Introduction of new teaching tools into the medical faculty classroom: gamification

Pedagogiskt docenturarbete

Manue Alvarez-Rodriguez
Title

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Abstract

Gamification is a term that has acquired a huge popularity in recent years, especially in digital and educational environments. The term defines one of the learning techniques that moves the mechanics of games to the educational-professional field in order to achieve better results: it serves to absorb knowledge and to improve someone's ability to reward concrete actions.

Despite the general tendency to think that it is only a "child's play", this belief cannot be further away from the truth. Moreover, one could think that the competition usually linked to a game is a negative effect that could affect the normal progression of the class. But, if we properly defined the terms of the serious game at the beginning of it, it should definitely increase cooperativism, which is just another way of competing but, in this case, as or within a group. This same activity also includes the dynamics of solidarity, by fostering mutual help between partners in an altruistic way.

One major aspect of this technique is the positive link of feedback to a reward, that has been shown as related to the facilitation of the internalization of the students’ knowledge in a more joyful way, generating a positive experience in them. In addition, they consider it a great opportunity to work on motivation, effort, loyalty or cooperation within the university environment and the implementation of the serious gaming.

Application and evaluation facts

Serious gamification offers training tools that might provide a simulated environment directed at reducing medical errors and subsequent healthcare costs (Mokhlysheva, 2015). Using game-based simulation to train interdisciplinary teams of healthcare professionals on different topics such as critical care triage and incident response, simulation-based virtual operating rooms for surgical trainees, are examples of using serious games for medical education (Graafland, 2012; for detailed information and links, see annex I). Firstly, Wattanasoontorn et al. (2013) have classified the serious games according to three related subjects: serious game, health and player.

![Diagram](Visual representation of classifications of serious games for health)

Figure 1. Classifications of serious games for health (Wattanasoontorn, 2013).
Serious gaming is a plausible educational strategy that could contribute to the transformation of health professional curriculum. The impact of the application of this methodology has been studied through the assessment of knowledge, skills, and traditional education. Serious gamification in a non-healthcare professional has been positively evaluated in school students and adults, in terms of cognitive and attitude changes and improved knowledge (Vogel, 2016; Fleming, 2014). In regards of healthcare professionals, there are some studies highlighting the increase over time of the number of interventions using gamification applications (Wang, 2016), but clearly stated the deficit in correct or standardized definition of the design and evaluation. Anyway, some evidences have been found on the improvement of knowledge acquisition and skills development in health professionals that participated in serious gamification contents (Gentry, 2019). One of the plausible explanation of this differences in learning outcomes is the increase in learner satisfaction, but no studies, to the best of my knowledge, there is a lack of studies of the cost-effective or accessibility of the healthcare professionals to this methodology. Lastly, the application of serious gamification might be useful in fields beyond healthcare professional, but directly link, e.g. games have been shown to be effective in focusing a patient’s attention away from the pain caused by their treatment (pediatric intravenous placement (Primack, 2012).

Additional background

The serious gamification or gamification of learning is an educational tool that motivate students by using learning environments. In this definition, we could include the PBL programs carried at LIJ and, particularly in the creating of learning scenarios: PBL cases should be realistic, energizing, challenging and instrumental (Kim et al., 2006) and has to be related to the content that you are attempting to consolidate in the students (Hak & Maguire, 2000). Norman et al. (2000) define the parameter “Instruction in problem solving” with an effect size of 0.54, conferring the scenario definition a key event in the overall success of the students.

Deepping into the application of gamification of learning, we could use and refine several available examples of gamification not only in education but also in life coaching, business, etc. This availability could enlarge the interdisciplinarity of these potentially beneficial tools. Gamification offers users different type of accumulative rewards, thus encouraging the active learning and, probably, the establishment of an effective feedback (Ryan & Deci, 2000). Moreover, in 2002, Nick Pelling defined for the first time as such, the concept of gamification as: “Applying game-like accelerated user interface design to make electronic transactions both enjoyable and fast.” The definition has been refined to “The application of typical elements of game playing (such as point scoring and competition) to other areas of activity.” (Pelling, 2007), and more recently, as serious game (Alvarez, 2012), providing health professions education via digital tools. The latter definition clearly stated the differences in terms of the design purpose, from the games carried out for just entertainment (Deterding, 2011).

