures during the 1930s. The term "homoludens," or "man the player," was first used by this author [1]. Huizinga characterized the play as "a free activity standing quite deliberately outside 'ordinary' life as being 'not dedicated,' but at the same time consuming the player passionately and utterly" and considered it a factor underpinning the construction of culture and civilization.

Because there is a choice region where players' enjoyment and experience take precedence over the search for outcomes, games are classified as areas of freedom. By acting independently, the player engages in the game and gains enjoyment, feelings, and gambling experiences. These gamification aspects can be applied to many facets of social life to inform, inspire, or make acting more appealing. Study demonstrates that gamification can be applied to energy-related fields such as pro-environmental behavior [2], consumer awareness, and environmental education. Gamification, or the incorporation of game principles and components into non-gaming environments in (Figure 1), has become a potent teaching technique.



**Fig. 1.** The power of gamification in education

Additionally, employing this approach can enhance student engagement, accommodate different learning styles, and offer more flexible learning. Studies have been using this enrichment technique for a few years now. Previous study revealed that because students were frequently regarded as regular users of technology [3], there was a decrease in their engagement with knowledge acquisition. To get out of this predicament, there must be a way to openly access this information. Gamification can improve customer satisfaction, efficiency, and achievement, according to several studies. Through the use of gamification, students will become more adept at achieving their goals.

The paper is divided into following sections: A survey of relevant literature is provided in Section 2, "Related Work." Section 3: Motivation focuses on the methodology, tools, and technologies utilized in the development of the mobile application, as well as the application prototype and implementation in Section 4. The paper's conclusion, included in Section 5, also discusses future study projects.

## 2 RELATED WORKS

To make normal human-computer interactions more engaging and motivating or to help support intrinsic motivation so that the user finds the activity more enjoyable, gamification aims to change these interactions. Nevertheless, the claim that gamification affects intrinsic motivation is not well supported by data [4]. For the designers, striking a nice mix between serious and humorous is a challenge. Another problem is ensuring that the gamification portion of the user interface is suitable for the user by considering the gameplay and prizes. In 1693, John Locke suggested in a letter on education that kids learn letters and spelling by playing alphabet dice. This is a simple example of using intrinsic motivation to support kids' learning through play.

However, the term given above is connected to related ideas such as light-hearted engagement, serious games, and game-based technologies. Designed with non-recreation in mind, serious games concentrate on subjects that are considered "serious," such as economics, politics, health, schooling, business, and the armed forces. The definitions of serious games that are most commonly accepted today follow the example set by Michael and Stokes [5], who defined serious games as either "games that aim to engage players as they educate, train, or change behavior" or "games that do not have entertainment, enjoyment, or fun as their primary purpose." Meaningful games, in contrast to gamification, have been around for an extended period before computer technology became widely used.

We have shown in earlier study that gamification interventions can be created to overcome predicted obstacles to behavior change by utilizing insights from behavioral economics. Because gamified mobile applications frequently provide incentives in the form of points or awards, these components might be a good fit to make use of the following behavioral economic concepts [6]: probability price increases, varied encouragement, and losing aversion. Gaming, or the use of game design components such as emblems, stages, and scores, is becoming more and more common in mobile applications meant to assist users in becoming more physically and mentally healthy.

The gamification concept can incorporate leaderboards, progress bars, meters, scores, medals that indicate various accomplishment levels, and other attainable prizes into educational apps and procedures. Educational gamification suggests using player events, societal roles, and game-such as rule structures to alter learners' behavior [7]. Because of this, gamifying a subject could benefit elementary school pupils greatly. More effective learning may occur if the motivational potential of games is applied to the challenges of desire in school.

