

# Investigating the effects of gamifying homework on students' perceived satisfaction, behavioral intention and intrinsic motivation

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**Abstract.** Gamification initiatives in learning contexts acknowledge that massive numbers of students play video games. Gamification in education, therefore, is based on introducing models to enhance psychological aspects within learning processes. These models come from the internal motivations, such as the human natural predisposition to learn, the desire for improvement, the desire to overcome obstacles and win, or the fun aspect that students find it in social relationships. The objectives of this study are examining the following research questions: a) What are the students' levels of satisfaction after using a gamified homework app (Pomawin)? b) what are students' attitudes and their behavioral intention towards gamifying homework? and c) how does implementing Pomawin for homework correction plan effect students' intrinsic motivation? The data has been collected and statistically analyzed from 53 primary school children at fifth grade (23 boys, 30 girls) after they achieved their homework by using Pomawin. The results of this study indicate that gamification can be used as an educational tool to improve student's satisfaction, behavioral intention and intrinsic motivation.

**Keywords:** Gamification, Homework, Behavioral Intention, Motivation.

## 1 Introduction

There is a growing body of literature that recognizes the importance of gamification of learning, especially in smart learning environments to motivate students learning process. Gamification is a learning approach that utilizing gameful design into the educational-professional field in order to absorb knowledge, improve some ability to reward concrete actions, and increase the engagement [1,2]. Gamification has many

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features that make it powerful vehicles for students learning. One of the main keys when applying it is that the students have perfectly assimilated the dynamics of the game that will be carried out. Moreover, it promotes communication, cooperation, and even competition amongst students [3].

The gamification in education is therefore based on introducing models to enhance psychological aspects within learning processes. These models come from the internal motivations, such as the human natural predisposition to learn, the desire for improvement, the desire to overcome obstacles and win, or the fun aspect that students find it in social relationships. But it also takes aspects of external motivation to maintain the participation of students in these learning processes, such as rewards, challenges, incentives or public recognition.

How can we gamify education in our classrooms? This question has occupied the minds of researchers for a while. Educators have tested this research question and have seen positive results. However, these results should be taken into consideration with caution [4,5]. Furthermore, these efforts have stepped slowly toward developing methods to design gamified services and systems [6]. Thus, promoting a new forms of research consequences and results which maximize the benefits of design research are desirable matter [7].

### **1.1 Research Motivation**

The concept of homework is one of the most controversial issues in education today, particularly in primary schools. Due to the limited amount of time in the classroom to cover everything on the intended learning subject, teachers assigned some homework for their students to be completed outside the class time. However, there is increasing concern that homework inserts students under a lot of pressure and if they spend their free time on doing homework, they miss out on chances to go outside and play and have fun.

On one hand, Galloway, Conner & Pope [8] surveyed 4,317 students, and pointed out that most of those surveyed spend more than 3 hours on daily homework. Almost two-thirds of the participants (72%) considered homework a primary source of stress, and 82% reported physical symptoms. The students slept an average of 6 hours 48 minutes, lower than the recommendations prescribed by various health agencies. On the other hand, children are digital natives and offering alternatives to traditional homework assignments is an urgent need. Gamification apps can be a great resource for visual examples and games that help children to practice concepts they are struggling with. Thus, the specific objective of this study is how to gamify homework by shaping the game around assignment context. Some systems have implemented attributing points and giving out badges to students when they reach a certain number [9].

Recent evidence suggests that using a wide spread from points, leaderboards, direct competitions and stickers or badges, to other game design aspects with respecting to motivation, participation as the main concern of gamification [7]. Challenge established through the game seems to be a prior for engagement and crucial for learning through the game [10]. Butler and Bodnar [11] draw our attention to that, gamification has an impartial effect on students' academic motivation towards homework, however,

gamification platform had a positive impact on student motivation which concerned with student's capability to dominate their education and receiving continued feedback on their homework. The current study examines the following research questions: a) What are the students' levels of satisfaction after using a gamified app (Pomawin)? b) what are students' attitudes and their behavioral intention towards gamifying homework? and c) how does implementing Pomawin for homework correction plan effect students' intrinsic motivation?