But, is the concept of gamification of learning a new discovery item? The response is easy and clear: NO. Chris Crawford, in “The Art of Game Design” (Crawford, 1984), argued that games are an old and traditional conductor or transporter of educational contents and there are a new fashion nowadays in the schools due to the recent discovery of their huge learning outcomes related to teaching tool uses. Moreover, even Freud conclude that the
student acts naturally when it comes to the use of a game, because the abilities and concepts that human beings learn are, by far, more complex and sophisticated than the abilities that the attempt to develop (Freud, 1908). In addition, the gamification of learning is not even closer to be as simple as playing a game at school. In 2013, Hamari and Koivisto stated two good motivations of gamification (Hamari & Koivisto, 2013): The main objective of gamification is to effectively affect human behavior, independently of the obvious intrinsic joyful effect that the game has by itself. The gamification, in the context of learning-related application, creates experiences, feelings and self-autonomy introducing effective and long-term changes on the human being. So that, there is a key difference between the gamification of learning and the simple use of games in teaching, the latter do not motivate students (Kapp, 2012).

In brief, game is not only, if well-designed, obviously fun but also a way of fulfilling some relevant desired attitudes: socializing and status, by means of teaching-learning new experiences and habits (Lee et al., 2013). Practical approach that resulted in a real challenge-reward system and ii) dynamics: global aspects of orientation, directly link to the goal or final objective. For this purpose, dynamics could include one or more mechanics. Gamification or serious gaming has the potential to actively increased the involvement of the student in terms of establishing their own objectives, personalization out the outcomes (Wortley, 2013). The students or health professionals should have the opportunity of developing analytical skills, decision making, and cooperative learning in group-bases gamification (Prensky, 2003; Susi, 2007). It is also worth to mention that serious gamification could be adapted to both health students and the clinical professionals and be used at a time a place that suits the learner (Gentry, 2019). However, it should be properly design in order to avoid unnecessary over timing in the lecture as compared to traditional learning. But, in contrast, this type of learning is easy to update, unlike a textbook.

Design of scenarios in PBL and serious games

Game mechanics are based on three principal components: 1) motivation, 2) mastery and 3) triggers.

1. **Motivation (why?).** We should reach students though motivation. We should, in certain way, be able to give reasons to students for not only capture the attention but also to establish long-term skills and/or behaviors in the students. This concept is important in order to design gamification tools that could easily adapt to different person-to-person responses, thus, addressing unpredictability.

2. **Ability (how?).** Also known as mastery, this is the establishment of both the rules and the knowledge or skills needed to finish the gamification in learning. If we fail in the description of this concept or if it is to poorly defined, the overall success of the process could be in danger, leading to an unfinished item and even frustration.

3. **Trigger (when? where?).** The last, but not the least of the concepts, trigger, is the implementation of the two first concepts and translation into a direct win- and motivation-related feeling in the student. The proper design of the overall study should present alternative outbounds, to achieve a final goal, but helping the students not to be distracted in the way to their success.
The main type of triggers could be divided in three types (Fogg, 2009): facilitator, signal and spark (Figure 2).

**Figure 2.** The main type of triggers could be divided in three types: facilitator, signal and spark (Modified from Fogg, 2009. A Behavior Model for Persuasive Design).

**Facilitator:** The type of trigger for students that present a higher motivation but lack of ability. Design of the game should elicit a change in behavior with an easy approach. **Signal:** High ability and motivation. It did not pursue to motivate but act as a reminder. **Spark:** High ability and low motivation. Here, the trigger is associate with a target behavior and must be carried in the exact planned moment, in order to increase motivation.