The MOOC participants can only create surface-level collaboration with these technologies for collaboration, interaction, and synchronous coordination. Peer reviews are one instance of this surface-level collaboration because there is rarely any meaningful contact between students during required assessments [8]. As a result, a collaborative atmosphere is not created. It also happens in forums when a student puts up a topic for discussion and the other students respond. This results in relatively little contact among students. Tools such as wikis, which prevent direct participant contact, only foster an atmosphere of surface-level collaboration. Rather, they merely offer a digital area on the internet where writers can access and modify information.

To comprehend gamification tactics and approaches, we need to be able to define precisely what a game is and what qualifies something as one. A game is defined as "any activity undertaken or regarded as a contest, including rivalry, strategy,

or struggle” by the Merriam-Webster dictionary. Throughout our lives, we have all such as played games for a variety of reasons [9]. Some people play games for personal reasons, such as taking pleasure in the competitiveness they provide. A lot of people play games to improve their mental or physical skills. Others view games as a way to prove their superiority in a particular area or as a means of making money through professional participation in sports or other activities. In summary, games are widely played because they are enjoyable.

It is believed that teachers who are today's digital immigrants will benefit students and heighten their attention in the lecture when these mobile apps are utilized as an aid for lectures. It is a known fact that grabbing the attention of digital natives requires utilizing new technology [10]. To maintain students' high levels of attention in the classroom, gamification techniques and gamified mobile applications are used to encourage in-class competitiveness. One of these programs is Duolingo, which is the most popular program for language learning. Students love it because learning a foreign language is entertaining and helps them stay motivated. The fact that the app works with both iOS and Android mobile devices is an additional benefit. Students are further encouraged to post their levels on the Internet.

### 3 METHODS AND MATERIALS

#### 3.1 Game essentials

A few examples of gamification elements are user avatars, game stages, progress bars, achievement-based badges, leaderboards, quests, and virtual items. Let us go into further detail about these [11]:

- A factor that makes users of the site loyal is involvement or devotion. This component may be used to gauge daily activity and the ratio of new versus old users.
- One component of the incentive system is points. Users receive points for behaviors that we, the developers, deem significant for the platform or application. In actuality, points represent instantaneous feedback that helps the user comprehend how work and rewards are related.

These components add up to a gamified atmosphere. The authors' intended activities for the users determine the importance of these components. Therefore, the elements would assist the developers of the website or application in achieving the desired user behavior [12]. The user would behave differently when they were rewarded via various gamification features. What components to include in a gamified layout is the primary query regarding game aspects. The conclusion is that only those components are beneficial and serve an objective.

#### 3.2 Illustrations of gamification

Gamification finds application in a multitude of domains, including websites, mobile apps, and real-world applications. Gamification has the potential to improve users' performance, increase their participation in sports, teach them new skills, increase productivity, and even lead healthier lives. By utilizing game components and layout, gaming is a tool that can be used to engage users with an app. In the

sections that follow, my job is to outline platforms and apps that employ gamification as a strategy to produce extremely engaged users in the areas of work, athletics, schooling, and healthcare (see Figure 2).