## 2 Method

Research-based design process was adopted to replicate the students' learning effects in this study. The research-based design process is proposed by Teemu Leinonen inspired by design theories [12]. The purpose of this approach is to generate new ideas and frameworks for conceptualizing learning towards building of prototypes and it emphasizes creative human computer interaction, exploration of various design concepts, continuous usability testing and redesign of the developing applications. The phases of this research design are as follows: contextual inquiry, participatory design sessions, design prototype, and case study as illustrated in figure 1.

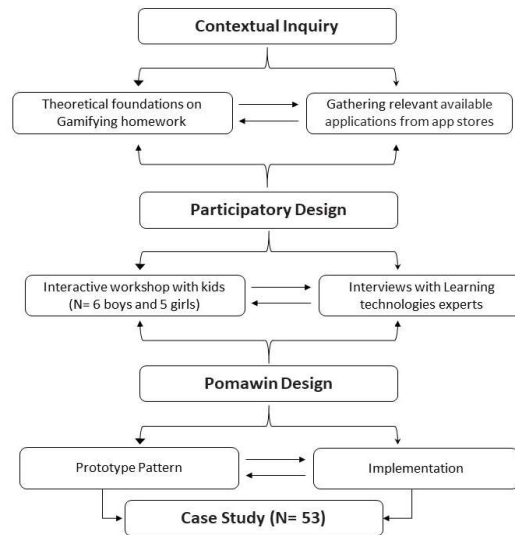


Fig. 1. Research design.

## 3 Contextual Inquiry

Experience points (XP), leaderboards, badges, levels, achievements, progress bars, and awards have been used as a gamification mechanics in a gamified homework portal for

students which implemented quests to be achieved with unlimited number of attempts, so they were awarded based on the quality of their work [11]. Another study shows that rising the engagement and positive feedback of students when they achieved a gamified assignment and tasks to be presented like a game in web development, while this study uses points, levels, progress bar, immediate feedback as game elements [13].

In order to gamify homework, the authors have to achieve some contextual inquiries which can be presented in the following items: selecting the educational course, grade, and unit; framing the types of homework assignment; formulating different kinds of questions which cover different parts and skills in the unit; planning for gamification scenario and mechanics. Moreover, we gathered some applications from app stores to find out if we can use it for gamifying homework.

#### 4 Participatory Design

In this phase, the study considered to inspect closely the children’s opinions and the obstacles with achieving their homework. So, the study surveyed 11 fifth grade primary school children (6 boys and 5 girls) on their difficulties with homework through an interactive workshop. The authors found that they feel bored while doing the homework, and it is not an important matter to be done. They pointed out to some issues related to the homework in English course; unit five; so, the authors selected the English course “Time for English” for the fifth grade of the primary education, the first semester of the academic year 2018-2019. The authors also held an interview with English teachers with good knowledge of using technology to determine the unit assignment and different kinds of questions of unit five “At the Food Festival”.

#### 5 Pomawin design

In this section, after fulfilling the last procedures for designing, the next step is developing the software “**Pomawin**” as summarized in figure 2.