But, how to apply the types of triggers into a serious gaming? Facilitator could be applied when the task requires a low ability, perhaps and the beginning of the degree studies. On the contrary, the signal triggers could help to the long-lasting consent retention. It means: in final courses of the specific degree, this type of trigger should consolidate the information, including skills, acquired during the study program development. The spark trigger could be applied in the middle term studies, when the work overload is usually a drawback for the majority of students.

According to Azer et al. (2012), case scenarios are used to: 1) establish a real-like situation through the oriented context, 2) link basic sciences and clinical situations, 3) arise discussions about the topic but also moral and ethical issues, 4) reason based on previous studies and 5) stimulation of long-term memory based on this process (summarized in table 1). Designing a scenario is similar to designing a building: each particular function is carried out by an individual component, and a problem generated could affect the stability of the whole created building. In this sense, correct planning and constant assessment is necessary for the correct functioning of the PBL scenario (Chin & Chia, 2005). The criteria followed to design an adequate scenario (Dobson and Tomkinson, 2012) are: complexity, currency, content, context and cumulative. Moreover, they have to fulfill the following basic points: challenge, theory, authenticity and ethics. In the design process we, as designers, have to pay attention carefully to identify a proper trigger, analyze its background and frame accordingly the problem. It is also of relevant importance to find the correct definition and criteria for students as well as the evaluation of how the overall results from the scenario reflects the learning experience.
Some key factors in the satisfaction of students include tutorial structure, case authenticity and resource availability (Kilgour et al. 2016) and among others, these factors are directly and/or indirectly related to the case/scenario design. Moreover, an important tool to introduce in the scenario planning is the concept-mapping (Hung and Lin, 2015) helping out students not only in the concept integration but also in the future application of this acquired concepts.

Following the classification of Azer et al. (2012) a general tips should be applied in the design of a scenario for PBL and thus, perhaps, serious gamification:

1. Establish writing teams: discussing and identify specific objectives, researching literature, identifying problems, establishing of a trigger relevant and up-to-date and constructing the tutor guide.

2. Identify the educational objectives of the case: with the definition of about 6-7 objectives per scenario, containing some of the following examples of verbs correlating, interpreting, explaining, providing evidence, justifying, integrating, showing relationships, constructing mechanisms and discussing. (Dolmans & Snellen-Bolendong 1997; Azer 2008).

3. Construct a template for cases: it must fulfill the educational objectives of PBL (Hung, 2006). Ensuring that the scenario address cognitive skills, consistency in the design and the congruence between content validity, learning objectives and learning experience.

4. Think about integration, logical flow of the case and authenticity: reflecting real situations more that a rigid structure, facilitating integration of concepts and addressing the educational outcomes of each tutorial group.

5. Adjust cases to students’ learning needs. In this sense, defining a simple but challenging scenario of concepts at the beginning of the course and then, define a more integrative scenario at the end of the academic year.

6. Start the case with an engaging trigger. A good trigger should address the objectives, highlights key problems and provides the basic information to start it with, including an innovative design.

7. Design images for the case and investigations. In case of needed, illustration could easily catch the attention of the students. We could use also virtual resources.

8. Ensure that a deductive approach is applicable. A logical flow and the possibility of using knowledge from literature and history by students usually lead to a progress in the case. This concept includes finding, interpreting and using the knowledge and, finally using evidence in making a decision.

9. Ensure that learning objectives are well represented in the case. Effectiveness of the discussions in the working group as well as the facilitation skills of the tutor are some factors involved in this point.

10. Think about students’ engagement with the case. A “perfect” scenario leads to a increasing interest for the students. Such perfect scenario will be well-structured, give some challenges, direct and/or indirect application to real life and rewarding situation when they reach the solution of the scenario.
11. Construct a tutor guide for each case. It is the base of the guidelines to be followed by the tutor to reach a successful PBL scenario. It includes trigger definition, alternatives of guidance; identify possible conflictive points where the task of the tutor should facilitate the problem, etc.

