Fast Gamification Approach: Increase of the Motivation in Remote Classes

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Abstract: Serious Games are considered as effective incentive tools for academic training. However, it remains a difficult challenge to use and generalize in university degrees. This paper aims at presenting a hybrid fast gamification approach for different training modules in order to improve the motivation context and involve non-game-specialist teachers. Thus, in various experiments, we have been able to show that a serious game with a unique and same storyboard increases motivation even in different formations. In the first part, we present the game scenario modeling. Then, in a second part, we detail integration mechanisms of several training modules into this scenario. Finally, in a third part, we present the experiments carried out and the results obtained from this approach used in distance learning, during the COVID-19 crisis.

1 INTRODUCTION

Serious games are effective tools to motivate learners in their formations. However, they remain very marginally deployed in vocational university training (Vlachopoulos and Makri, 2017). There are a variety of reasons for this. In addition to overcoming strong resistance to change inherent in the academic system, the difficulty of creating a playful scenario also known as gamification (Kapp, 2012; Bíró, 2014; Deterding et al., 2011)) and the lack of simple tools are the main obstacles.

Moreover, the quarantine and the closure of university campuses have imposed the need and the generalization of distance learning. In this difficult context, for teachers and especially for students, motivational tools such as serious games appear to be essential to maintain students' attention and to avoid the phenomenon of dropping out (Muratet et al., 2012).

This article presents a hybrid approach called rapid gamification. The main point of this gamification consists in being able to create a same game context for one or more existing training modules very quickly. This approach relies on a simplified model of the interactions between a fun activity and an educational activity. Thanks to this approach, the teacher,

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who is not a serious game specialist, integrates his teaching activities into a fun framework initially prepared by a serious game specialist, regardless of the field of use that will be made of it. The first part of this article presents the modeling used to build this type of playful scenario and the dedicated modeling tool.

In the second part, we present the experiments achieved during the quarantine. Indeed, this approach has been tested on different teacher modules in a remote classes context. The last part describes the outcomes collected in different vocational training sessions: Imperative Programming, Database, Control Theory. Moreover, this approach has been experimented in various university degrees.

2 FAST GAMIFICATION APPROACH

2.1 Playful Scenario vs Pedagogical Scenario

Classic script-writing approaches are generally based on the gamification of an educational process (Botturi et al., 2006) (Kim et al., 2018). In this type of ap-

proach, the trainer and the game designer try to build a playful scenario from their educational and / or playful experience, or even from a learning path established elsewhere. To do this, they can use models that will describe the steps of a player-learner's progress.

In literature, we can find the following models:

- IMS-LD-SG (Tran et al., 2010) is a modified version of IMS-LD in order to design serious game (SG) scenarios by adding specific types of resources dedicated to the SG;

- SGORM (Bisognin et al., 2010) is an extension of SCORM allowing to define playful components;

- MoPPLiq (Marne et al., 2013) corresponds to a specific model for representing SG scenario that can be easily modified;

- SG-LOM (El Borji and Khaldi, 2014) focuses on metadata scheme and proposes an application profile of IEEE LOM. It takes into account the different evaluation studies and relies on a SG classification.

Most of these models integrate playful elements into an educational logic. Finally, there is an interdependence in the design of the educational scenario and the playful scenario (Buckingham and Burn, 2007). These approaches produce good results but the constraints are very strong. On the one hand, they require a high level of expertise; on the other hand, they often induce long production time and some very specific developments.

The modeling approach that we have chosen creates a decoupling between the playful and educational facets (Abed et al., 2018). In particular, this allows the models to be produced in parallel and independently, by different people.

2.2 Fast Gamification Approach (FGA) Modeling

We therefore opted for an opposite approach to the previously mentioned approaches. Indeed we have deliberately modeled a playful scenario with a progression in the game independently of any pedagogical consideration.

2.2.1 Playful Model

The playful modeling is based on a decomposition approach by aggregation around the following concepts: universe, activity, scenario, quest and task. The universe characterizes the playful context in a thematic or dreamlike coherence (example: a medieval-fantastic universe). The activity represents a play unit (example: a set of multitouch table activities, a 3D game, a

2D Web Game, a VR game session). These two concepts are mainly categorical elements that help game designer (and as we will see later teacher) to identify the granularity.

The structural modeling of a scenario can be broken down into several quests, each quest being able to be broken down into tasks. The dynamic of the playful scenario is characterized by the sequence of quests and tasks whose links are based on predicates.

