Does Gamifying Homework Influence Performance and Perceived Gameful Experience?

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Abstract: There is a growing body of literature that recognizes the importance of applying gamification in educational settings. This research developed an application to gamify students' homework to address the concern of the students' inability to complete their homework. This research aims to investigate students' performance in doing their homework, and reflections and perceptions of the gameful experience in gamified homework exercises. Based on the data gathered from experimental and control groups (N = 84) via learning analytics, survey, and interview, the results show a high level of satisfaction according to students' feedback. The most noticeable finding to extract from the analysis is that students can take on a persona, earn points, and experience a deeper sense of achievement through doing the gamified homework. Moreover, the students, on the whole, are likely to be intrinsically motivated whenever the homework is attributed to factors under their own control, when they consider that they have the expertise to be successful learners to achieve their desired objectives, and when they are interested in dealing with the homework for learning, not just achieving high grades.

Keywords: gamification; gamifying homework; feedback; satisfaction; user experience; completion rate

1. Introduction

Using gamification in the classroom can enhance the learning process and motivate students to learn. Gamification is meant to make learning more engaging by using game features to support learning processes [1]. An implicit feature of gamification is the gameful experience which refers to "the positive emotional and involving qualities of using a gamified application" [2]. Chee and Wong referred to the fundamental aspects of game design and the game natures like behavioral complexities, and the hedonic which were abandoned in the applications and directed our considerations to novelty, curiosity, exploration, challenge, and aesthetic value to enforce extrinsic motivators integration [3].

Gamification practices have several challenges with applying game elements in different contexts, which restrain identifying its effects on the learning outcomes and the perceived gameful experience. Overall, there is variation in the results of gamification studies when applying different systems in different contexts and objectives which leads to inconsistency [4]. To fill this gap, gamifying an activity in a certain context in education could help to recognize its effect [5]. Thus, gamification studies in supporting learning English as a second language reported positive effects on both the learning experience and outcomes [6], including language acquisition [7]. Zarzycka-Piskorz [8] referred to applying game elements and extrinsic motivators in learning English grammar after using "Kahoot!" motivated students regarding the competitiveness aspect.

Homework is one of the controversial issues that carries two sides. The educational advantages of homework can help students outside the classroom domain to support their learning; however, they are required to accomplish the assignments of each subject whereas the allowed time to complete it is not enough. Furthermore, homework can affect students' physical and mental health in addition to causing academic stress and lack of balance in their lives [9]. The negative effect reflects on academic achievement [10].

To overcome these issues, gamification literature suggests focusing on situational contexts, developing new forms of innovative research, and prosperous design of applications [5,11]. Therefore, a gamification approach to homework assignments can motivate students in learning and homework accomplishment [12–15]. The results showed a positive effect on motivation and completing the assignments. Most of the studies focused on investigating motivation and academic achievement for higher education level and university students. The current evidence in this regard recommended paying particular attention to students' responses in the gamified homework and focusing on learners' experiences and perceptions of gamification in the future [13,16], especially for primary education homework [17,18]. Furthermore, there is no agreement about the effect of homework on students' performance [18].

There are unexplored questions concerning students' reflections and perceived experience when gamifying homework for K-12 students. Therefore, employing further investigation of gameful experiences and homework performance is crucial to recognize the relationship between gamifying K-12 students' homework and the ability to complete learning tasks. This research aims at investigating students' perceptions and reflections of the gameful experience in the gamified homework and identifying the effects of using the gamification elements on completing the homework assignments.

To investigate the effects of the gamified homework on students' perceptions of the gameful experience and evaluate their performance in completing homework exercises, a quasi-experimental study on primary school students was conducted. Consequently, this research addresses the following research questions:

RQ (1): What are the differences between the experimental and control groups in the homework completion regarding the final score?
RQ (2): What are the differences between the experimental and control groups in the homework completion rates?
RQ (3): What is the perceived feedback about completing homework assignments between the experimental and control groups?
RQ (4): How do students perceive the gamified homework experience?

The findings can contribute significantly to gamification literature by supporting teachers, instructional designers, and researchers with the main inclusions that support their understanding of implementing gamification applications in school homework. It provides the systematic instructional design process for educators and designers as guidance to gamify learning assignments. Moreover, it explores students' perceptions of the gameful experience regarding the homework context and other factors such as time spent and homework completion rate, which enhance our understanding with evidence derived from quantitative and qualitative methods.

This research is structured as follows: Section 2 presents work related to this research. Section 3 includes the research methods. Section 4 demonstrates the process of gamifying homework followed by the results in Section 5. We discussed the results in Section 6. Finally, Section 7 summarizes the research conclusion with the limitations and recommendations for future work.

2. Related work

Since gamification was reported by Nick Pelling in 2002, it attracted a lot of interest in technology-enhanced Learning (TEL) [19]. "The use of game design elements in non-game contexts" is a popular definition of gamification [20]. Gamification is a methodology that includes technological domains, and a multidisciplinary research field that connects

with different fields; one of the most closely related research field is education [5,21]. Extensive research has shown that gamification of learning is "the use of game logics (components, mechanics, and dynamics) and game aesthetics designed to promote and enhance learning through motivation (seen as the combination of the elements of attention, relevance, confidence, and satisfaction)" [4].

Most of the reported outcomes of using gamification in education were psychological outcomes represented in engagement, motivation, and involvement [22]. Recently, the gameful experience found a special interest in gamification literature. It can be defined as a "psychological state resulting from the interaction of three psychological characteristics: perceiving presented goals to be non-trivial and achievable, being motivated to pursue those goals under arbitrary externally-imposed constraints, and believing that one's actions within these constraints to be volitional [23]." Accordingly, the prevalent psychological outcomes in gamification research involved "the perceptions of use, use experience, perceived enjoyment, and fun [24]."

A substantial amount of research focused on achievement and progression as the most used affordances which involve point, challenge, badge, and leaderboard [24]. There is a remarkable emergence in the number of quantitative and qualitative gamification studies from 2013 to 2016 [25]. Although gamification research has reached an advanced level of maturity, it is considered to be in an early stage in the long term [11]. Thus, many research endeavors have sought to study the impact of gamification in education.

