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GAMEWORK
homework gamified environment

ANALYSIS OF THE GAMIFICATION FEATURES



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PATRAS
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Analysis of the gamification features

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Introduction

GameWork is an Erasmus+ Project financed by the European Union, that aims to motivate students to work on their homework and alleviate their reluctance to do it. Towards this goal, GameWork Team will develop a gamified homework environment that will use gamification techniques to motivate students to do their homework. So, GameWork have three precise objectives:

- 1 Homework organisation**
Learners can access the environment with their smartphone or tablet and see the daily list of activities that they must perform to prepare for the next day, ticking the completed ones.
- 2 Student engagement**
Engage students from the early stages of development, allowing GameWork Team to investigate their views and ideas about gamified homework, possible features and gamified mechanisms.
- 3 Progress monitoring (for students and teachers)**
A verification process will be designed for a student not to skip the assignments and declare them untruthfully complete. The platform will ask for answers to one or more questions essential for each task.

Analysis of the gamification features

The present report will present a brief analysis of gamification features. In this sense, first we will approach the gamified elements and mechanisms that our students wanted most to see in GameWork environment. For that, we will present a definition of each gamified element/mechanism, explain how it can be implemented and, if possible, write about its impact on other projects and research studies.

Also, we will present other elements and mechanisms of gamification that could be helpful for technicians that are responsible for the development of our environment.

Gamified elements/mechanisms chosen by our students



Achievements/Mission/Goal

Definition

Achievements are defined by Groening and Binnewies (2019) as a secondary system that tries to motivate players to adopt a certain behavior. For that, achievements are given to players as rewards when they demonstrate that they have performed this specific behavior.

Missions and goals are very similar to achievements, since these gamified mechanisms also want to promote a certain behavior. In this sense, missions and goals are defined as a set of actions that players must perform to fulfil/achieve a certain objective (Metwally et al., 2019; Metwally et al., 2021).

Implementation

Instructions regarding achievements should be **clear and direct**, so the player can easily understand how he/she can reach it (Groening & Binnewies, 2019).

Additionally, missions and goals should have **different range of difficulty**, starting from easy and moving subsequently to moderate and hard missions.

In addition, these mechanisms should be aligned to student's/ player's level and should respect his/her history in completing previous missions/goals (Santana et al., 2016).

Examples

If we include a **level-system** that includes points:
"To receive 5 extra-points complete three math tasks"

If we use **badges**:
"To receive this badge you have to ask for teacher's feedback for at least two times"

Impact

According to Groening and Binnewies (2019), implementing **achievements** in games can **improve players' performance**. This happens because this system gives them a specific direction on what players should do. So, they tend to be more persistent and direct their efforts to complete their tasks. However, information about the relationship between achievements and motivation are quite vague. Players showing more persistence doesn't mean that they like the game or that they are motivated to play it.

Gamified elements/mechanisms chosen by our students



Another finding from Groening and Binnewies's (2019) research is that lower quantity of achievements leads to higher persistence. This happens because players perceive the achievement as more difficult to reach. So, **we suggest including clear, direct and low number of achievements in GameWork environment.**

Regarding missions and goals, if these elements are too difficult, too easy or with an inadequate progression it may lead to demotivation for players (Santana et al., 2016). This means that **it's essential to develop a congruent system of progression for missions and goals.**

Points

Definition

Point-based gamification has been studied in the past few years to understand its relationship with motivation, performance, engagement and learning (e.g., Koppitsch & Meyer, 2022; Mekler et al., 2013a). Points, as an **element** of gamification, are defined as the score that is given to the student for performing a certain task. It can operate as a positive reinforcement mechanism and be integrated into a system of levels (Butler & Bodnar, 2017; Goehle, 2013; Goehle & Wagaman, 2016; Metwally et al., 2021).

Implementation

There are several online environments that use a point-based gamification technique, like Kahoot or Quizizzis. As the definition itself indicates, the points must be given considering the fulfilment of a certain task. In this sense, in academic context, **points can be attributed according to the rating parameters of an answer.**

However, studies indicate that point-based techniques that require a correct answer and **reward the students by taking into consideration their response time** are more effective (Koppitsch & Meyer, 2022).

Examples

Considering the **rate parameters of an answer:**

For each *correct and complete answer*, the student receives *2 points*. For each *correct but incomplete answer*, the student receives *1 point*. For each *wrong answer*, the student *does not receive any points*.