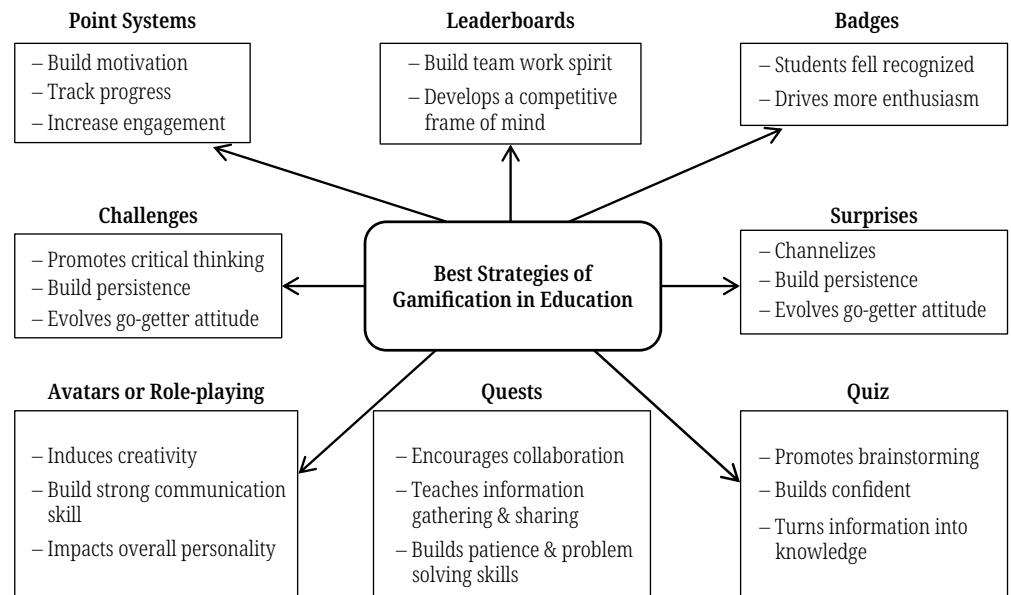


Fig. 2. Gamification in the classroom: overview, approaches, and instances

- **Instruction**

Duolingo and Cockade are two educational platforms that heavily rely on gamification components to keep users learning more. Users of the language learning website Duolingo can pick up new languages, including Spanish, Dutch, and French [13]. Lessons are created from the smaller, more manageable abilities that make up the learning process. Users earn lingo's (fictitious gems) and experience points (XP) as they finish the skills and lessons. The player can gain access to special functions and climb the ranks by gathering them.

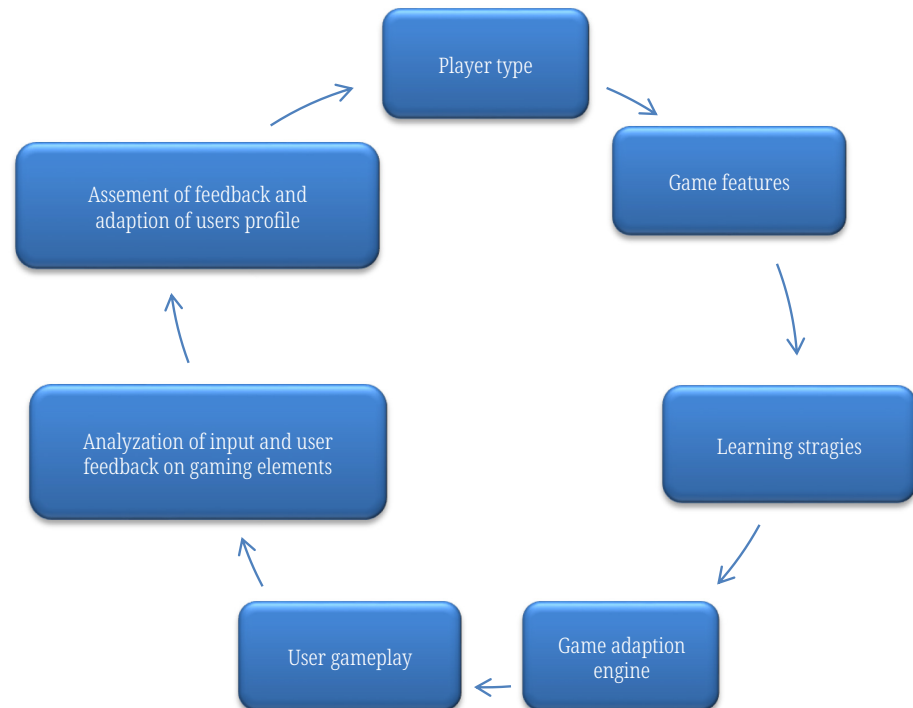
Users who want to construct apps or websites can learn how to compose codes. Numerous coding languages and courses are available, including ones that teach how to create a website. Users of this platform can always track their progress on the advancement bar for each skill and obtain badges for finishing the courses.