Focusing on the educational context, homework is an essential part of pedagogical practices. It is defined as "tasks assigned to students by school teachers that are meant to be carried out during non-school hours" [26]. It plays a critical role in enhancing learning, achievement, performance, and supporting communication [17,27]. Fan et al. [28] figured out the effective impact of homework on math and science achievement for primary school students. Moreover, the positive relationship between homework and academic achievement is better in post-primary grades than in K–6 [17]. Magalhães et al. [18] refer to the homework performance indicators that could be "retention of knowledge, exam and final grades, homework assignments completed, overall performance". Results showed that homework in different formats had positive results for increasing and keeping students' performance [29,30]. Bembenutty and White [31] indicated the importance of homework logs and intrinsic motivation for the academic performance that reflects on students' satisfaction.

Given the importance of implementing gamification in the homework context, there are promising endeavors that elucidated the positive effects of using gamification for achieving homework assignments. Goehle and Wagaman [13] denoted that students appreciated and enjoyed using gamification elements in doing their online homework. Gamification increased primary school students' disposition to experience flow when applied in a social learning environment (SLE) with a set of learning activities as homework tasks [32]. More recent investigation has supported the positive impact of gamifying homework on primary school students' enjoyment, intrinsic motivation, and satisfaction [33]. Kulhanek et al. [14] reported that university engineering students felt empowered, interested, motivated towards completing the assignments where a gamification platform was applied.

Regarding gamification elements, levels and achievements have been employed in mathematics homework. Students felt supported, enjoyed, and tracked their levels and achievements [34]. Other studies indicated the importance of integrating badges with homework systems to help university students for homework submission before the deadline which reflected on their efforts to obtain the badge that rewards the highest score, and impacted their behavior [35,36]. Furthermore, implementing points, levels, leaderboards, badges, progress bars, achievements, and awards in a quest-based portal showed the neutral effects of the gamified environment on the academic motivation towards homework; however, there is a positive impact of the platform regarding the motivation and feedback support for homework [12]. Overall, most of the studies supported the positive impact of implemented game elements in homework assignments.

3. Methods

The design science research (DSR) approach intends to create and evaluate artifacts to solve identified problems and evaluate artifacts to solve identified problems and needs [37]. This investigation takes the form of a user evaluation study employing an iterative design process, and adopts a quasi-experimental design [38] for assessing the effect of the applied game elements when students are doing the homework assignments. Furthermore, it applied a qualitative method [39] to explicate the complicated process of gamification [40]. This would bring the strengths to understand students' perception and evaluate gamification's role in learning assignments.

3.1. Settings and Participants

Given the study objectives, the research employed a quasi-experimental design in which students were randomly divided into two groups, i.e., an experimental group and a control group. The experimental group of students used gamification elements when accomplishing the homework on the platform, while the control group of students did the regular homework assignments without using the gamification elements on the same platform. The same homework assignments were associated with both the groups aside from the instructions for using the gamified homework platform. To promote participation, gamification features such as freebies, points, badges, and other elements were used. It was the application of game design mechanisms to non-game contexts with the goal of increasing involvement, interaction, and student loyalty.

Participants in this intervention were students on a voluntary basis. They were selected from an Egyptian public school to form the two groups. Respecting the ethics of scientific research in dealing with children's behavior, study approval was acquired from parents or the child's legal representative. Eighty-four sixth-grade Egyptian primary school students studying English were randomly assigned to the groups (40 students in the experiment group and 44 students in the control group). For the interview, fourteen (14) students participated in the interview session from the experiment group to express their feelings, their experience, and their perceptions of the gamified homework. All participants' information was kept anonymous and confidential.

To identify students' feedback and perceptions during the experiment, there was an intercept optional survey (pop-up survey)., which was used as a satisfaction survey [41]. It provided a direct method in accordance with their experience during homework completion as illustrated in Table 1. This method considers a quick evaluation method to understand the initial responses of students and give indicators of the results.

Table 1. Feedback survey questions.

Question	Responses			
Do you like learning with the platform?	Not really	Maybe	Yes	Very much
How does doing the homework make you feel?	Active	Focused	Bored	Motivated
What do you like most in this homework?	Collaboration	Competition	Freedom to create	Challenge
Did you put a great deal of effort into advancing your learning through this platform?	I have always had a very hard time trying to finish this homework	I spent at least 20–30 min per night on homework	I have spent too much time in doing my homework	I read through each lesson before starting the homework

The archived data of student's activities on the platform's back-end provided a detailed analysis of and insights into the homework exercises' completion rate to reflect homework performance. Furthermore, a semi-structured interview was also carried out after the experiment to identify students' perceived gameful experience. Interview questions were prepared based on the literature on gamification and the research objectives. It was examined by two experts and included the following questions: (1) What was it about the game you played that was most helpful to your learning? (2) How many points do you expect to earn in this game? (3) What parts of the game were obstacles to your learning? and (4) Do you have any specific recommendations for improving this educational game? The researchers used questions for screening and follow-up (e.g., "How is that?", "What does it mean?" and "Tell me some more"). Each interview lasted around 20 min.

3.2. Procedure

Gamifying homework requires following systematic procedures to achieve gamification goals in educational settings. After reviewing the literature, we found that the majority of models follow a similar process. The seven-phase process was adopted from [42] as shown in Table 2.

Table 2. The main processes and activities of gamifying homework.

Process		Activities
Preparation	■	Defining the objectives; identifying requirements
Analysis	■	User analysis; context analysis
Ideation	■	Thinking about new ideas; design techniques and tools
Design	■	Prototype; use cases; homework exercises; design a scenario
Implementation	■	Implementing design; manage implementation; testing
Evaluation	■	The quantitative results; the qualitative results
Monitoring	■	Improvements list

The process starts with the initial phase of *preparation* and *analysis* that includes identifying the objectives of the gamified application and applying the main analysis of users and context. The following phases are *ideation*, *design*, and *implementation* respectively, in which the main activities in these phases are proposing the design ideas, thinking about the prototypes, and developing the design by using the authoring tools. The *evaluation* phase involves assessing the students' perceived experience. In this phase, we reported the results of the total number of points on the system which reflects student scores in addition to analyzing the activities during the time of the experiment. Moreover, the embedded quick survey meant reflecting the feedback towards the gamified homework. The qualitative results of the interview were applied for understanding students' satisfaction and reflection of the study experience. The last phase, *monitoring*, aims to revise the application overall and enhance the design process and practices.

