10 Commandments of the Serious Game Padawan: Lessons Learned After 4 Years of Professional Training

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10 Commandments of the Serious Game Padawan: Lessons Learned After 4 Years of Professional Training

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Abstract Serious Games (SGs) offer advantages for learning but yet, their use in classrooms is still very marginal. The design of SGs by teachers themselves seems to be a viable solution to develop their use since they are in demand of training on the subject. However, the creation of SGs ideally involves the close collaboration of several experts: pedagogical experts (teacher), game designers, graphic designers and developers for digital SGs. However, schools rarely have the means to hire such teams and teachers find themselves leading this project alone. What advice can be given to these teachers? In this paper, we propose the 10 commandments of the SG padawan, based on our experience in training more than 86 teachers in higher education on the subject and accompanying them in the creation of 21 digital and non-digital SGs.

Keywords: Serious Game, design method, gamification, professional training

1 Introduction

Serious Games (SGs) are games whose purpose is not strictly entertaining. This paper focuses on **SGs for learning** that can be used by teachers, from kindergarten [1] to adult professional training [2]. SGs and gamified courses are particularly good tools to create engagement and increase motivation [3, 4], but also to learn concepts differently, through simulations, exploration, experimentation or trial-and-error [5, 6].

Despite an abundance of existing SGs, they rarely correspond to the needs of teachers and only a very small proportion of these SGs can be modified [7]. Teachers therefore feel the need to design their own custom SGs. However, SG design ideally involves several specialists, including an educational expert (*e.g.* a teacher), a game designer and a graphic artist. Competent people are also necessary to make the game material or to develop software in the case of a digital SG. But in reality, schools rarely have the means to hire such teams and teachers have to carry out this project alone. However, the SGs we are studying are primarily teaching tools. Therefore, only teachers are essential to the design process. Indeed, their pedagogical expertise has been acquired with the experience of several years of teaching with a given audience. With the right training, the other skills (game design, graphic design, game material design...) can be partially acquired, compensated by methods (*e.g.* in the form of design patterns [8]), tools or brought by external contributors.

In this article, we present the **professional training course *Ludifik'action*** we have been providing for the past four years and which aims to support teachers in the design of a custom-made SGs. The lessons learned from this experience are formalized, in the third part of this article, in the form of 10 guidelines teachers can follow to create their SG. Each guideline is titled as if *Master Yoda* said it. We chose this little gamification of form for three reasons: first, this particular phrasing helps draw attention to the important words, secondly because the readers of this article will probably be geeks, sensitive to this type of humor ☺ ; and finally, because it amuses us and an article written by enthusiastic researchers is bound to be more enjoyable to read. Each principle is then supported by evidence from the literature and our experience as animators of *Ludifik'action*. Finally, two *Ludifik'action* trainees (Cindy and Thomas) will comment on each guideline with their perspective.

2 Ludifik'action Training Course

Ludifik'action is a professional course to help French higher-education teachers create custom-made SGs (digital or not) (examples in figure 1). This course teaches them the basics of game design and puts them in contact with experts who can help them in this adventure. We have conducted six sessions of this course, with a total of 86 participants.

