

GAMED: Gamification-Based Assessment Methodology for Final Project Development

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Abstract—Teachers and psychologists report that students may suffer from multiple psychological issues such as lack of interest and high levels of stress during the development of final course projects. In this context, approaches such as gamification arise with the proposal of improving students motivation by bringing games elements to school. However, employing gamification into classroom is not a trivial task since, if not managed properly, students may lose their focus. In this paper we present GAMED, an assessment methodology that introduces systematic steps to improve students engagement through gamification. We used GAMED in a class with high school students during two semesters and the results showed that it can improve aspects such as motivation, engagement, and teamwork.

Keywords—Gamification, Formative Assessment, Students Motivation.

I. INTRODUCTION

Motivation has received considerable attention in educational institutions because of its influence on students actions. The self-determination theory [1] indicates that the driving force within a human being is called intrinsic motivation. However, there is a kind of motivation called extrinsic motivation which is dictated by external factors. Therefore, extrinsic motivation can affect several students lives in several ways such as: academic career, participation in projects, interaction with colleagues and instructors, and students' effort in understanding the content presented in school. Besides, loss of desire can lead to communication issues, reduced academic performance, and even school dropout. Based on the above, the high school scenario is even more worrying because teenagers have to deal with issues coming from adult life and, by consequence, are more likely to develop psychological or social problems.

Hence, educators have discussed ways to create more enjoyable activities to promote adolescents engagement. In this context, one of the pedagogical practice that has been used to encourage learning is gamification. This approach brings game characteristics to school, incorporating game-like elements, such as avatars, progress bars, challenges, and feedback mechanisms enabling teachers to understand students behavior in real time [2]. Besides, bonus systems allow students to be aware of their progress in learning. Consequently, this also provides support to the formative assessment.

In this sense, this paper presents GAMED, a gamification-based methodology used to enhance adolescents' engagement to study, as well as foster their academic achievements during

the development of their final course project. The proposed methodology was employed in the two last semesters of a class with 15 students of an integrated modality of high school along with computer science technician course. After the experimentation, students expressed their impression of the methodology and educators highlighted the positive gains regarding teamwork and collaboration in classes.

The remainder of this paper is organized as follows: Section II draws the motivation and theoretical framework introducing fundamental concepts of gamification and formative assessment. In Section III, we present the proposed methodology (GAMED), in Section IV we analyze and discuss the results obtained during the use of our proposal with high school students, and in Section V we present the final remarks and topics to be addressed in future researches.

II. BACKGROUND AND CONTEXT

In overall, Brazilian technical schools¹ usually require a final project, similar to an undergraduate thesis in universities. Several studies investigate the symptoms caused to students at this course stage such as: mental fatigue, concentration issues, and memory loss [3]. In the institution used as testbed for this work, the reality was not different, since many students were unmotivated and suffered with other issues, such as: stress and low achievement due to concerns with their final projects. For this reason, professors along with professionals from the psychology sector planned a strategy to make this phase healthier and less painful for students.

This section presents the methodology background that underlies the evolution of the related case study. First, we explain gamification concepts and their benefits in the educational context. Afterwards, we describe a notion of formative assessment, which also supports our approach.

A. Gamification

Gamification takes advantage of students interest in games to enhance the learning process. Gamification is based on the assumption that the engagement experienced by gamers could be adapted to the learning context. To achieve that, gamification applies proven entertainment mechanisms such as badges, points, levels, and leaderboards to capture students interest and improve aspects such as participation, engagement, and competition.

¹Term used in Brazil for schools that offer vocational education at the secondary level.

Caponetto et al. [4] present a literature review of gamification in education. Among the results, the authors describe the growth of initiatives that use gamification over different educational levels, in search for enhancing students' motivation and engagement in learning tasks. However, the results also show that the majority of the initiatives focus on undergraduate students. Nevertheless, other studies also discuss the positive impact of gamification in high school and report positive experiences [5].

B. Formative Assessment

Formative assessment proposes the use of methodologies that allow teachers to monitor students achievement during the learning process, so they can identify specific contents where students are struggling and detect the effectiveness of the employed teaching strategies [6].

While summative assessment focuses on evaluating students progress at specific points of a given instructional period (e.g., at the end of a semester or after teaching a particular set of contents), the primary goal of formative assessment is to give teachers information about students achievement while they carry out their tasks. As a consequence, formative assessment offers a higher level of detail about the students learning process, allowing teachers to understand the challenges their students are facing.

III. PROPOSED METHODOLOGY

GAMED consists of a novel methodology that brings to the course curriculum a set of activities based on concepts of gamification and formative assessment to improve students motivation and engagement. Keeping in mind the students' issues presented in Section II, we designed GAMED with four main phases (shown in Figure 1).



Fig. 1. Strategic phases adopted by GAMED to improve students motivation and engagement.

With the issues mentioned earlier in mind, we composed our approach by four main phases: the study of the context, gamification in the digital platform, individual monitoring and qualitative assessment. These steps are explained next.

A. Context Study

This step consists in performing a dynamic moment of reflection with the students to find out how they feel about

the development of the final project. First, professors ask questions to students that have to write their answers in post-its anonymously. The questions asked to students are: "What do I want to present as a final project?", "What have I done?", "What is lacking to do to complete the final project?", "How do I feel?", "What difficulties did I find?", and "What do I need?".