If we could add the **time of response as a point factor**, we propose to implement the following system of reward:

Gamified elements/mechanisms chosen by our students



Table 1. Points rewards for students' answers

Type of answer		
Correct and complete	Correct but incomplete	Incorrect
2	1	0
Response time bonus		
Less than 30 sec	Less than 1 min	More than 1 min
+2	+1	0

Impact

A study carried by Merkle and colleagues (2013a) showed that the use of points in gamification can **increase players' intrinsic motivation**. Additionally, a recent study suggests that a point-based gamification technique **improves student's perception of engagement**, compared with traditional methods of learning (Koppitsch & Meyer, 2022).

Also, Koppitsch and Meyer (2022) believe that a speed-to-answer strategy can promote higher levels of focus. However, the authors alert that this may lead the students to be more interested in respond quickly than in thinking about the content of the question. So, it is important to avoid competition and implement a reasonable point-system.

Progression

Definition

Progression is a dynamic illustration of the current level the student is, usually implemented in point-based techniques (Dichev et al., 2014). Moreover, it can be part of the levelling mechanism and is defined as a graphical representation of the player's evolution.

Gamified elements/mechanisms chosen by our students

The main purpose of this gamified element is to provide players knowledge about their path and how much is left for a specific goal, which can improve their motivation (Dichev et al., 2014).

Implementation

It can be a percentage bar representing how much XP the player has already acquired to pass a level. Another form is a percentage bar that indicates how many activities the student has completed to finish his/her homework (Goehle, 2013; Goehle & Wagaman, 2016; Metwally et al., 2019; Metwally et al., 2021). Also, it can appear evolving right after the student finished a task as a reward (Dichev et al., 2014).

Examples

Percentage bar



Score graphics



Impact

Progress bars and score graphics can help players to set goals and give a sense of competition between users (Westenhaver et al., 2022). Moreover, applying this gamified element allows teachers and caregivers to track students' learnings and establish new ones (Kiryakova et al., 2014). Basically, the great impact of using progression bars is to **promote the achievement of specific goals**.

Additionally, a recent research carried out by Mazarakis and Bräuer (2020) aimed to understand the role of this gamified element in motivation. Results suggested that when players have access to their progress, their motivation on the following tasks increases.

Increasing difficulty

Definition

Increasing difficulty is a game feature that assumes a progressive increase in the questions' difficulty, passing a level or reaching objectives (Metwally et al., 2021).

Gamified elements/mechanisms chosen by our students



Implementation

This gamified mechanism should be used in a level-based game (Kumar, 2013; Metwally et al., 2021). In this sense, each level must be more complex when compared with the previous one.

Examples

We can implement increasing difficulty in several ways. If we chose to have a level-based game we can include rules to increase level, like:

- **Level 1.** Starting level
- **Level 2.** To achieve level 2 collect 20 points
- **Level 3.** To achieve level 3 collect 40 points
- **Level 4.** To achieve level 4 collect 70 points
- **Level 5.** To achieve level 5 collect 100 points
- (...)

Since we are approaching level-based gaming, it's important to reinforce positively students after they level up. This way, we are promoting their motivation and engagement. We can do this by using the following badges right after they achieved a new level:



Additionally, we can implement increasing difficulty questions in homework. To do so, we have to **present first easier questions followed by increasingly complex questions.**

Impact

The aim of using gamified mechanisms like increasing difficulty is to promote students' motivation and engagement (Metwally et al., 2021). A study carried by Cao and colleagues (2022) had as its main objective to understand if more challenging activities were related to more students' achievements in education. According to these authors (Cao et al., 2022), when students perceive an activity as easy, they tend to present positive emotions towards it. This means that students enjoy the proposed task.

Regarding students' motivation, students seem to have higher levels of motivation when they perceive a task as easy. Contrarily, they present lower levels of motivation with more complex activities (Cao et al., 2022).

Gamified elements/mechanisms chosen by our students



Despite high difficulty doesn't predict lower performance, when students were demotivated, they presented lower scores in activities and exams (Cao et al., 2022). Similar to the above-mentioned achievements/goals/missions, **it is important to establish appropriate levels and rules for passing them.**

Chances

Definition

Chances is a mechanism that allows students to have the opportunity to re-respond to a task/activity (Metwally et al., 2021).

Implementation

To implement chances, it is necessary to have some challenge, questions, task or activity that allows students to fail without a consequence.

Examples

Inside each subject we could make available students' activities regarding their homework, but also other tasks and challenges (see figure 1).

These challenges could be a brief questionnaire with questions that can help students to study for their exams. If students answer correctly to all questions, they should receive a reward like 15 more minutes on exams, 2 points extra on exams, one help during oral presentations, turn in a late homework assignment without penalties, 5 extra points to level up and so on.