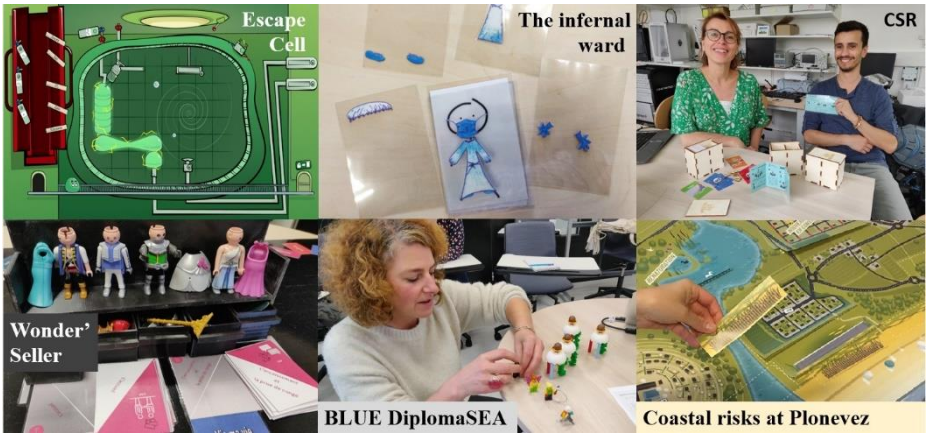

Fig. 1. Examples of Serious Games designed during *Ludifik'action*

Ludifik'action has undergone several organizational changes to adapt to the available human resources and cost constraints imposed by the training centers that managed it. The complete training program (sessions 3, 4 and 6) is composed of 2 full days of face-to-face training (3 to 5 months apart) and a personalized follow-up between them. During the first day, trainees learn the basics of game-based learning theories, practice modifying existing games into SGs, and discover as many games as possible (the course itself is gamified). Thanks to a brainstorming session with the trainers, at the end of the first day, the teachers identify the outlines of their SG and the main game mechanics. The teachers must then design a first SG prototype, on their own, and test it with students. They benefit from a half-day of personalized follow-up during which one of

the trainers, comes to their school to test the prototype. This trainer has the role of game designer and helps them find the right game mechanics to improve their SG. He/she also helps them organize a test session with students if it has not been done yet. During the final full day of training, all the trainees test the new SGs and share feedback. They also improve the SG rules and work on the game material with 3D printers and laser cutters (ideally in a Fab lab as in sessions 3 and 4).

Table 1 shows, for each session, the different organization (number of trainers, number of days, follow-up), the profile of trainers and trainees (teacher alone or accompanied). G represents a Game designer, P represents a Pedagogical expert (teacher), E represents a pedagogical Engineer (or other support staff who help teachers set up pedagogical innovations) and D represents program Developer. In order to identify the level of completion of the designed SGs, a score from 0 to 3 was given to them: 0 indicates the trainees did not create a SG, 1 means a prototype was created, 2 means the SG was tested with learners at least once and 3 means the SG was tested and improved (in terms of game design and game material) and was reused, at least a second time, with learners. Some teachers carried on creating more SGs after *Ludifik'action*. This is indicated with a $^{+}$.

The presented data was collected by questionnaires, sent by email, or with a phone call when people had not responded. We managed to get a response from all the teams in sessions 1, 3, 4 and 6. Only 5 trainees from sessions 2 and 5 could not be reached because they had changed employers. Since no other trainees from these sessions had created SGs, we considered it highly likely that they had not created any either. In this paper, we also use some responses to the satisfaction questionnaire sent out immediately after the training course, to which 52/86 trainees responded.

It should be noted that the session 6 was conducted during the COVID pandemic. We postponed the second session (several times) so it could be done face-to-face. The restrictions also made it harder for teachers to test their SGs in class.

Table 1. Training modalities and designed Serious Games

Modalities		Trainees – Designed SGs - Completion level (0 à 3) - Stats			
1	Trainers : GE 2 days + follow-up for 2 groups	PE PEE P PEE PD P P P	**Library Game** – app to discover the library (follow-up) **Defy your grammar** – past tense in French **Civilization Timeline –** history **Chatterbox –** technical vocabulary in English **Chimory –** chemical transformations app (follow-up) *3 other teachers, by themselves, did not produce SGs*	3^{+} 3 1 2 3 0 0 0	 AVG 1,5 SD 1,4 MED 1
2	Trainer : G 1 day	Px15	*15 non-accompanied teachers participated in this course, but none of them produced a SG*	0	0
3	Trainers : GEE 2 days + follow-up + Fab lab	PP PPE PE PE PEE PE	**Pharma Ludo** – bibliographical research **Question of rights –** plagiarism, image rights **Once upon a time –** written and oral argumentation **CSR –** Corporate Social Responsibility **Moodle Escape Game** – Moodle course gamification	3^{+} 3 3 3 1 0	AVG 2,2 SD 1,3 MED 3