- **Athletics**

To motivate individuals to participate in sports, gamification is being used by a number of mobile and web-based companies, such as Nike+, Strava, Endomondo, and Runkeeper. Their primary function is to give the user immediate feedback by presenting data and accomplishments derived from their actions. One additional feature of these is the social competition section, which allows users to rate themselves and their friends against one another.

**Components of gamification for users and online learning.** The goal of the gamified e-learning model for higher education is to increase student motivation, satisfaction, efficiency, and economy. This paradigm incorporates contemporary e-learning and education theories and practices. According to contemporary conceptions of effective learning, learning is most successful when it is location-based, problem-based, immersive, active, and gives quick feedback. Examined gamification from a theoretical perspective as a way to improve user engagement on e-learning

systems Gamification in e-learning platforms appears to have the potential to boost student motivation, but achieving that effect is not simple; great effort must be put into the experience's design and execution in order for users to find it truly inspiring.



**Fig. 3.** Components of gamification for users

We need to understand our consumers' demands in order to create an e-learning paradigm that can be implemented in gamified higher education settings. Most college students have established their career direction and personal aspirations. Most of the time, university coursework is more rigorous than that of other school levels. Higher education students have a greater understanding of the value of the schooling they have chosen. Gamification is used in the model to raise student motivation even further. The preceding sections define a few terminologies, including game dynamics, game mechanics, and gamification. Incorporating gamification into the simulation in a way that strengthens students' perceptions of the value of schooling for the future (see Figure 3) [14].

The goal of gamification in e-learning is to motivate students to continue working despite their current failures. During the e-learning process, we need to collect data about students and their activities in e-learning. Adequate data provides a basis for analyzing and adapting e-learning to achieve the optimal state of the entire system. This type of work gives students full autonomy over their work. Having autonomy at work reduces the fear of using e-learning.

#### 4 IMPLEMENTATION AND EXPERIMENTAL RESULTS

Nine items in the first category were scored on a Likert-type scale from 1 to 5, with the goal of examining students' motivation and perspectives towards science learning through the use of an adaptive gamification application [15]. After

gathering and organizing the data into Table 1, which is shown below, it underwent a descriptive analysis.

**Table 1.** Students' attitudes and motivations on adopting the adaptive gamification programmer to learn science

Questions	Absolutely Disagree (%)	Disagree (%)	Strongly Agree (%)	Mean Average	Std Deviation
I like to learn about natural phenomena using applications like the one with the water cycle application.	1	1	70.0	5.54	1.637
I am interested in learning about natural phenomena in school.	1	4.9	52.4	5.37	1.784
I prefer to spend more time learning about natural phenomena from other subjects.	6	3.6	42.4	4.99	2.098
I can learn natural phenomena using applications such as the Water Cycle.	3.6	3.6	53.6	5.35	1.901
I feel more confident learning about natural phenomena in a fun way.	2.4	3.6	53.6	5.31	1.893
The classroom lesson on natural phenomena is boring.	27.4	12.4	33.6	4.15	2.614
Learning about natural phenomena such as the water cycle increases my interest in learning.	1	6.0	58.6	5.42	1.823

According to Table 1, 82.5% of students agreed or strongly agreed that they had a very high level of liking for learning science when utilizing the adaptive gamification program ( $M = 5.53$ ). Even though students appear to be highly engaged in learning science concepts in the classroom (Q2) ( $M = 5.36$ ) and even indicated that they would prefer to spend more time in science classes than in other subjects ( $M = 4.99$ ), almost half of them (55 percent, agree or strongly agree) think that science education is taught in a traditional way in the classroom, which they find boring.

Additionally, this affected the students' trust in their ability to learn, since they reported feeling more confident while using an enjoyable technique to study natural phenomena ( $M = 5.30$ ) (Q5). A noteworthy 62.5% of pupils expressed strong agreement with this statement. However, students reported a considerable boost in their engagement in gaining knowledge through the adaptive gaming environment (mean = 5.41) (Q7), in contrast to standard classroom teaching approaches. Merely 5% of the respondents disagreed with this statement.