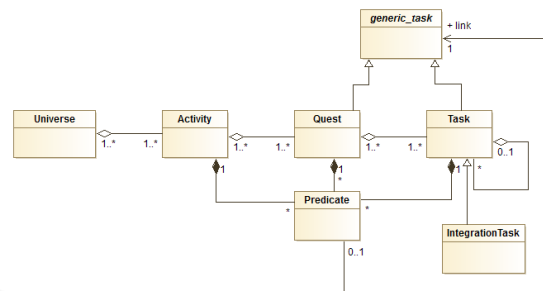Figure 1 describes the model used with UML notation.

Figure 1: FGA playful model.

Figure 2 illustrates an extract from the scenario model which was produced for the experiments in a University and in an Institute of Technology. We developed a web tool: a simple graphical editor called ScenarFab to facilitate the global visualisation of each scenario.
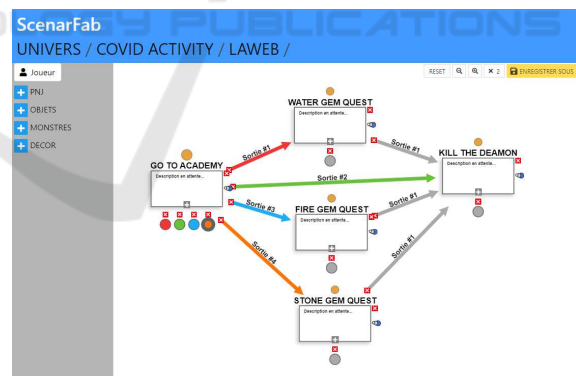

Figure 2: Quest modeling example.

2.2.2 Pedagogical Model

In order to get/reinject existing pedagogical content (exercises, video, documents, questionnaire), we only add one concept: the "integration task". The educational model represents a simple extension of certain elements of the playful model (see Figure 3). Thus, the quests include exercises or video capsules. Some exercises can be detailed, if necessary, by breaking them down into tasks.
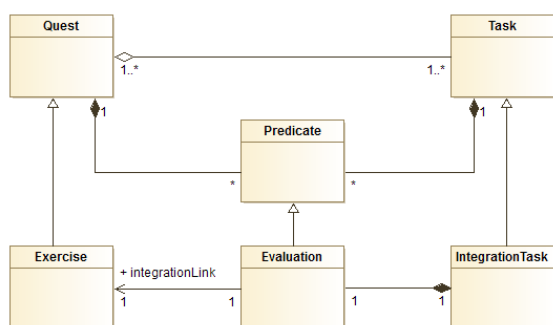
Figure 3: Extension of playful model FGA.

The pedagogical-playful integration is thus naturally done through the integration tasks and their evaluation link. These tasks will define the pedagogical attachment points which will then be used by the trainer. Figure 4 shows an example of integration with an exercise in ScenarFab. An important feature of ScenarFab is the recursive aspect: game designer and teacher may zoom into each level of granularity (playful activity, scenario, quest) in order to get a clear vision of that part of the scenario. ScenarFab generates a JSON file with the full scenario but currently we are not yet able to directly generate the game from this JSON file.
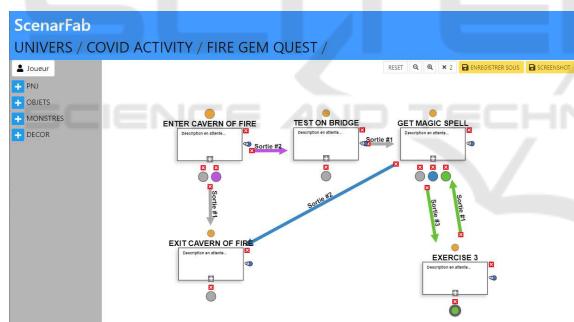

Figure 4: Integration example.

With this approach, the creation of the exercises is totally decoupled from the playful scenario. This allows the trainer in particular to work in parallel with the game designer. Another advantage is that the same scenario frame can be used for different training modules.

3 EXPERIMENTS AND RESULTS

This section presents the experiments carried out with FGA. The approach allowed us in particular to very quickly offer a context of motivation during the health crisis of COVID-19.

3.1 Experiments Context

We tested our approach on three different learning modules in two different training courses.

- first cohort with 56 students (Computer Science bachelor)
  - a module on imperative programming in C language: Imperative Programming, functions, separate compilation, pointers.
  - a database training module: Relational DBMS, SQL
- second cohort - 80 students - Institute of technology diploma GMP (mechanical and production engineering department).
  - control module : Linear system, identification, PID

The table 1 presents the characteristics and conditions of these experiments and in particular the distribution of hours worked face-to-face (before the COVID crisis) and hours worked in remote class context (during quarantine). The duration represents the effective game play including briefings and debriefings. We did not take into consideration gender because most of these students are male in the degrees for these experiments. Average age is around twenty-one.