4	Trainers : GGEE 2 days + follow-up + Fab lab	PP PE P PEED PP PE	**Coastal risks at Plonevez** – coastal management **BLUE DiplomaSEA** – marine biodiversity **Historia Compta** – history of accounting **Escape Cell** – web game on photosynthesis **GPS** – geometric specifications **Time TP** – prepare a chemistry lab session	3^+ 1 1 3^+ 2^+ 2	AVG 2,0 SD 0,9 MED 2
5	Trainer : G 1 day	Px23	*23 non-accompanied teachers participated in this course, but none of them produced a SG*	0	0
6	Trainer : G 2 days + follow-up	P PPP P P PE	**Schematic –** signal processing diagrams **VocaPro –** vocabulary of commerce and sales **EscapeEspaceGame** – escape game design **The infernal ward –** caregivers training **Wonder'Seller** – sales	1 1 2 3^+ 3^+	AVG 1,6 SD 0,9 MED 1
G=Game designer, P= Pedagogical expert, E=pedagogical Engineer, D=computer Developer					

3 The Ten Commandments of the Serious Game Padawan

Each commandment is commented by two trainees who participated in the last session of *Ludifik'action*: Cindy, a commerce teacher accompanied by Thomas, a pedagogical engineer. They created the game *Wonder'Seller* (lower left corner of figure 1), in which learners go through all the stages of sales, materialized by *Playmobil* characters that move on a board.

3.1 Think Small, You Must

We have observed that almost all teachers start the training course with unattainable ambitions of grandeur. Some want to turn their entire course into a SG and others want to recreate commercial digital SGs. Teachers are unfamiliar with the numerous professions involved in developing a SG, and unless they have the resources to hire such a multidisciplinary team for a year, they are likely to become exhausted trying to take on all these roles, and eventually, disappointed with the partial result they have achieved. In addition, SGs can be very intense in terms of attention and emotions for learners and teachers and are therefore not recommended for an entire course.

It is therefore important to **start with a very small SG project** that can be completed quickly with the available resources. The process should start with a positive experience that will reassure teachers and motivate them to continue. Other training courses on SG design also advocate this approach [9]. The best way to achieve this goal is to **identify a single thing that needs to change**. It may be the learners' behavior or a complex concept that they have difficulty understanding. This way, the SG will change a part of the course that is currently not satisfactory and the results can only be positive.

Cindy: "*My original intention was to sprinkle fun into my entire course but the training helped us identify our main problems and the design of a board game, which can be used at different times of the course, finally seemed more appropriate. Our students are very difficult to engage in activities. We also perceive a zapping phenomenon, difficulties in accepting constructive criticism and a great need for recognition. These different observations led us to embed the important knowledge and skills in a board game. The learners draw cards with questions related to our*

educational objectives. If they answer correctly, the game offers several reward mechanisms such as choosing an outfit or an accessory to customize their Playmobil character, moving forwards along the path or literally attaching a ball and chain to another player's Playmobil pawn to slow them down. The design of Wonder'Seller allowed me to confirm my intuitions and gave me the motivation to create two other SGs. It is by moving small stones that we move the mountain (Chinese proverb)."

3.2 With Other Padawans, Work You Must

Like any type of pedagogical innovation, **SG design is very time consuming**. It is a path paved with many obstacles. First, it is necessary to rethink the course and how it could be improved with game mechanics. Then comes the design and creation of the SG material which requires the mastery of new software and tools. It is also important to communicate about the project, especially internally, to be sure it will be well received by colleagues and management. SGs are still rare in higher education and convincing arguments must be used to justify the project. It is therefore essential for teachers to be surrounded by people who can provide, at least, moral support.