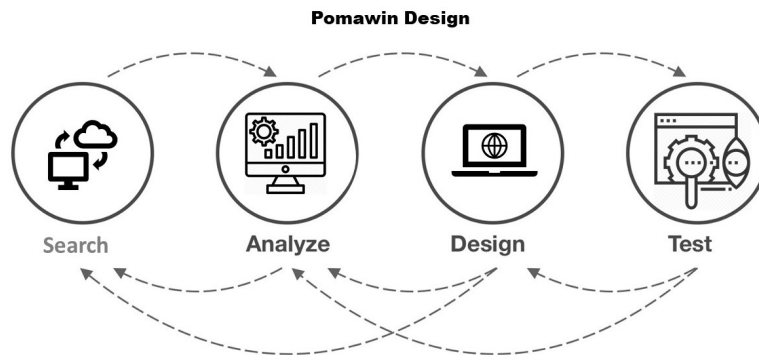
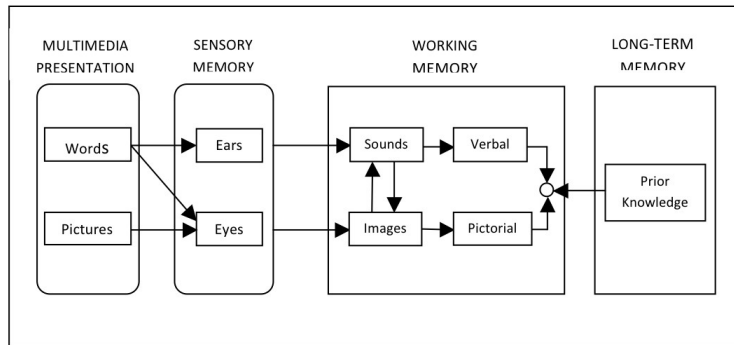


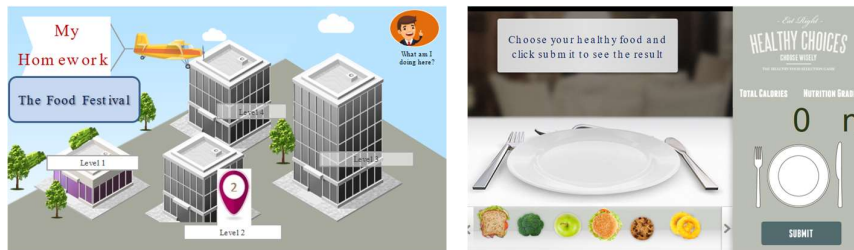
Fig. 2. Visual Representation of the Pomawin Design.

In this design phase, the authors follow the cognitive theory of multimedia learning by Mayer [14] who presents principles to guide designers of learning technologies to reconsider how students get engage with the learning material without the traditional paper-based methods as shown in figure 3.



**Fig. 3.** Visual Representation of the Cognitive Theory of Multimedia Learning.

In the light of the cognitive theory, we designed a gamification scenario to present the homework with a gamification interface and game elements. We assigned the homework in four levels, each level could include tasks, competitions, quizzes, challenges, rewards, feedback and game like. We used different components of gamification such as; points, badges, achievements, gifting, countdown timer, and progress bar. Providing multimedia resources is very important to be embedded in the homework. Based on gamification scenario we developed the homework with gamification elements. We accomplished basic tests to make sure there are not technical mistakes that will appear while using as shown in Figure 4. We collected the feedback of users and English teacher then, we edited some items upon their feedback.



**Fig. 4.** Some screenshot form Pomawin.

## 6 Case Study

In this study, the sample consisted of 53 primary school children at fifth grade (23 boys, 30 girls). Convenience sampling was applied because the primary school were selected according to accessibility and willingness to participate.

### 6.1 Data Collection

The following part of this paper moves on to describe in greater detail the quantitative and qualitative data from students' experience in this homework session. The Evaluation methodology falls under three headings: (1) application usability; (2) behavioral intention evaluation; and (3) children motivation.

#### Application Usability

The first question in this study sought to determine the students' levels of satisfaction after using Pomawin. The System Usability Scale (SUS) invented by Brooke [15] is a simple, ten-item attitude Likert scale from Strongly agree to Strongly disagree for measuring the systems usability. This study used this questionnaire as a general usability evaluation for the Pomawin application. The total number of completed responses for this questionnaire was 53 collected over a period of two weeks. The table below illustrates the summary of the SUS usability evaluation.