Table 1: Characteristics of modules using serious play.

Module (total)	C Lang	DBMS	Control
Total	24	24	16
before COVID	20 h	16h	7 h
during COVID	1 x 4 h	2 x 4 h	3 x 3 h
SG Duration	2 h	2 h	2.5 h
Quests Nb	7	9	7
Exercise Nb	5	7	5
E-learning	Moodle	Moodle	Claroline
Discord	yes	yes	yes
LAWEB	yes	yes	yes

The three scenarios have been modified with FGA and the ScenarFab tool (cf. Figure 5). It is important to note that the first and the second scenario (of the C.S. Bachelor cohort) are part of the same scenario background although they involve two totally independent modules in training.

These scenarios have been implemented in the LAWeb platform. LAWeb is a collaborative-RPG game platform running within a simple web browser[1]. Besides LAWeb, the students also had an audio virtual room to communicate within their team (figure 6).

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[1]It can be seen as a layered build based on an editor software of 2D game called RPG Maker.
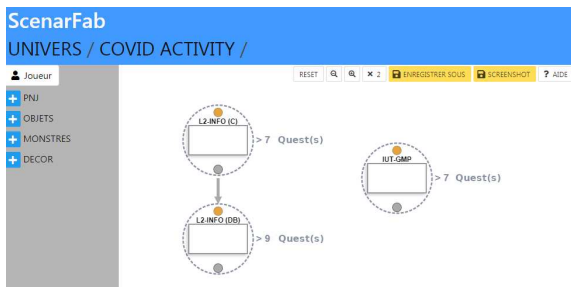
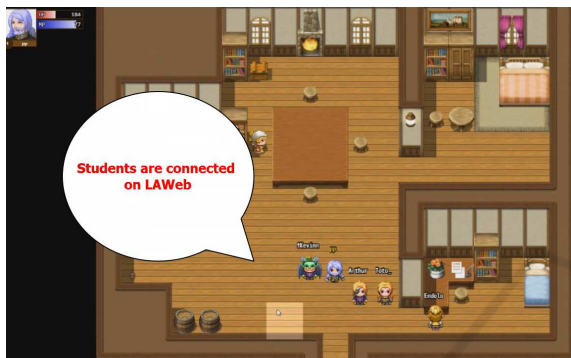Figure 5: Extract from the scenario model with ScenarFAb.

Figure 6: Used gaming tools : LAWeb.

Table 1 also summarizes the quests and integration tasks of the different scenarios. As we indicated in the previous paragraph, the trainer defines the exercises. As part of these experiments, we integrated exercise evaluation mechanisms with two different approaches.

The first approach is based on online tests within an LMS (Learning Management System) platform. The second approach is based on a shell/CLI (Command Line Interpreter) assessment engine (the answers are compared with a correct test set): the input interface is available within the game (Figure 7).
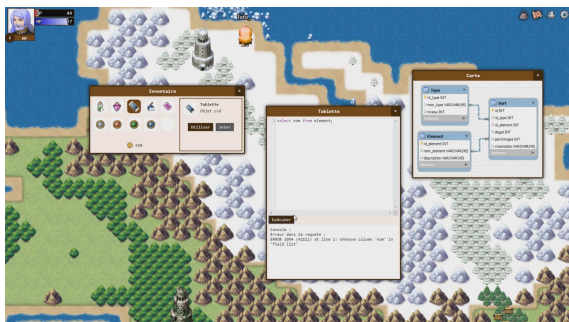

Figure 7: Global evaluation on C and SQL modules.

Here, the role of the trainer is simply to provide a set of exercises with assessable results.

3.2 Results Analysis

The results presented here are extracted from an anonymous survey carried out at the end of serious gaming sessions. The response rate for the first cohort is 57% (same response rate for both scenarios). The response rate of the second cohort is 48%.

Table 2 presents general student opinions on serious gaming, for the C programming module and for the Database module. The results are mostly positive. We note that at the end of the first scenario, the students wish to continue the game for another module (74%). The fact of continuing the scenario for the second module did not modify their opinion in a negative way. Moreover, 94% of students would be ready to continue on a third module (cf. Tables 3 4). These results show that the "pedagogical discontinuity" (in the same game environment, sequence of modules from different domains or subjects studied in remote class) has no impact on the already known contribution of serious games. More accurately, the learners considered as positive to find the same environment again and to continue to explore it, to already master the use of the interface, to find the same NPCs (Non Playable Characters) again.