Feedback from *Ludifik'action* (Table 2) shows that teachers who tried to create SGs alone were 33% (3/9) more likely to abandon, even with a complete training over several months (sessions 1, 3, 4 and 6). When teachers are accompanied by at least one other person, the risk of abandoning drops to less than 7% (1/15). In addition, we find that teachers who are alone just managed to create a prototype (average of 1,16 out of 3) while those who are accompanied usually manage to finish their SG, test it with learners, and some even manage to improve and test the SG again (average of 2,3 out of 3, standard deviation =1). According to a Parson's chi-square test, this difference is statistically significant (p-value = 0.043).

It is therefore recommended to contact universities who offer the services of pedagogical engineers to accompany teachers, or team up with other teachers, in order to create a group dynamic and share experiences. In the final questionnaire of *Ludifik'action*, "sharing feedback with other trainees" was the most appreciated aspect of the course, cited in 22 out of the 52 answers.

Cindy: "*Teaching and preparation classes is time consuming and I don't have time to adjust my teaching posture and explore new pedagogy. Working with Thomas allowed us to mutualize pedagogical, technical and human competences. We also exchanged tips with other teachers, thus enriching each other. In particular, we initiated a collaboration with three other teachers during Ludifik'action who ended up using an adapted version of our game in addition to theirs."*

Table 2. Comparison outcome depending on the number of team members

N. team members	MIN	MAX	AVG	SD	MED	Abandonment
Alone	0	2	1,1	1,16	1	33% (3 out of 9)
Group of 2, 3 or 4	0	3	2,3	0,97	3	7% (1 out of 15)

3.3 With a Master, Succeed you Shall

Olivier (session 4 trainee): "*The follow-up pushed us to get the game out, otherwise I imagine that if we had only done the first session we wouldn't have gone further!"* This is indeed what happened. None of the trainees in sessions 2 and 5, which consisted of only the first day, created a SG. This can also be explained by the fact that trainees who signed up for this single day of training did not necessarily have the intention of creating a SG. However, during the first session, for which only two local teachers benefited from the follow-up, the groups without follow-up were 50% (3/6) more likely to drop out (these were single teachers). This suggests that the follow-up is essential to boost the creation process. The teachers admitted they had worked hard and slept very little the week before our visit to make sure they had a presentable SG. Another variable that seems to increase productivity is the number of trainers. Indeed, the SG completion scores (Table 1) are highest in sessions with more than 2 trainers (sessions 3 and 4). This can be explained by the fact that the brainstorming sessions were richer and gave the teachers more choices to find suitable SG scenarios.

Cindy & Thomas: "*SG design is a long and tortuous journey filled with technical challenges. It is therefore necessary to have an internal dynamic supported by external actors to gain perspective, feedback and added value. It is also necessary to have a clear organization with milestones and concise objectives that are easily attainable. By signing up to this course, we placed ourselves in a project dynamic, benefiting from methodological contributions of an expert. We realize the importance of her real time and in situ regulation in order to keep a unique line of conduct. Like a lighthouse in the middle of a storm (French proverb from the Auvergne region)."*

3.4 In Other Games, Inspiration You Will Find

Commercial games are the product of years of development iterations, player testing, and improvements. It is therefore in the teachers' best interest to draw inspiration from existing games (or parts of them). Several researchers have proposed methods for designing SGs based on this principle [10, 11]. During *Ludifik'action*, we ask trainees to modify existing games into SGs in only 15 minutes. We use very simple games such as *Time Line*, *Taggle*, *Concept* and *Who am I* that can easily be adapted. Children's versions of games are particularly interesting because they have very simple rules and can be complexified with educational content. At the end of the first day, trainees leave with a selection of games that they can use as inspiration to refine their SG.