To promote students' interest in doing these challenges they could have one chance to correct wrong answers from these questionnaires.

This mechanism could also be implemented in extra tasks.

Figure 1. Subject page layout proposal



Gamified elements/mechanisms chosen by our students

Impacts

Including chances allows students to **learn from their mistakes** and **transforms the process of learning to something more meaningful** (Rincón-Flores et al., 2019). Plus, when we give a chance to students, they can assess immediately their wrong answer and give **instant feedback** (Rincón-Flores et al., 2019). This is related with **higher levels of motivation and engagement** (Cao et al., 2022).

Moreover, Rincón-Flores and colleagues (2019) revealed that **challenges can increase intrinsic motivation**, since students know where they have failed and want to solve their mistakes (problem solving and metacognition are highly useful).

Levels

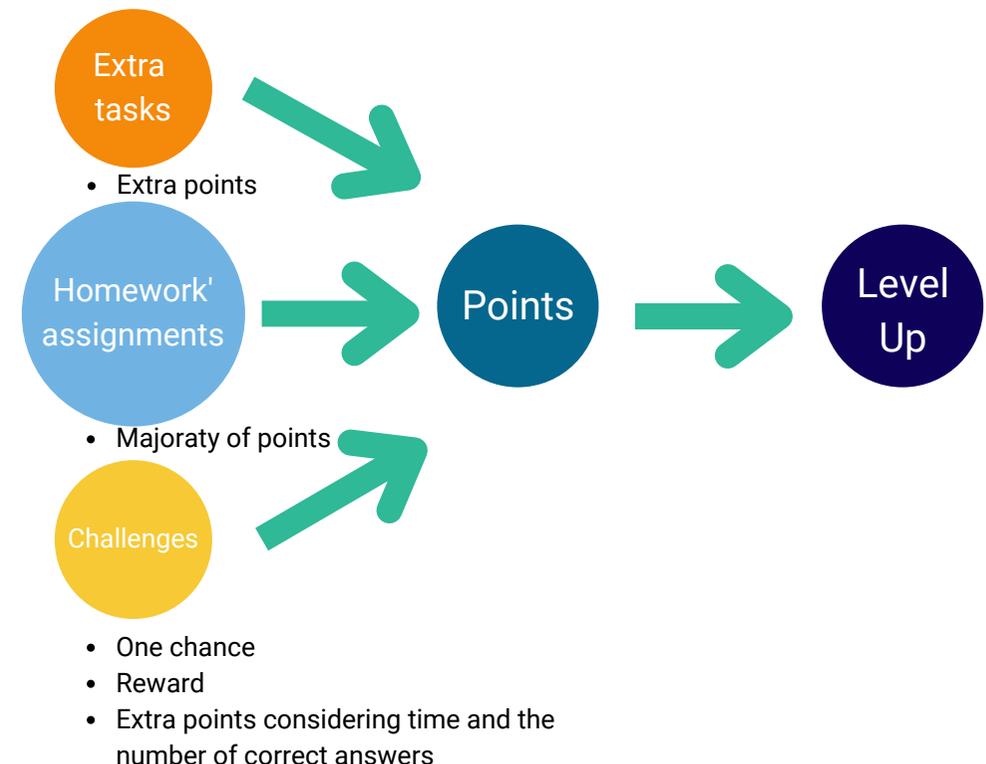
Definition

Levels is a gamified mechanism that gives players a sense of progress. Typically, the first levels are easier to achieve and require less effort and skills. Gradually, the difficulty of passing the levels increases and the time required to reach a new one can be longer (Gohele, 2013).

Implementation

We previously presented a proposal concerning the prerequisite conditions to reach a new level. In the following examples, we summarize a schematic game mechanism that can aggregate the various choices made by students regarding game elements, including levels.

Examples



Gamified elements/mechanisms chosen by our students



Impacts

According to a research carried out by Mekler and colleagues (2013b) the use of levels in games can **promote the maintenance of players' performance** for longer time period than a basic point system. Performance is also maintained when participants understand what they have to do to reach the next level.

It is important to note that some studies alert to the fact that the advancement of levels does not always mean better learning on the side of students (Goehle, 2013). However, other studies state that levels can work as feedback, since they can help both students and teachers understand students' progress (Tulloch & Randell-Moon, 2018).

Feedback

Definition

Feedback is defined as a space where students receive teachers' perceptions of their work, notes and suggestions to improve (Foucault et al., 2019).