Furthermore, students showed increased interest and thought the app was a useful resource for learning science (mean = 5.34). (Q4). Furthermore, 75.5 percent of learners agreed or strongly agreed that using the program increased their motivation to study and perform well (Q8). Lastly, the application had a favorable effect on students' anxiety (mean = 4.84), with almost two-thirds of students confirming or admitting that they felt less anxious and more at ease during the learning process (Q9).

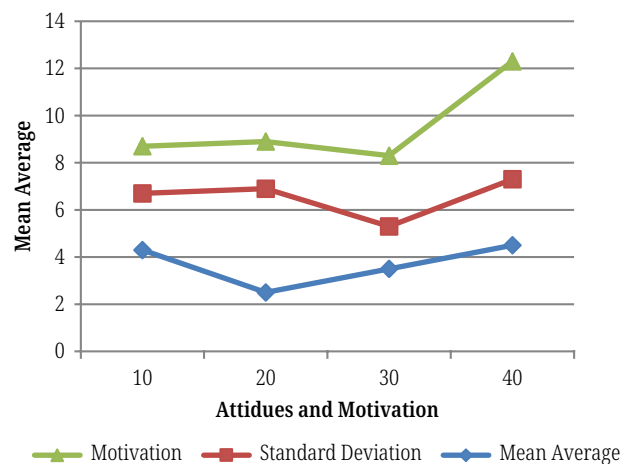


Fig. 4. Motivating students and their perspectives on studying science

The second category sought to evaluate how students' motivation was affected by the processes and game features they came across in the adaptive gamification environment. There were 11 subcategories in this category, each of which represented a different aspect of the game [16] in Figure 4. Six questions were changed to have the same meaning within each subcategory. The first inquiry at the beginning of each subcategory was to find out if the students had come across that particular aspect during their playthroughs. The learner would indicate "NO" and skip the current subcategory in favor of the next if they had not come across it. The student would reply to the next five inquiries in that category if their response was in the affirmative. Similar to the first category, every question was looked at in a descriptive manner.

Table 2. Encouragement and collaboration

Subcategory	Questions	Participants Answered	Absolutely Disagree (%)	Disagree (%)	Strongly Agree (%)	Mean Average	Std Deviation
Students' motivation for promotion	I liked the app because I could get promoted.	72	2.7	1	59.3	5.4	1.844
	I was actively trying to get promoted.	72	4.4	7.7	59.3	5.14	2.098
	I got the promotions I wanted in the app.	72	7.7	7.7	57.6	5	2.236
	I liked getting promoted.	72	2.7	2.7	67.5	5.44	1.837
	I used to get nervous when trying to get promoted (reversed question).	72	43.7	26.5	31.4	3.52	2.629
Students' motivation for cooperation	I liked the app because I could collaborate with/help other students.	68	6.4	6.4	73.3	5.34	2.134
	I actively tried to cooperate with/help other students.	68	8	6.4	57.5	5.11	2.195
	I cooperated/helped the other students I wanted to help.	68	2.9	8	64.5	5.26	2.034
	I liked working with/helping other students.	68	6.4	4.6	64.5	5.27	2.089
	I was stressed when trying to cooperate/help other students (reversed question).	68	39.7	15	38.2	5.80	2.730

Table 2 shows that 51 students encountered the promotion aspect, and 67 students effectively employed the cooperation feature by working with classmates.



The promotion component was well-such as by the majority of students (M = 5.43) who also said that the introduction of this component made the flexible gamification environment acceptable (M = 5.30). Furthermore, nearly seven out of ten students (62.1% agree or completely agree) successfully attained their intended promotion (M = 5.00), and nearly three out of four individuals (67.1% agree or totally agree) proactively made an effort to get advanced during their games (M = 5.13).