Cindy & Thomas: "*The construction of our SG was a melting pot of player experiences. The teacher becomes a pedagogical hacker of the game: we reinvest the game mechanics in our own SG. Ludifik'action gave us the keys to identify the game mechanics that match the pedagogical objectives and the desired learning environment. It's like a recipe: list the available ingredients, identify the important ones, combine them, let it simmer, taste it as you go along and serve: a table!*"

3.5 Like You, the Game Must Be

When a SG is intended to be used in class, teachers play a central role in facilitating the game (explicitly if they are game masters or implicitly). The teachers' positive and

engaging attitude is therefore essential for the SG to run smoothly. Teachers therefore need to design a game that they are comfortable with.

Cindy: "*My role during the game is totally reversed. I become a facilitator, a regulator, even a player, and not a knowledge provider. It was important for me to design a game universe with a visual identity. The game creates a strong cohesion in the class and a dynamic throughout the year. I feel it creates a special bond that was co-constructed and co-maintained: an ecosystem of fertile learning [12].*"

3.6 Exploit Your Students, You Can

It is useful to involve learners, from the beginning of the design process, in the choice of game mechanics and the game world to make sure it appeals to them [13]. They can also be asked to create parts of the SG during a project. Several studies show the positive educational effects of asking learners to design their own SGs [14, 15].

Cindy & Thomas: "*We involved the learners in several ways. First of all, a student, with former training in graphic design, offered to redesign the board, cards, logo, and pictograms. The learners can also add a card about the local company in which they are doing their apprenticeship or to share an experienced situation. This contributes to the evolution of the game and allows learners to leave their mark. Finally, the learners created online surveys and filmed feedback sessions to measure the usefulness of this new educational device. Involving the learners increase their confidence and involved them in the development of an educational tool that reflects their image.*"

3.7 Justify the Game Mechanics, You Must

The choice of game mechanics must be made in relation to the pedagogical objectives, the contexts in which the SG will be used, the learners' and the teacher's profiles [8]. Many SG design methods are proposed by researchers [15, 16], but none of them has full consensus in the community. We tried several of them during our training, but they remain difficult to use, even for SG specialists, because they rely on complex concepts that can be interpreted differently. In addition, these methods seemed too cumbersome and, above all, too long to set up, whereas our objective was precisely to encourage teachers to start small and light (1st commandment)! There are simpler design methods for teachers, but for designing a particular type of SG such as educational escape games [17] but this implies knowing whether this type of game is adapted to the initial needs. The general rule, found in all methods, is that **the choice of each game mechanic should be justified according to a pedagogical objective**. Adding game mechanics that cannot be justified can generate unnecessary cognitive load for learning [18]. This is especially important for SGs that will be used in the limited time of a class, and that must therefore be pedagogically efficient. On the contrary, it may be useful to add extra game mechanics for SGs that are to be used at home or whenever the students want, to motivate them to play again. Game mechanics can easily be identified through illustrated lists such as Marczewski's [19] or *Mecanicards* (www.mecanicartes.com). Our experience shows that **it is important that teachers take time to justify the choice of mechanics themselves, in writing**. It helps them build a solid argumentation to support the pedagogical potential of their SG and defend their project.

Cindy and Thomas: "*Placing ourselves in the role of SG designers allowed us to reflect in depth on the game mechanics to use in order to provide an effective and efficient experience. Ludifik'action helped us formalize these concepts that we had informally acquired in our various gaming experiences. We used game mechanics in line with our pedagogical objectives and our learners: challenges, progression, ranking, avatar customization and the possibility to play in teams. The game cards also cover the official program (i.e. make a sale, develop customer loyalty…) and help students practice their skills by asking them questions related to real situations."*

3.8 Introduce and Debrief After the Game, Necessary It Is

The majority of teachers think that SGs are sufficient on their own, but this is not necessarily the case. First, teachers must explain why they chose this new form of pedagogy, while avoiding the word "game", as this may be associated with commercial video games and could therefore lead to disappointment. Teachers must also take the time to list the skills that will be used. If the SG offers an immersive imaginary world and game scenario, a debriefing phase, after the SG, is also necessary to recall the used concepts and skills and discuss how they can be applied in other contexts [20].