The next section will focus on presenting the first five phases of gamifying homework, the evaluation phase will be addressed by the Results section, and the monitoring phase will be discussed and summarized in the Discussion section.

4. Gamifying Homework Process

4.1. Preparation and Analysis

In the preparation phase, we came up with the initial queries such as deciding the solution, defining the objectives of gamifying homework, and identifying the experiment requirements (including the deadline of executing, constraints, and the required resources).

The analysis phase concerned users and context analysis. During this phase, we selected sixth-grade students who study English in the first semester of the academic year 2019/2020. The results of the first iteration in the authors' previous work covered the need

for a motivational solution for helping students in their homework achievements [33]. The analysis of students' needs revealed that they are willing to use gamification in school assignments. Regarding context analysis, employing gamification design elements was implemented by using an online gamified platform. We chose two units of the English course: Unit 3 "Daily Activities" and Unit 4 "Visiting a Film Studio".

4.2. Ideation

It aims to think of new and creative design ideas. We reviewed the literature and the published gamification projects, gamification apps, and games from both theoretical and practical perspectives. We also applied a set of techniques like board and video games, and best practice/gamification patterns [42] to underpin our thoughts of the design. Thinking about the design idea led to "Find the Treasure" which is the name of the gamified homework. This design distributed the homework exercises of Units 3 and 4 in different places on the map. The mission for each student in the experimental group was to find the treasure by completing the homework exercises of Units 3 and 4, collecting points and badges, and advancing the level. Therefore, game elements include points, achievement badges, scoreboard, time constraints, levels, unlock items, challenges, feedback, and achieving the mission to reach the Win state.

4.3. Design of Prototype

We created a visual mockup of the application using hand drawings. The ideas of design could be appraised and discussed with a group of users genuinely as shown in Figure 1.
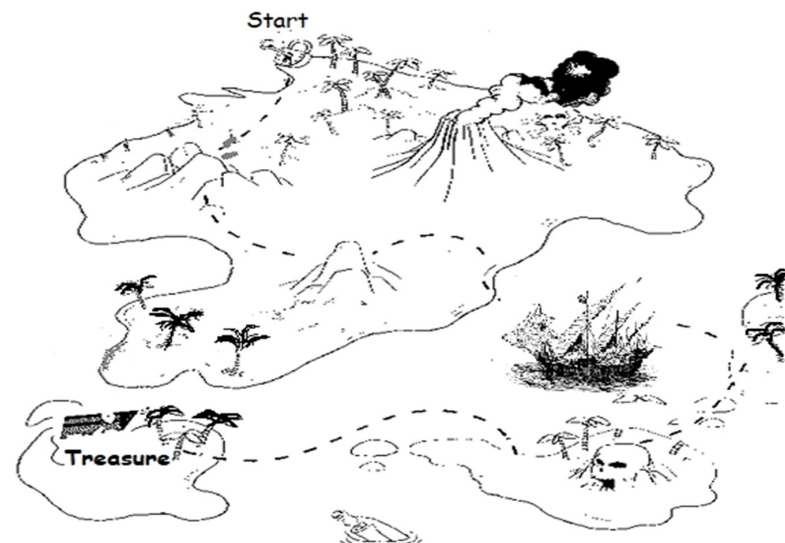

Figure 1. The paper prototype of the design.

The paper prototype aimed to determine the use cases of the gamification app. The use cases of the students are meant to describe how students will achieve their homework on the gamification system [43]. Therefore, use cases are useful for clarifying the responses of the system when the students request some functions, which are beneficial to develop the design for the next phase.

Coming up with the unit content analysis and providing the supporting materials and resources for preparing several kinds of questions is essential in this phase. The question types involved multiple-choice, filling the gap with a short answer, matching, and arranging in order [44] to cover the English language skills that included listening, reading, and writing skills. Therefore, the established homework was created and shaped into the main exercises to reflect the units' structure. Furthermore, identifying the gamification elements is crucial in the design phase. We used a previously proposed and evaluated taxonomy to analyze the game elements used in gamified learning environments. Then,

we considered implementing the game elements derived from dynamics, mechanics, and components [45], as listed in Table 3, to support completion behavior and provide the opportunity to practice homework exercises [46].

Table 3. The list of used game elements.

Elements	Description
Points	The obtained score to reward students after answering the question.
Badge	Visual feedback to symbolize rewards if students obtained a specific number of points or answered the exercise under a set of conditions.
Levels	Gradual achievement stages to reach the milestone in which answering the exercises advances students' status and could represent their achievement.
Progression	The visual representation to identify students' position towards completing the homework.
Challenges	Advanced level of questions that necessitate focused attention and high-level skill to match the right answer.
Chance	Attempts to answer the questions if the answer was wrong, up to three attempts.
Time Constraints	The limitation of the available time for completing the exercise which stimulates the quick responses of students.
Locked Items	Items requiring students' response or action to be opened such as the exercises which entail writing the passcode.
Scoreboard	A board for displaying students' names and scores for the leading players.
Mission/Goal	Refers to the goal of doing the homework. It requires performing a set of actions and following the player's journey to accomplish the mission, for instance, finding the treasure.
Win State	The showing state after achieving the final mission and collecting the rewards.
Increasing Difficulty	The feature for raising the difficulty level of questions gradually.
Notifications	Kind of announcement to inform students about obtaining rewards or passing exercises.
On-boarding/Tutorials	Set of instructions and illustrations to help students, especially in the first interaction with the platform, to understand how they achieve their homework by using gamification elements.