Implementation

Feedback should be meaningful to the one who receives it. In this sense, it is suggested to be short and actionable, which means that students' weaknesses should be explained briefly, helping them to improve (Foucault et al., 2019).

Examples

In GameWork it could be interesting to include a space dedicated to contact between students and teachers. In addition, it could be useful to implement simple mechanisms for teachers to give quick feedback on a certain activity or question.

Impacts

Feedback is an essential tool in education, since it can lead to **higher quality education and better learning outcomes**. Also, when feedback is given effectively, **it can promote students' motivation, self-efficacy and confidence** (Ani, 2019).

Additionally, this mechanism can **improve the relationship between students and teachers**, creating a more friendly learning environment. However, for this to happen, feedback must be specific and individual, so students perceive it as meaningful (Pankonin & Myers, 2017).

There are several types of feedback, but Ani (2019) suggests that a **combination between positive feedback** - value the learning and academic achievements of students; **and negative feedback** - alert students to mistakes made and areas for improvement; can **help students to achieve advanced academic skills**.

Rewards

Definition

Rewards are elements created to encourage players to be active in games. There are four types of rewards:

1. "Glory - Scores, leader boards, medals, achievements, badges
2. Sustenance - Resources
3. Access - Unlocking mechanisms
4. Facility - Currency, points, level, virtual items/tangible rewards" (as cited in Zhao & Guo, 2019)

Implementation

In GameWork we suggest using **glory rewards** through achievements and badges, and **facility rewards** through points and levels.

Examples

In the *increasing difficulty* section, we already presented examples of possible badges and rules to achieve new levels.

Also, in the *levels* section we presented a map that explains the possible way to include different gamified elements, including these rewards.

Impacts

The main objective of rewards is to motivate players to continually participate in activities. In educational contexts, gamified rewards can **promote students achievements regarding knowledge and skills** (Liaw, 2008).

Recent research confirmed that rewards have positive impact on students' participation in activities, improving their engagement. Since rewards were assigned to recognize students' effort, it also promoted students' academic performance (Ricon-Flores & Santos-Guevara, 2021).

Badges

Definition

Badges are visual representations of students' achievements (Metwally et al., 2020).

Implementation

It would be interesting if we could have a space in GameWork where students could see all badges that they can conquer. We could create badges not only for passing levels, but also for respond quickly in challenges, complete homework assignments on time, complete extra tasks, improve their performance (given by teachers) and for collaborative work with their colleagues (given by teachers) (Rincon-Flores & Santos Guevara, 2021).

Examples

Next, we will present some badges that could be implement into GameWork (only as suggestion).

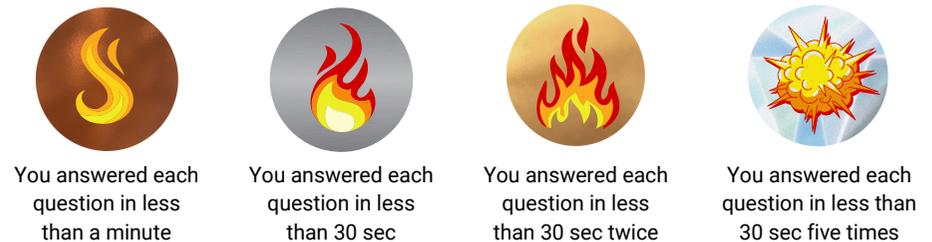
Passing levels

Every time a student achieves a new level (rules in increasing difficulty section).



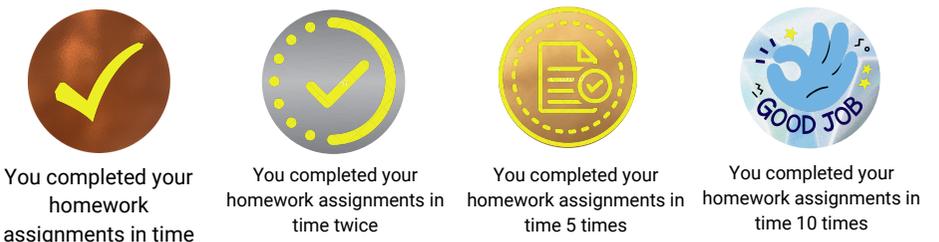
Quick answer in challenges

When students respond to each question in less than 30 sec or in less than 1 min.



Complete homework assignments

When students complete their homework assignments in time.



Other gamified elements/mechanisms

Complete extra tasks

When students complete extra tasks proposed by their teachers.