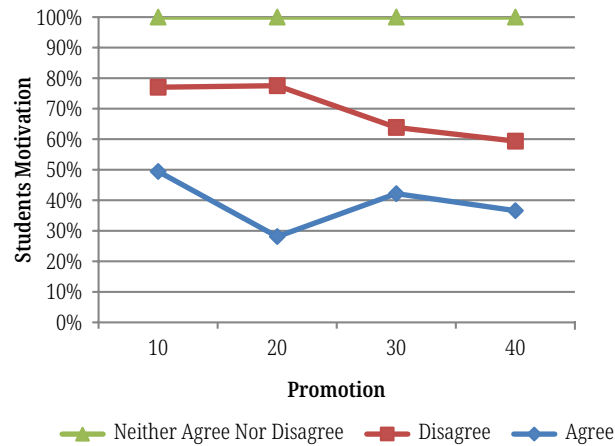


Fig. 5. Pupils came across the promotion element

It is noteworthy; therefore, that a sizable portion of students—41.1%—said they felt anxious about the promotion component. The cooperation component received a lot of praise because many people (76% agree or totally agree) mentioned how much they enjoyed collaborating with other pupils. (M comes to 4.26). In a similar vein, 76% of learners agree or strongly agree that the cooperation feature is one of the reasons they enjoyed the program (M = 6.36) in Figure 5. It is noteworthy, nevertheless, that out of all the other game features, and the percentage of adverse answers for both questions was approximately 10%. Moreover, a significant proportion of students (60.7%) agreed or strongly agreed that they made an effort to collaborate with other students (M = 6.09), and the same proportion thought that they had succeeded in attaining collaboration from their point of view (M = 6.25).

Regretfully, students’ stated stress levels were rather high when it came to the teamwork part, with 52.1% of them confirming or strongly confirming that they felt pressured. This makes sense since some students found it difficult to collaborate, which raised stress levels above those of other game components.

Table 3. Difficulties and personalization

Subcategory	Questions	Participants Answered	Absolutely Disagree (%)	Disagree (%)	Strongly Agree (%)	Mean Average	Std Deviation
Student motivation for the challenges	I liked the app because it had challenges.	90	3.6	3.6	56.4	5.25	1.918
	I was actively trying to overcome challenges.	90	4.9	2.4	66.4	5.32	1.989
	I overcame the challenges I Wanted to overcome.	90	7.4	8.6	61	5.04	2.233
	I like to overcome challenges.	90	3.6	6	71	5.41	1.962
	I used to get nervous when overcoming challenges (reversed question).	90	61.4	21.4	26	3.4	2.563

(Continued)

**Table 3.** Difficulties and personalization (*Continued*)

Subcategory	Questions	Participants Answered	Absolutely Disagree (%)	Disagree (%)	Strongly Agree (%)	Mean Average	Std Deviation
Student motivation for customization	I liked the game because of the change in appearance.	37	21.6	4.9	52.4	4.82	2.358
	I was actively trying to change my appearance.	37	1	21.6	52.4	5.05	2.039
	I managed to change my appearance as many times as I wanted.	37	52.4	25.5	25.5	3.39	2.501
	I like to change my appearance.	37	1	5	59	5.09	1.998
	I used to get anxious when I tried to change my appearance (reversed question).	37	61	8.9	8.9	3.24	2.424

Students showed a strong preference for the customization feature, which allowed them to alter their looks ( $M = 5.08$ ). But because this game mechanism was there, they might have valued the adaptive personalization environment higher ( $M = 4.81$ ). Out of all the elements, this one caused the greatest number of students—16%—to say they did not such as or detest the application. Taking Table 3's data into account, this response makes sense.