Regarding the instructional design process, we promoted a new scenario for gamifying homework which included the main items of homework exercises and the gamification elements (see Table 4). Consequently, there were 15 exercises divided into both units 3 and 4 taking into consideration the proportionality in skills and question types for each unit.

Table 4. A gamifying homework scenario.

No	Exercise Name	Question Type	Number of Questions	Level of Difficulty	Points (Total)	Level	Badge Name
1	Listen carefully and answer	Multiple choice	20	Easy	40	One	Binoculars

4.4. Implementation

Developing gamification software or a platform is a bit challenging. It requires adequate programming skills and web developers to assure the project success rate. Expanding and adopting successful gamified platforms supports gamified educational activities for carrying out experimental studies to approve the practices [5]. This way, we implemented the online platform "Seppo" for this purpose due to its distinctive features for developing educational games and gamification applications by teachers which can be used efficiently to gamify the learning assignments.

According to the prototype and use cases, the interface was developed as can be seen in Figure 2. The development process was achieved with the iterative procedure in the development cycle. The trial version was released to encourage some researchers to try using the application and recording notes according to their use. This was for detecting any errors in the design. We noticed that some of the participants among the researchers were

enthusiastic to obtain the highest score so they sought to advance their score by answering the exercises more than once in case they answered wrong. This gave an initial positive indicator about the design. Moreover, we also invited the English teachers to log in on the platform to recognize their feedback on the gamified homework designing and the ease of using the application. They appreciated the idea of a design which boosted completion of the homework. They had some recommendations for adjusting the font face, size, and color, numbering the questions, and fixing some grammatical mistakes.

Figure 2. The gamification interface.

Considering these recommendations, the final version was released to start the experiment as shown in Figure 3. Before conducting the experiment, we received approval from an Egyptian school, in accordance with ethical standards. Then, we obtained consent from the students' parents who were informed that the gathered data would be secure and anonymous and that they could leave the research study at any time. The researchers established a session to introduce the application and to provide students with the required information for login through individual accounts and using the main tools on the platform. They could preview the tutorial and instructions for completing the homework on the platform. Students were encouraged to log in on the platform by using their accounts to answer the homework exercises from a personal computer or mobile device. After completing the homework, students were asked to express their feelings and reflections about the gamified homework by writing comments on the platform, so the experiment was accomplished within one month accordingly.
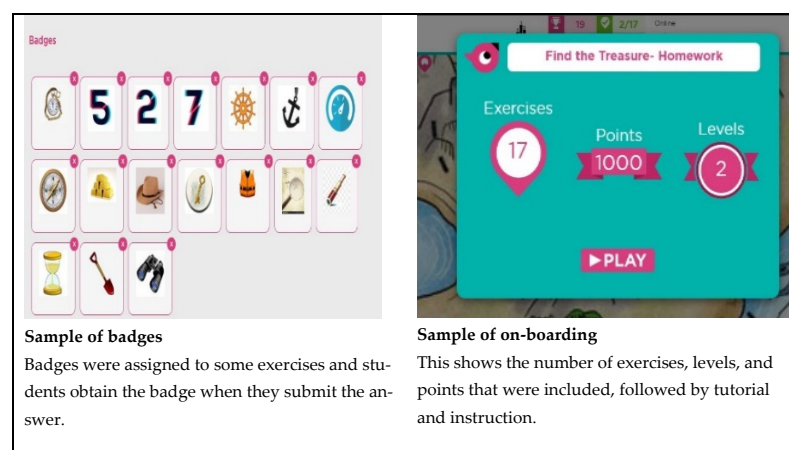
Sample of badges
Badges were assigned to some exercises and students obtain the badge when they submit the answer.

Sample of on-boarding
This shows the number of exercises, levels, and points that were included, followed by tutorial and instruction.

Figure 3. *Cont.*

Sample of levels

It presents students' level and their achievements to complete the exercises.

Sample of locked items

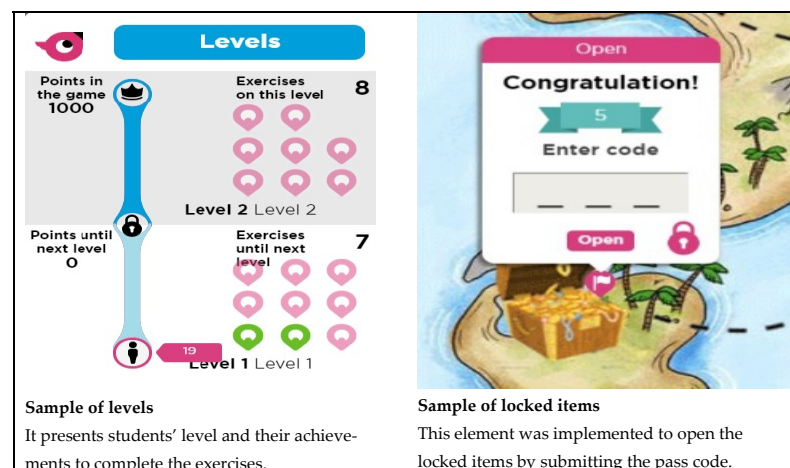This element was implemented to open the locked items by submitting the pass code.

Figure 3. Game elements.

5. Results

Data for this research were collected by using learning analytics, surveys, and an interview. In the following sections, the study findings will be described thoroughly.

5.1. Learning Analytics

To answer the first research question, "What are the differences between the experimental and control groups in the homework completion regarding the final score?", we captured and reported the students' activities of homework completion after cleaning the data. In all, 25% of students (10 of 40 students) in the experimental group who achieved the gamified homework were rewarded at least 60% of the final score (600 points or above of the total 1000 points), while nine students obtained the correct code for unlocking the final item.

On the other hand, in the students' activities of completed homework in the control group without using gamification elements in their assignments, about 68% of students (30 of 44 students) obtained 60% of the final score at least (600 points or above of the total 1000 points).

The homework completion according to the total points was analyzed statistically by an independent sample t-test as shown in Table 5, a significant difference was found between the experimental and control groups: $t(82) = 5.16$, $p = 0.000$. The mean points of the control group ($\bar{x} = 704.32$) was higher than the mean of the experimental group ($\bar{x} = 463.43$).