Cindy: *"The game is introduced quickly at the beginning of the course and is very well received. You can tell that the learners are proud to be involved in the design of this new device. I don't do a debriefing because the game refers to real situations. On the other hand, we have found several ways of using the game for key moments of the course: in a full 2-hour session, in a 30-minute focus session, just with the cards to review skills with the entire class or in battle mode, with a buzzer, in small groups."*

3.9 Crucial, the Design Is

The pleasure of playing is greatly related to the graphics and the ergonomics of the game material [8]. Even if it is possible to test SG prototypes with post-its, the design should not be neglected. The box is one of the central elements, as it is the first contact with the SG. Placed on the table, the learners will have an irresistible urge to open it, like Pandora's Box. Designing a well-proportioned box with compartments is also very helpful from an organizational standpoint, as it will prompt learners to put the material away correctly at the end of the game. We encourage teachers to get in touch with a Fab lab, use box and card templates and purchase game material (*e.g.* paws, dice, tokens) from specialized sites.

Cindy & Thomas: "*The visual aspect is very important to generate emotions and engagement. We learned how to use new software such as Nandeck (www.nandeck.com) to generate the front and back of the cards from a CSV file containing 680 questions. We also learned how to master a laser cutter and a 3D printer to make a custom dressing room in which all the pawn, accessories and cards are stored. All this seemed sometimes tedious but the game was worth the candle (French expression), because we immediately saw the importance of the material. The wow effect is a real emotional trigger to start a game in the best conditions."*

3.10 Play, You Will

Most teachers are not gamers. They only remember a few classic games they played as children (that sometimes left them with bad memories) such as *Monopoly*, *Scrabble* or *Trivial Pursuit*. Yet, thousands of new games are created every year, including collaborative games that are much more suitable for classroom use. The best way to understand the tensions, the interactions, the dilemmas and the emotions triggered by game mechanics is simply to test it in a game. It is therefore essential for teachers to play. Games are now available in municipal and university libraries. Specializes game libraries also offer a wide selection of games and advice from enthusiasts.

Cindy & Thomas: "*To create a SG, you need to have a culture and experience of games that allow you to understand and identify the game mechanics that can be reinvested in an educational context*."

4 Conclusion and Perspectives

For the past four years, we have been giving the *Ludifik'action* training course to help teachers design custom SGs. Six sessions of this course were carried out with different modalities, which allowed us to identify those that seemed to be the most effective. We express the lessons learned in the form of 10 guidelines. We advise teachers to start with a very small SG project, with the help of educational engineers or colleagues. We also urge them to seek help from a game design experts, by enrolling in a training course that offers personalized follow-up. It is also recommended to draw inspiration from existing games to design a SG and to involve learners from the very beginning of the project. In addition, teachers need to design a game that they feel comfortable with in the classroom. The choice of game mechanics is particularly crucial since it must suit the teacher who will be presenting the SG, the learners, the contexts in which the game will be used, but also the pedagogical objectives to be achieved. We also recall that it is essential to present the SG to the learners before its use, to facilitate its acceptance, and to set aside time after the SG, to review the important concepts and acquired skills. In addition, the design of the game material should not be neglected, as it plays an important role in the acceptance of the SG, but also in the time it takes to set up and put away the SG. Finally, teachers are strongly encouraged to play with their families or colleagues to discover inspiring game mechanics.

Thanks to research on SGs over the last decade, the design of effective SG is progressively getting easier. However, the human expertise of a game designer still seems to be essential to choose, in a relevant and efficient way, the game mechanics that compose a SG. We therefore advocate that this type of profile should be hired by universities and schools, as support staff for the design of educational innovations. At the same time, more research needs to be carried out for teachers who do not have the means to contact such experts. Several solutions are possible, such as the development of simple design guides for a particular type of SG or authoring tools for teachers to create digital SGs. Teachers should also disseminate their SG as widely as possible by writing a teacher's guide, but also by giving the source files of their SG material so that other teachers can adapt it to their needs and adopt them.

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