12. Review and encourage feedback. Students and tutors have the important task of evaluating in order to improve the scenario and also the hidden problems that arise once the scenario is applied in a group of students.

Overall, I consider that scenario design in PBL is largely common to the serious gamification and requires a large expertise from the tutor and should be definitely taken into account as a starting point of the scenario success. It should be beneficial for the overall mind-wellness of students and could avoid frustration for the problems in the resolution of a given scenario.

Limitations

There is a heterogeneity in the learning outcomes, and it has been related to the application of this methodology only in high-income countries (Gentry, 2019). Moreover, there is an absolute lack of studies focused on assessing patient outcomes or clinician trials with and without the implementation of this methodology in the healthcare professional curriculum. In addition, there is a lack of studies that includes an evaluation of different healthcare professionals specialties and whether this factor could affect the final performance of the serious gamification implantation, is yet unexplored.

Conclusions and future challenges

We already know that the game really motivates and works, but the really novel thing is to create a methodology for working with the students that in a procedural and structured way uses the tools offered by gamification to enrich and improve the learning process. And not only that, but also the great advance would be produced by fitting this system into the courses and private curricula established by the Swedish educational framework. Although serious gaming appears to have much potential, rigorous evaluation is required to study whether they can end up in an effective learning. There is a potential risk for the game or to become a distraction rather than a facilitator of learning. For this reason, both teachers and institutions have a *long and hard way to go* in this regard. But the road is full of challenges, objectives and satisfactions that make for some of us irresistible not to carried out and advance on it.

Application of gamification in learning tools in academics is certainly a *current challenge* that, in my opinion, need to be applied in order to address the constant changes an adaptation that universities have to adopt. These changes could be tackled by different perspectives. At LIU, we are a pioneer academic center in innovative teaching skills such as almost complete programs base on Problem Base Learning (PBD). Gamification, mainly digital, should be an additional value to add to our system, not only for the final outcome of increasing of active learning of the students but also for the enrichment of teaching skills in docents actively involved in the overall success of the medical faculty at Linköping University. But, of course, we do not have to forget that the quality of the contents needs to be of utmost importance in comparison with the use of new and advanced available technologies.
References


Annex I.

Online resources for evaluation of serious gamification implantation

Grendel Games: “Serious gaming for healthcare”.

Gamelearn: “The quality of a serious game is also measured in the way we deliver it to users”.

Brainscape: “Study Less, Remember More, & Improve Test Scores”.

Knowre: “An online core supplement for Grades 1-12 helping teachers personalize learning for all students - because students don’t hate math, they hate being frustrated”.

Minecraft. Education edition: “A game-based learning platform that promotes creativity, collaboration, and problem-solving in an immersive digital environment. Educators in more than 115 countries are using Minecraft: Education Edition across the curriculum!”.

Peardeck: “Enhance Remote Learning with Audio in Lessons”.

Kahoot!: “Teachers, students, businesses and parents all use Kahoot! for group learning, e learning, distance learning, and self-study everywhere!”.


Classcraft: “Turn your school into a place where everyone wants to be — whether it’s in person or online.”

CodeCombat: “The most engaging way to learn computer science”.

ClassDojo: “Bring every family into your classroom”.

ChemCaper: “ChemCaper brings out the fun in Chemistry and takes the dread out of learning”.

Quizlet: “Master any subject, one success at a time”.

Genially: “Create stunning presentations, infographics, and more in just seconds”.

Gamification online links:
https://grendelgames.com/serious-games/healthcare/?aclid=QDKCxwN32BRCCARIsADZJ4vAkkxgXygNmCl9Q098WPWRkG6sR1FgFbjDfYfGr7aVSt6ywwRz30aAfFEEALw_wcB
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