At this point, psychologists talk to the class about how to deal with adolescence moments of anguish and how to meet school commitments. After the talk, students create their *individual goals* which is a document where they write a timetable with deadlines and activities they consider necessary for the completion of the final project. After analyzing the students' feedback, the online gamification platform is configured.

B. Gamification on Digital Platform

The second phase focuses on exploring the features of the chosen gamification platform. GAMED does not include any digital-dependent task. However, we recommend using a digital gamification platform since they usually allow teachers to configure the gamification environment with less effort and provide analytics regarding students achievement. Also, considering that GAMED focuses on teenage students, we believe that a digital platform could be more attractive as they usually are familiar with playing on digital devices.

After choosing the digital platform to be used, teachers have to create the online classroom and customize the badges with positive skills and aspects to improve, each one containing with different scores. Thus, students earn points if they have appropriate behavior and lose points if they do not follow the rules. Also, it is essential that the classroom has a sum of scores from all students, so it is possible to create class goals that students have to reach together. The group goals encourage students to help their classmates since, as the higher the number of points the group has, the faster they will achieve the goal and consequently earn the bonus. These game mechanisms must be defined and agreed between students and teachers.

C. Individual Monitoring

GAMED includes an individual monitoring phase where teachers make a continuous evaluation of students achievement (preferentially weekly assessment). At this stage, it is essential to analyze students progression and commitment indicators such as the amount of time dedicated to developing the final project. We suggested that the schedule created by students should be put in a visible place and checked at each class.

Some questions may guide the individual monitoring of each student: i) Does the student help his colleagues? ii) Is the schedule being followed? iii) Are there meetings with the final project advisor? iv) Is the student autonomous and persistent in finishing the tasks?

In this sense, if students are facing obstacles, it is possible to make the necessary referrals to help them in a timely manner and avoid low performance. Besides, continuous monitoring also allows a qualitative yield assessment.

D. Qualitative Assessment

As already mentioned, teachers identified failures in the final project examination process since some students did great projects but were not able to present their proposals accurately. Thus, these limitations fostered the relevance of continuous monitoring.

Therefore, GAMED takes advantage of the interaction of advisors and students to build a thorough report on students achievement. To do that, advisors receive a questionnaire that not only evaluates students' writing and development skills but also assesses students attitudes based on weekly reports generated by the gamification platform. Many qualitative criteria can be considered, such as: participation, effort, autonomy, organization, etc.

IV. CASE STUDY

In this section, we present a case study of GAMED with 15 students from a vocational program that integrates high school and computer science technician courses.

A. Online Platform

Given the criteria for choosing the gamification platform, we adopted Class Dojo [7], whose proposal is to reward student behavior, encouraging values in the classroom. The platform provides a scoring system in which teachers can give points to students based on specific actions, either positive behaviors or aspects to improve.

Class Dojo also provides reports about students' achievement that can be accessed by the students themselves, teachers, and parents. Besides, teachers can create class goals, that are small challenges that must be achieved by the class. With each goal completed, teachers can create class bonuses, which may include short walks or other activities that students may suggest.

In the class, we adopted this approach since students demonstrated an interest in small snacks. So the 50-point goal had free soft drinks for the whole class, 100 and 500 points earned cake and pizza, for example. It is important to emphasize that the award did not include school grades, otherwise to activities pleasurable to students such as a picnic.

B. Experimental Assessment

The final project is developed during the last two semesters of the vocational course. Usually, students are between 16 and 18 years old, and their final projects are in the area of computer science, such as website development, computing models, etc. The urge to employ a different methodology occurred because in a class of 15 students the progress in the initial semester was very negative, since only 2 students reached the minimum grade.

In this situation, experimentally we planned the proposal with this group that was already working (second semester). It was noticeable the increase in motivation of the students to do their tasks, and the achieved results were excellent. At the end of the year, all students were approved. Therefore, in the next year we started applying the methodology in the first semester

so students could already start the development engaged. This class had 13 students.

At the end of the first semester, students were invited to share their feedback by answering an online questionnaire about the new methodology, and the results were significantly positive, where students stated that GAMED was able to encourage them to meet the proposed deadlines since it brings more fun to classroom activities.

Students completed their final projects and presented it to the scholar community. The contribution of each student was evaluated, and the grading was based on a qualitative assessment, besides theoretical learning. Despite the qualitative principle, we need to highlight the positive quantitative results presented by the students that followed the methodology. **The average grade was approximately 8.8 on a scale of 10, while in the previous year only two students were approved with grade superior to 7 (minimum grade to be approved). Besides, teachers positively evaluated the students' results and highlighted the cooperation between them, higher dedication, and reported that students were looking their advisors more frequently.**

V. CONCLUDING REMARKS

In the educational context, there is a concern about ensuring students engagement since lack of motivation can lead to critical issues such as low achievement or even school dropout. Thus, in this paper we present GAMED, a methodology that employs concepts from gamification and formative assessment to improve students motivation and engagement during the development of their final projects. GAMED was used in a class of 15 students during two semesters. After the experimentation, teachers observed positive behavioral changes in aspects such as engagement, teamwork, and scholar achievement.

We also identified some limitations of the proposed methodology in how well its results generalize to other situations. Indeed, further research is needed to better determine the best practices in using gamification in the high school, particularly in technical courses context. However, this approach can still be used to encourage and help other teachers apply the gamification with teenagers. Thus, as future directions, we intend to employ GAMED in more classes of different courses.

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