**Table 1.** Usability Evaluation of Pomawin application.

System Usability Scale (N=53) (1) strongly disagree and (5) strongly agree		
NO	Item	M
1	I think that I would like to use this system frequently	4.6
2	I found the system unnecessarily complex	1.5
3	I thought the system was easy to use	4.4
4	I think that I would need the support of a technical person to be able to use this system	3.6
5	I found the various functions in this system were well integrated	4.2
6	I thought there was too much inconsistency in this system	1.9
7	I would imagine that most people would learn to use this system very quickly	4.7
8	I found the system very cumbersome to use	1.4
9	I felt very confident using the system	4.5
10	I needed to learn a lot of things before I could get going with this system	1.8
<b>Sum</b>		<b>32.6</b>

- M= Mean; N = number of completed responses.
- The overall value of SUS = 81.50

Simple statistical analysis was used to calculate the SUS score, first sum the score contributions from each item. Each item's score contribution will range from 0 to 4. For items 1,3,5,7, and 9 the score contribution is the scale position (0) for strongly disagree and (4) for strongly agree. For items 2,4,6,8 and 10, the contribution is (4) for strongly disagree and (0) for strongly agree. Multiply the sum of the scores by 2.5 to obtain the overall value of SUS [15].

The overall value of SUS score from the questionnaires was 81.50, which reflects that “Everything is well, and the children are pleased with the application and will recommend it to their friends” Currently there is no need to make changes to the software in regards of usability. Figure 5 provides an interpreting of SUS score.

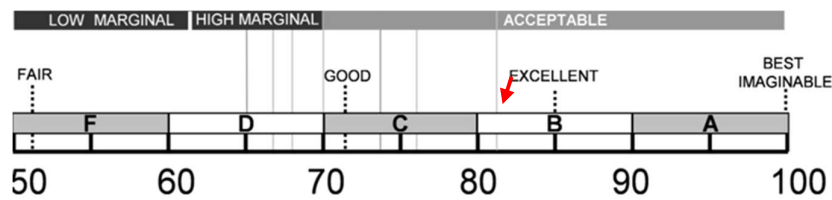


Fig. 5. The overall value of SUS = 81.50

### Behavioral Intention

The second question in this study was what students’ attitudes and their behavioral intention towards gamifying homework? To measure attitude and behavioral intention, we developed a form according to Giannakos [16], who administered a survey assessing enjoyment and happiness. For happiness, a single visual scale ranging from very happy (5) to very unhappy (1) was offered to students to describe how they felt about doing homework with the Pomawin as presented in figure 6.

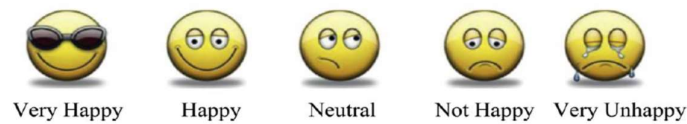
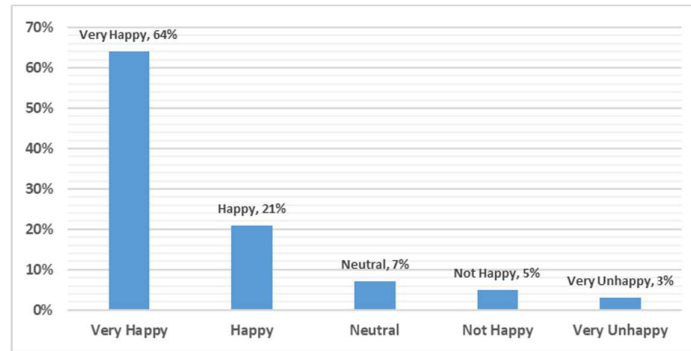


Fig. 6. Emoticons used in the survey to measure students’ happiness using Pomawin.

In this study, students’ happiness when using Pomawin were determined by a 5-point Likert scale (5) very happy, (1) very unhappy. Most of them reported feeling very happy (M 4.41, SD 5.951) as shown in Figure 7. A possible explanation for this might be that achievements and levels are common gamification mechanics which have been applied

in online homework system and made the students enthusiasm to achieve the assignment with possibility to try unlimited numbers to solve the homework problems [17].



**Fig. 7.** Students' self-reported happiness level after doing homework using Pomawin.

In this study, to assess students' enjoyment of Pomawin, a 3-point ordinal scale was used. Giannakos [16] and Venkatesh [18] used the same items in their studies to determine the degree to which Pomawin were perceived to be enjoyable. Cronbach's alpha for the attitude form was 0.86.