Table 5. Independent sample t-test results according to the final score.

	n	$\bar{x}$	*Sd*	*df*	*t*	*p*
Experimental group	40	463.43	238.99	82	5.16	0.000
Control group	44	704.32	187.86			

To answer the second research question, "What are the differences between the experimental and control groups in the homework completion rates?" for the experimental group, the average completion rate reached 65.8%. There was a drop in achieving or submitting some exercises which were limited with time for submitting the answer or had advanced difficulty level as challenges. For instance, the lowest number of students (14) with a completion rate 35% completed and submitted the answer before the ending time for Exercise #4 in Unit 3 which is constrained by the time-count as shown in Figure 4.
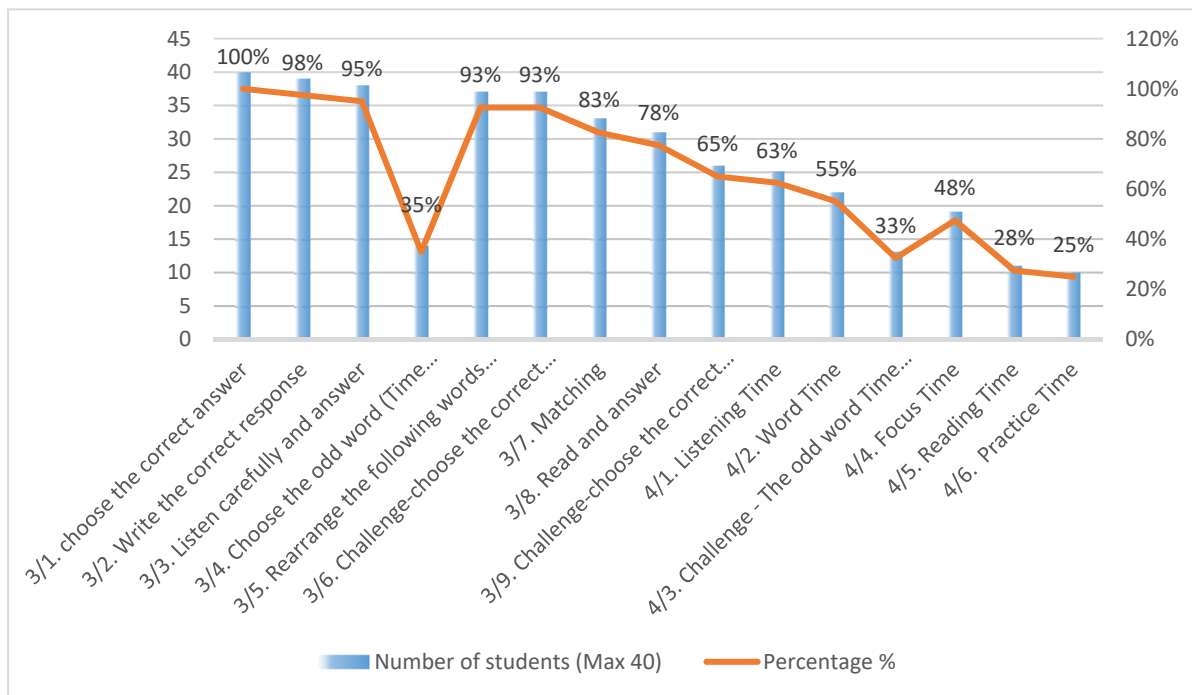
Figure 4. The completion percentage of homework exercises for the experimental group.

In the case of the control group, there was consistency in the homework completion percentage among the exercises as presented in Figure 5 with the average completion rate (89.5%).
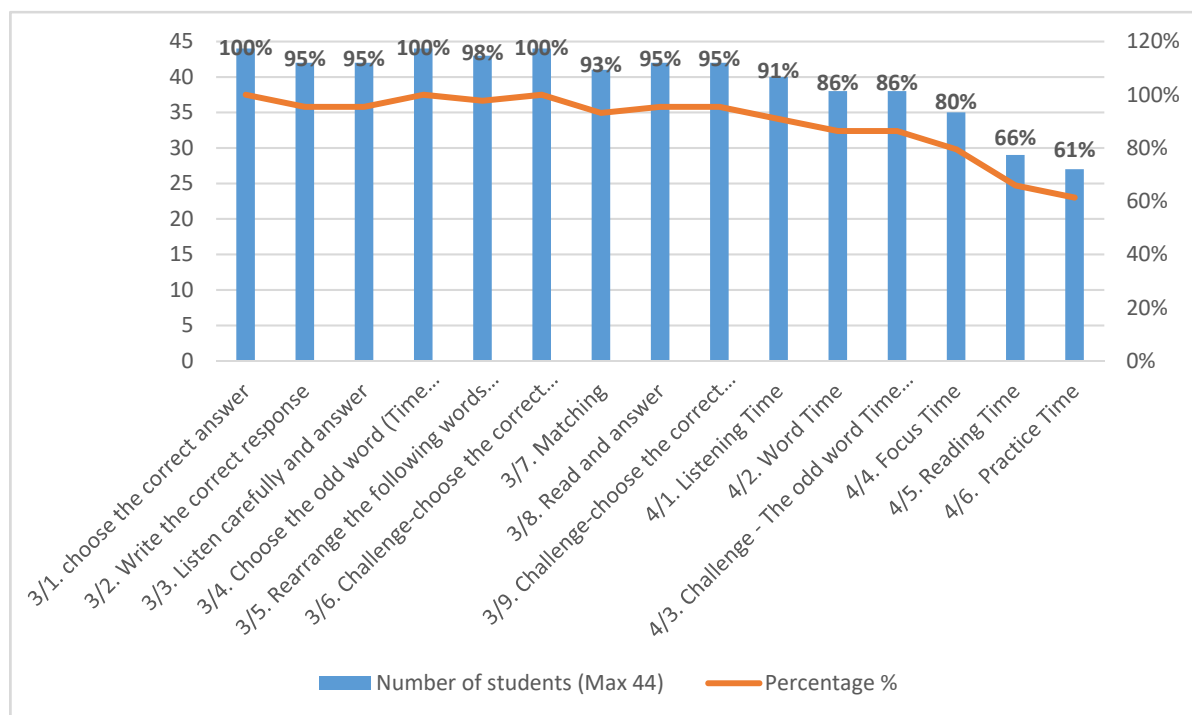

Figure 5. The completion percentage of homework exercises for the control group.