Table 2: What is your general impression about use a serious game in this module?

module	C Language	DataBase
Very Bad	0	0.03
Bad	0.04	0.03
Without view	0	0.10
Good	0.19	0.38
Very Good	0.65	0.58

Table 3: Would you like to play another game in a different module?

after module	C Language	DataBase
No	0.26	0.06
Yes	0.74	0.94

Table 4: Has your opinion changed compared to the previous module?

No my opinion has not changed	0.48
Yes my opinion has changed but it's more positive	0.45
Yes my opinion has changed but it's more negative	0

The results (cf. Tables 5 7) were obtained for the first cohort (C.S. Bachelor) and for the second cohort (Institute of Technology Diploma). They show that the main interest of serious games remains an increase in motivation. Nevertheless, the students do

not think that this directly facilitates their learning. However, even without a direct impact, many studies (Prensky, 2001; Connolly et al., 2012; Westera, 2019) have shown that motivation is a determining factor in the ability to learn, and with these very difficult pandemic contexts, motivation become a crucial criteria to avoid the dropout.

Table 5: Do you think this serious game is an asset for this module?

cohort	C.S. Bachelor	IUT
No	0.06	0.08
Yes	0.94	0.92

Table 6: If you think serious play is an asset, which one do you think is most representative?

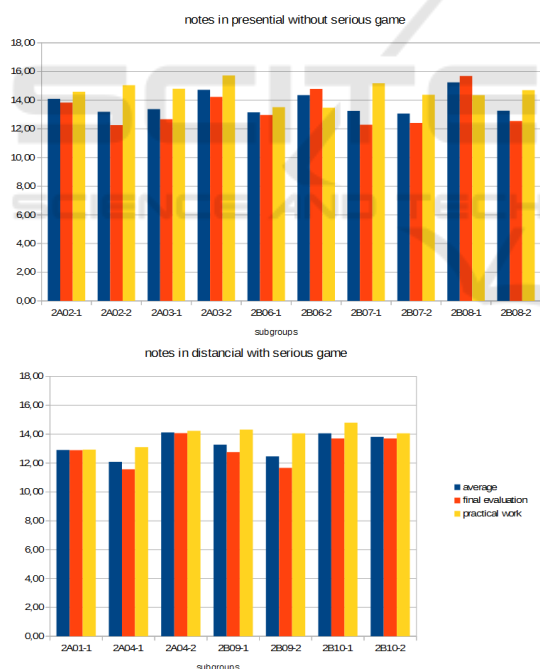| cohort	C.S. Bachelor	IUT
It's motivating	0.70	0.75
It changes my view on the module	0.18	0.25
This helps to better understand	0.12	0

Figure 8: Ratings compared with and without serious game.

This pedagogical point is confirmed by the results of Figure 8 since the scores of the groups who performed the module before quarantine (without the serious game) are more or less the same as the groups who did the module remotely with serious games. This finding was not observed in the other modules

of the training.

Table 7 shows that the distance had no impact in serious game. For the two cohorts, the results are roughly the same. An important point is that for the second cohort, the serious game session took place over two sessions by dividing the cohort into two groups (around 40 students per group). Thus, thanks to the "MMO" game (not really massive but multiplayer and online), it was possible to manage two sessions of 40 students in distance learning, instead of the four that would have been necessary in face-to-face or even more with current (post-confinement) pandemic risk restrictions in the universities.

Table 7: Because the COVID containment, you followed this scenario in distance learning, what is your opinion on this point?

cohort	C.S. Bachelor	IUT
It was not a problem	0.94	0.71
I have no opinion	0.03	0.25
It was problematic not to be in presential	0.03	0.04

4 CONCLUSIONS

In this article, we have proposed an approach to quickly implement a motivation context thanks to serious gaming. In order to involve the non-game-specialist teachers, this approach is based on a scenario construction approach decoupled from educational aspects. The pedagogical link is carried out a posteriori by using points of attachment on some specific tasks thanks to a graphical editor called Scenar-Fab. This method allows the work of the designer and the trainer to be done simultaneously. Furthermore, the results obtained show that there is no playful dissonance and that the pedagogical discontinuity is not seen as a hindrance on motivation feeling. Moreover, the results clearly present an effect of increased motivation in distance learning that makes a lot of sense especially in these times of pandemic uncertainty.

Among the perspectives to be developed, we wish to bring an increased and deeper adaptability of the educational and play paths. Currently, the educational hooks are linked to an exercise. In fact, there is no pedagogical adaptation apart from the possibility of putting optional play tasks. We wish to study the possibility that the attachment points are no longer linked to an exercise but to an exercise pool so that the learner can do exercises according to a level of difficulty. Another point concerns the real-time monitoring of the scenario by the trainer. Experiments have

shown that it is necessary to have suitable indicators in order to be able to monitor a large group of students in real time and react at the right time.

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