More than half of the pupils said they could not attain the level of customization they wanted (67.7% completely disagree or disagree), and despite the fact that students actively attempted to alter their look ( $M = 5.04$ ), only a small percentage were able to do so. Thankfully, 33.1% of students reported substantial stress levels (agree or completely agree) with the customization factor, which was related to stress levels comparable to several other game elements.

**Table 4.** Characters

Subcategory	Questions	Participants Answered	Absolutely Disagree (%)	Disagree (%)	Strongly Agree (%)	Mean Average	Std Deviation
Student motivation for the roles	I liked the game because I had a role.	89	2.4	6.2	72.6	5.54	1.717
	I was actively trying to "play" my role.	89	1	3.7	69	5.46	1.768
	I wanted to and succeeded in improving my role within the application.	89	10	3.7	72.6	5.23	2.256
	I liked having a role within the app.	89	1	3.7	69	5.48	1.735
	I was nervous when I had a role within the app (reversed question).	89	59.8	11.4	27.9	3.39	2.590

The role game element, which is the final game element in the program, is shown in Table 4. The majority of participants observed and encountered the role-playing game feature, based on the data. Response to this element was quite favorable ( $M = 5.47$ ), with 91.1% of participants saying they such as that it had a function in the application (agree or completely agree). Furthermore, because this part was included, nearly the same proportion (94.6%, agree or completely agree) indicated affection for the program ( $M = 5.53$ ).

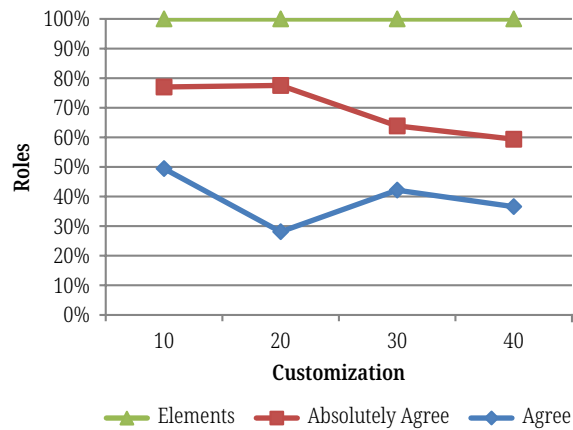


Fig. 6. Role of student's motivation

Pupils were very interested in and involved in “playing” their parts (M = 5.45), and about 8 out of 10 (70.7%, agree or strongly agree) were able to improve their role throughout playtime (M = 5.22) in Figure 6. Nonetheless, almost one in four respondents stated that they experienced some level of anxiety (agree or strongly agree) when doing their designated tasks.

As a result, their worry may increase if they are unable to save up enough money to buy things they have their sights set on and make in-game purchases. In addition, the challenge component required the use of timers because both difficulty and support were related to time. Contrary to the results of prior study investigations, students did not report feeling more stressed than most other game features.

## 5 CONCLUSION

The present study discovered that gamification may be included on any platform and can support more engaged learning among students. To inspire learners and boost learning engagement, gamified e-learning platforms that accommodate various learning modalities will be created.

The technique of gamification is discussed in this article. Gamification can help mobile applications last longer and make enough money to cover their long-term costs. Through points, stages, difficulties, virtual environments, and a leaderboard, we encourage users of our mobile application to interact and drive the visible and long-lasting parts of our product. We predict that users’ desire to accrue virtual badges and points will eventually fade. As a result, we intend to provide certain material incentives in the real world to promote greater community development and connection, as well as boost the expansion of nearby businesses.

Our results provide fresh insights and improve the application of responsive gamification. We gained important knowledge on how to personalize gamification, especially by proving that one of the most applicable methods for determining user preferences for game aspects is the Hexad user typology. But in this application, different user types were taken into consideration while modifying game features and learning tactics. We acknowledged that during games, incentives could shift and become more flexible. As a result, the learner’s profile served as the basis for adaptation, as opposed to the literature’s suggested static adaptation, which categorizes people only on the basis of their profile information after an initial selection.

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