The exercises' completion rates according to the number of students were analyzed statistically by an independent sample t-test as seen in Table 6, a significant difference was found between the experimental and control groups: $t(28) = 4.16$, $p = 0.000$. The mean

exercises' completion score of the control group ($\bar{x}$ = 39.40) was higher than the mean of the experimental group ($\bar{x}$ = 26.33) which indicates a significant completion increase compared to the experimental group.

Table 6. Independent sample t-test results according to exercises completion rates.

	n	$\bar{x}$	*Sd*	*df*	*t*	*p*
Experimental group	15	26.33	10.97	28	4.16	.000
Control group	15	39.40	5.29			

5.2. Survey

The third research question was "What is the perceived feedback about completing homework assignments between the experimental and control groups?" To answer this question, we encouraged students to answer the presented automated questions of the optional survey voluntarily, so we obtained a few responses. In terms of students' feedback from both groups, the survey results showed that some students were excited to use the online platform for learning and doing homework. They spent about 20–30 min daily on homework and had preparation time for reading before starting their homework as shown in Figure 6.
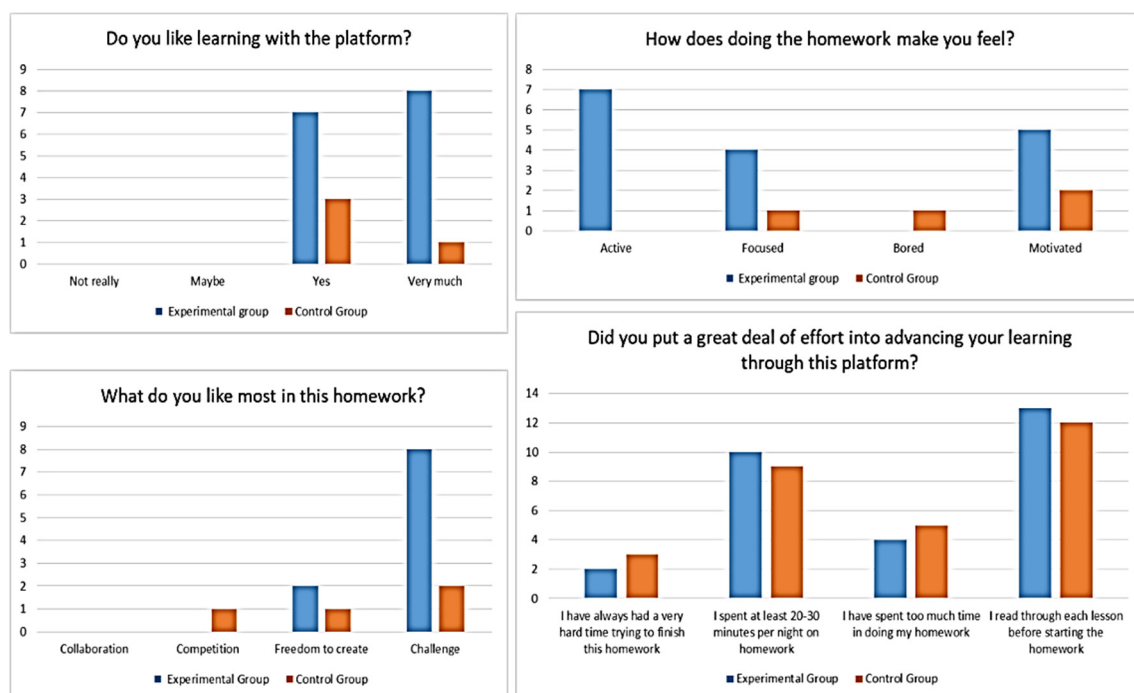

Figure 6. The results of students' feedback about achieving the homework assignments.

The optimistic responses indicated that students praised the application for learning and doing the gamified homework exercises where they were active, motivated, focused, and enjoyed the challenges. Furthermore, few students reported that they had a hard time trying to finish their homework on the platform. Some of the control group students liked learning through the platform. Some students spent too much time on homework accomplishment in which they felt bored and were not quite motivated or focused compared to the experimental group. This finding still denotes the positive perceived feedback about the gamified homework.

To enrich the finding for deep understanding, we sought to connect the qualitative data with the last finding for both the experimental and control groups in a way that we can confirm and validate the results by comparing the comment with the obtained score on

the platform. In other words, we matched the score of the experimental group students who dominated the leaderboard (ranked number 1 and number 4) with their feedback and comments on the platform after completing the homework compared to the feedback of another student in an average ranking. It is crucial to mention that the students' status on the leaderboard in the experimental group is visible and active for all students unlike the students' status of the control group. This function was disabled to fulfil the experimental setting, but we obtained these data through the admin panel. Below are the comments made by students as stated and quoted in Table 7.

Table 7. Students' comments.

Comments of Experimental Group Students	Comments of Control Group Students
"It's very fun and interactive. Questions were very easy. The only problem is that it glitches so I lost points because I couldn't answer a question, or I couldn't edit my answer, etc. I also clicked on the wrong answer accidentally a couple of times. But overall a great app" Made by the dominant student on the leaderboard (ranked No.1). Total points = 894	*"I found it useful to receive new information or review old information in an easy way. I like the form of questions, I have enjoyed"* Made by the first student on the rank (ranked No.1). Total points = 993
"It was a good game and intending way to improve grammar and vocabulary" Made by the dominant student on the leaderboard (ranked No.4). Total points = 825	*"1-The homework contains a variety of questions. 2-Develop thinking and realizing 3-Development the hearing skills by listening audio"* Made by the fourth student on the rank (ranked No.4). Total points = 923
Moreover, there is more positive feedback from a student who completed all the exercises with an average score comparing to the dominant students on the leaderboard.	
"I'm happy to play that game I benefit from this program It is very important" Made by a student who completed all the exercises	*"I like the different categories of question and the question easy in different stage. It's provided me a lot of experiences thank you for great effort"* Made by a student who completed all the exercises

5.3. Interview

A semi-structured interview was carried out face-to-face to determine students' perceptions of the gameful experience in homework assignments. We received informed consent from the study participants of the experimental group (both students and their parents). They also knew that they were free to withdraw from the interview at any time, and that the data were analyzed anonymously. It is worth indicating that the interviewers used "game" instead of "gamification" synonymously during the interview, as the game concept is familiar for students.