**Table2.** Enjoyment items (N = 53).

No	Item	Yes	Neutral	No
1	Doing homework is more interesting using Pomawin	44	5	4
2	Doing homework with Pomawin games is funny	42	7	4
3	I like using Pomawin for doing my homework	46	4	3
4	I think I will learn something in the next six months with Pomawin	45	5	3

In this study, students' enjoyment of Pomawin was determined by an ordinal scale ("I agree," "Neutral," "Disagree"). One interesting finding is that all students enjoyed the activity (M = 2.82, SD = 0.553). They found that the Pomawin interesting (M = 2.85, SD = 0.443) and fun (M = 2.76, SD = 0.253) and stated that "I like using it" (M = 2.96, SD = 0.253) and "I think I will learn something in the next six months with Pomawin" (M = 2.84, SD = 0.519). It refers to the positive impact of gamification on perceived enjoyment [19]. Below are comments made by parents on our trial with a group of students.



**Parent A**

*“I was very surprised when I saw my child doing the homework without difficulty. I let him do his homework independently and he says that he enjoyed it and it was fun.”*

**Parent B**

*“I was very happy when I saw my son enjoying the time to do homework with Pomawin and it was fun for him.”*

**Intrinsic Motivation**

Motivation is one's direction to behavior. In fact, there is a set of forces that act behind the motives. The present study was designed to explore the relationship between students' motivation for learning when engaging with gamification activities during the homework time. In order to assess the motivation considering the attention, relevance, confidence and satisfaction dimensions, the Instructional Materials Motivation Survey (IMMS) [20] was conducted based on the ARCS motivation model [21]. Data for perceived motivation were collected with 5 points Likert scale questionnaires and the results are summarized in table 3.

**Table 3.** Results of the IMMS instrument applied for each dimension of the ARCS model

Motivation Dimensions	M	SD
Attention	3.79	0.81
Relevance	4.13	0.94
Confidence	4.31	0.61
Satisfaction	4.40	0.87

In general, it seems that the results are promising since they indicate a positive impact on all four dimensions. Relevance (M=4.13; SD=0.94) and satisfaction (M=4.40; SD=0.87) dimensions rated better than the other two. One of the most important factors to empower and engage learners around the world to participate in learning activities is attention [21]. In this study, there was a significant improvement of students' attention during achieving their gamified homework. Using gamification elements like points, levels, badges can help students positively to engage and achieve online homework [22]. This finding broadly supports the work of other studies in this area linking gamification with doing homework. These factors may explain the relatively good correlation between the cognitive theory of multimedia learning and gamification design. On one hand, gamification design principles including providing coherent verbal, pictorial information, guiding the learners to select relevant words and images, and reducing the load for a single processing channel etc. [14].

## Conclusion

In recent times, the massive reach that the use of the Internet, social networks and video-games have had led specialists in social sciences, psychology, and technologies to look for entertaining ways to use these forms together. Pomawin is a new homework app that is designed to make it easier than ever for parents to motivate their children to finish their assignments on time. Pomawin includes points, leaderboards, direct competitions and stickers or badges, levels to motivate learners and facilitate learning. In this study, attitudes towards Pomawin were analyzed to examine the correlation between gamifying homework and increasing student's enjoyment and motivation. Results showed that the students were satisfied with the Pomawin, were happy while using this application during their homework time. In accordance with these findings, we make some recommendations of the potential benefits of successful gamification initiatives in the classroom including:

- Gamification should give students the freedom to fail and try again without negative repercussions.
- Inspiring students to discover intrinsic motivators for learning.
- The relationship between enjoyment and homework achievement should be explored in future researches.
- Developing the affordances of immersion like avatar, virtual world, the 3D world in gamified homework software.
- Expand investigating the psychological and behavioral outcomes in gamifying homework to include social interaction and performance.
- Future research in gamification of education should concern more on different affordances when applying them and extend the scope of affordances in the context of education.
- Examining the effectiveness of implementing immersive technologies with gamification in education.
- Children perceive Pomawin as “fun” and enjoy human-like interaction.

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