You completed an extra task



You completed an extra task twice



You completed 5 extra tasks



You completed 10 extra tasks

Performance improvement

Teachers could be responsible for these badges and give them to students according to their assessment.



You improved!



Your effort was recognized!



Your teacher is proud!



Congrats for all your improvement!

Great colleague

Teachers could be responsible for these badges and give them to students who help others and work well in group.



You helped a friend!



Your group made a great job!



You all are an incredible team!



You are a great friend!

Impacts

The use of a reward system can **promote students' motivation, engagement and participation**. Moreover, badges have a positive impact on both students' **extrinsic** and **intrinsic motivation**, since they have a better perception of their achievements. This leads to an **improvement of their academic performance** (Rincon-Flores & Santos-Guevara, 2021).

Also, badges can be perceived by students as fun, as a **booster of their confidence**. Additionally, badges can help students on doing a **self-assessment** of their knowledges and learnings. To increase the power of badges, it is advised that they should be **multi-level, systematic and continuous** (Aldemir et al., 2017).

Quizzes

Definition

Quizzes in general terms is a task that involves answering a set of questions (Metwally, et al., 2019; Panahandeh & Chalak, 2020) and they are described as an element of a game that creates learning opportunities (Sanchez et al., 2020).

Implementation

We suggest implementing quizzes inside challenges. This way, students have the challenge of respond to brief quizzes to win rewards, points and badges. Also, we think that it would be better if these quizzes were developed by teachers, so they could be in line with subjects that students were addressed in class.

Examples

There are some online platforms that allow you to create quizzes in a gamified way, such as Kahoot, Quizizz, Typeform, Google Forms.

Impacts

A research study carried by Sanchez and colleagues (2020) aimed to understand the impact of online quizzes on students' grades. According to this study, **students who completed only quizzes before tests, had better results on their grades**. Also, authors wanted to understand the difference of gamified quizzes and traditional quizzes. **Students who completed gamified quizzes had better grades**, compared to ones who completed traditional quizzes (Sanchez et al., 2020).

Moreover, **chances/attempts** are important and **can lead to significant learnings gain**. The fact that students have more opportunities to take the quizzes, makes their **grade average increase**, the **response time decrease** and their **learning is solidified** (Cohen & Sasson, 2016).

Time constraints

Definition

Time constraints is defined as the amount of time the student has available to complete an activity. It may appear on the gaming platform as a countdown. This mechanism encourages players to respond quickly. You can use it as a reward for giving students more seconds/minutes to complete a task (Metwally et al., 2019; Metwally et al., 2021).

Implementation

In GameWork Project time constraints can be implemented as a gamified mechanism in challenges.

Examples

There are several games that use time constraints as a gamified mechanism. In GameWork, we suggest to implementing this mechanism through a timer that appears once challenges have started.



Impacts

To the best of our knowledge, no research study was found regarding the impact of limited time on games applied in an educational context.

Tutorials

Definition

Tutorials can be available as students sign in the game environment for the first time, so that they learn how to interact with it. They can also be used in the game's logo, showing instructions or illustrative images to help students complete tasks (Metwally et al., 2021).

Implementation

We suggest to including tutorials in GameWork in two different ways. The first one is to **help students on their first contact with our platform**. In this sense it would be great if we could develop a brief video with instructions for how to use GameWork environment and its main features and areas.

The second way of using tutorials is through explanations by teachers on how to solve an exercise, a video clarifying frequent doubts that arise from students, etc. Basically, to **create a space where teachers and students are closer to clarify doubts**.

Examples

There are numerous websites with tutorials, like KhanAcademy, CodeAcademy or Codingame. However, these sites are usually related to coding and are more useful for students or those interested in software development.

Nevertheless, there has also been an increasing number of videos made available by teachers on YouTube, which explain specific parts of subjects.

Impacts

The use of tutorial may **increase students' motivation** in activities (González et al., 2014), may minimize frustration and **prevent drop out** (Martin et al., 2005).

Conclusion



The purpose of writing this report was to describe the mechanisms and game elements most desired by students. In this way, the team responsible for the development of the GameWork environment will carry out its work in an informed manner and in accordance with the students' expectations.

As it was possible to understand through the writing of this report, there are several mechanisms and game elements, which impact the performance, motivation and involvement of students in academic tasks. However, to maximize the effects of these mechanisms, we can implement them together, as for example the map suggested in the section on levels.

In this sense, in addition to including the elements and mechanisms most chosen by students, we also describe those that can be easily integrated into the game system.

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GAMEWORK TEAM



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