We opted for grounded theory methods [47]. There were 14 valid responses to the interview from the experimental group. The interview data were transcribed at the end of the interviews. A template analysis guide was applied to analyze the data for generating possible themes [48]. Students' opinions in terms of gamification aspects were classified under five different themes titled "good design, the thrill of solving the mystery, self-control, points, and challenges". In response to the first question, most of those interviewed indicated that good design and the thrill of solving the mystery of reaching the treasure were the items that most increased engagement and motivation. Moreover, the self-control of the gamified homework helped them to learn the necessary skills according to their own pace as shown in Figure 7.
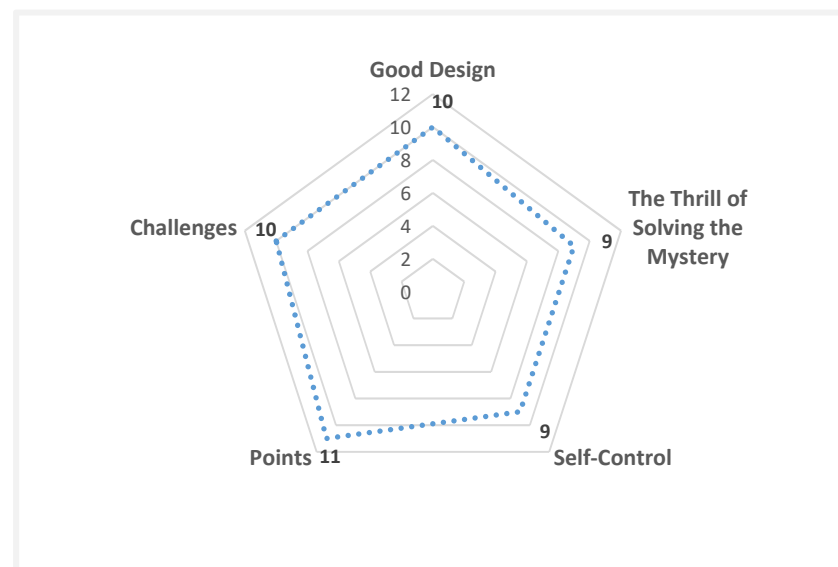
Figure 7. The most helpful aspects of the gamified homework.

Nearly 70% of those who were interviewed indicated that the exercises they completed during the game were easy and accessible to their level, and they expected more than 65% of the scores as presented in Figure 8.
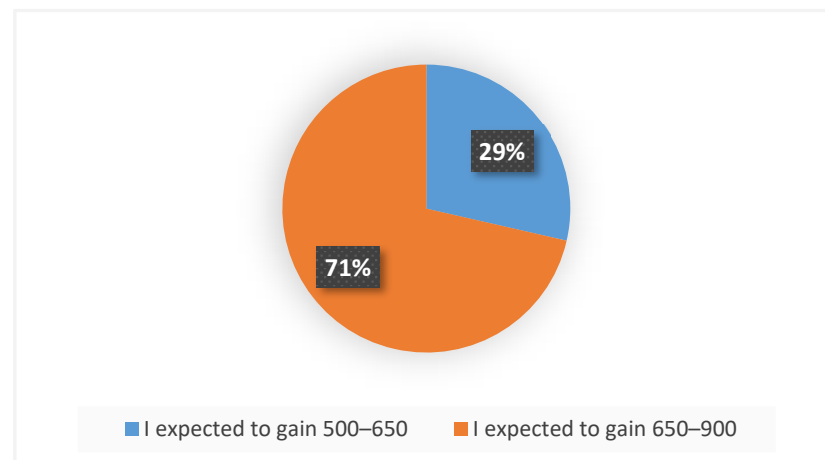

Figure 8. The expectation of collecting points.

The majority of those who responded to the question "what parts of the game were obstacles to your learning?" felt that the technical problems and loading time were the most problematic during the homework accomplishment. Moreover, seven students referred and drew attention to the need for operating further instructions to find the treasure.

Respondents were asked to suggest some specific recommendations for improving this educational gamification app. They suggested (1) that they prefer to work in cooperative groups rather than through individual learning, (2) creating a set of unique incentives that are appropriate for a number of unique students, (3) reducing page loading times, (4) giving real-time feedback during the homework and activating chat with the teacher to discuss some technical and homework issues, and (5) providing a dashboard and reports on the progress level, including students' strengths and weaknesses.

6. Discussion

The final score of the homework exercises indicated that the control group completion rates were higher than the experimental group. The possible interpretation could return

to using some gamification mechanics like time-constraints that obstructed collecting points easily, or the gameful design requires more concentration when students need to collect the badges to find the correct passcode whereas achieving the homework in the control group does not entail finding the badges or answering in limited time. This finding is partly consistent with the finding of Magalhães et al. [18] that showed that online homework helped students to complete the learning assignments. However, the positive feedback, comments, and the perceived gamified homework experience of the experimental group denoted that the gameful experience was distinguished by using points, badges, and rewards mechanisms in addition to the gameful design. Gamification mechanics are the motivational affordances to enforce the motivation for achieving the learning assignments but do not guarantee student performance [4,13]. Time constraints mechanics were effective to motivate some students who prefer the challenge spirits. However, it obstructed the students who failed to answer the questions under time pressure, so it caused the decline of completion rates in the exercises that used this mechanic. This finding is in line with Huang et al. [49] where the analysis showed that the activities which were related to the time were not significant. Thus, we have to consider the unpleasant effect of time pressure [50].

In terms of analyzing homework completion rates, low completion percentages in some exercises were observed because of the time constraints mechanic, or challenges that required higher levels of thinking. However, we cannot rely only on the completion rates to evaluate the experience, so we implemented a survey and interview to verify the finding. Points were used as an indicator to investigate the efficacy in the game-based system to solve homework problems [51]. Obtaining the highest was is not only the target of applying gamification. Badges also did not impact the final score [35], but enhanced students' motivation [52]. Gamifying homework aims to increase motivation and engagement for enjoying homework achievement by carefully implementing the game elements.

Regarding feedback from students who participated in the survey, the experimental group appreciated the gamified homework for its role in the learning process. This is in line with the findings which revealed that gamified e-quiz exercises contributed to engaging students in learning [53]. Students expressed positive perceptions and were enthusiastic about doing homework assignments [34,54], unlike students' feedback from the control group; however, few students were motivated to complete their homework on the platform. Gamifying homework changed the perception of the learning tasks; hence, the positive feedback from the experimental group outweighed the control group's feedback. Furthermore, challenge-based gamification is seen as helpful to support students' learning [55].

Comparing the written comments on the platform after completing the assignments between some students of the experimental and control groups and matching them with the results of the survey proved the usefulness of homework on the platform in terms of supporting the English language learning, including grammar, vocabulary, and listening. It also asserted the value of converting homework in an enticing way from the conventional one.

The interview findings highlighted the self-control feature as an important aspect in the gamified homework. It can foster intrinsic motivation that connects the main psychological needs: "competence, autonomy, and relatedness" [56]. Students' expectation rates of obtaining a high score indicated their interaction with the design. Although students made efforts to advance their learning, a few students had a hard time trying to finish their homework. This can be interpreted as being due to the possible technical problems and loading time issues they faced. Moreover, students who were struggling in school spent a long time to achieve their homework [17]. The interview finding confirmed the survey results where students appreciated the good design, the thrill of solving the mystery, points, and challenges as the most helpful features in the gamified homework. This result is particularly relevant to the theory of gameful experience [23]. The gameful design in the

gamified homework system reflected on student's perceptions and promoted the gameful experience. Students suggested a set of recommendations from their perspectives of achieving assignments which included achieving the learning tasks in cooperative groups and activating the real-time feedback of the instructor. It confirmed the momentousness of supporting students with different kinds of feedback [54]; instant feedback could enhance the intrinsic motivation for learning English [57]. As a practical implication, the effective design of the gamified homework should concern the extrinsic and intrinsic affordances that enhance the gameful experience. These inclusions require particular investigation in the future with applying the principles of human-computer interaction (HCI) and user experience (UX). This way, the research suggests coming up with innovative design strategies for enhancing the perceived gameful experience in gamifying the learning assignments.

7. Conclusions

7.1. Summary

The present study aims to determine and evaluate students' perception of gamifying homework. Approaching gamification with learning assignments is an interactive approach to inspire students to learn through the use of web-based-game design and gaming elements in learning environments. Our objective is to maximize enjoyment and engagement by capturing learners' interest and inspiring them to continue learning. Thus, we developed a gamification application to help students doing their homework. The most noticeable finding to extract from this study is that the students perceived the homework assignments positively by using a gamified homework application. Moreover, the study highlighted that feedback should be issued as promptly as possible and should be sensitive to the student's individual needs. It would be worth coming up with personalization of gamification homework in accordance with some endeavors in this research track. Applying the gamification strategies in the classroom along with the gamified system in the way to integrate the gamified activities would be recommended as a future direction.

7.2. Limitations

The first limitation concerns the small number of participants (n = 40) of the experimental group from one primary school. Rectifying this requires extending the investigation to different grades and increasing the study sample. This may cause a lack of investigation into other identification or insights to recognize some differences for students in other grades or the demographic differences, including gender.

The second limitation goes to implementing the gamified homework in the English course so the generalization of this research's findings cannot be confirmed to evaluate its effectiveness in other courses or subjects or whether gamification might also work differently in case of another kind of learning activities.

The third limitation is that the period of experimenting was short for recognizing the effect of gamification. It would be worth investigating the intervention for a long time by conducting a longitudinal study.

The fourth limitation concerns the measurement tools and instruments. This research sought to identify the influence of the gamified homework on students' ability to complete learning tasks, as well as investigating the perceived gameful experience by using learning analytics, surveys, and interview measurements. It is indispensable to conduct follow-up research for applying or developing other instruments to investigate the gameful experience as well as the learning analytics mechanism.

7.3. Future Work

While this research evaluates students' reflections and perceptions of the gameful experience of homework assignments, there are certainly several recommended variables and issues for future works. Examining the effects of gamifying homework through longitudinal studies is highly recommended to avoid "the novelty effects" [40], with a further analysis of the perceived gamification experiences alongside a convenient sample

to strengthen the reliability of the experimental design. Furthermore, this research suggests examining learning styles and personalized gamification elements in the homework context, in addition to cognitive load and behavior change [58]. This research suggests developing instruments to investigate the gameful experience as well as the learning analytics mechanism, expanding the gamification application accessibility to mobile apps that promote learning outside the classroom, exploring the leading factors and the possible threats that affect the gamified homework [59], and lastly, the research suggests examining gamification effects in the classroom setting by utilizing tangible rewards.

The research experiment can be accessed when logging in as a player at: play.seppo.io; with the pin code: 19AFA3, or by scanning the QR code, as shown in the following figure.
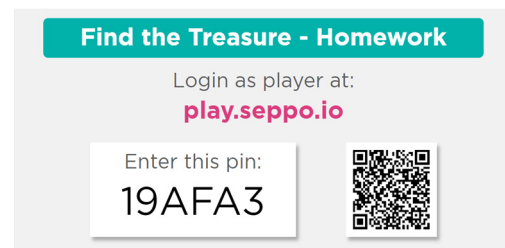
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