

Serious game Gademavo: How to enhance students' ability in taking decisions in a complex world

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« All that is taught to a child will prevent him from inventing it or discovering it.»
Jean Piaget. Extract from a conversation with J.C.I. Bringuier

Abstract: The objective conditions are gathered in order to develop alternative training resources. Serious games represents a good example of a tool welcomed and appreciated by students stemming from the Digital Natives, while at the same time assuring progression in knowledge acquisition. The Gademavo game, developed by the e-learning Center HES-SO Cyberlearn, aims at providing students in the tertiary sector, with the competence expected for solving problems and decision-taking. This game relies on a space and graphic metaphor closely related to the professional contexts aimed at, and can be customized to the required courses. This paper briefly reviews the researches related to serious games and describes the Gademavo game.

Introduction

More than 19000 (27% of all Swiss UAS students) learners enrol every year in the different curricula proposed by the University of Applied Sciences Western Switzerland¹. This university offers students strong references to the real professional world, either by linking the teaching laboratories with real experiments or by developing projects with professionals in action. Since 2004, an e-learning centre has been in charge of developing and conducting research in blended learning, along with new innovative training means.

The average student age at the HES-SO is 25, and most students attending a Bachelor curriculum belong to the “digital natives” generation. It can be noticed that the distinguishing features of their learning process is strongly influenced by technology, private and public multi-tasking, and the abundance of images to which they are submitted. This type of student shows short attention spans, they are zappers, they need a variety of small activities, preferably in a visual form, to maintain their attention. Some of the specific learning characteristics of this generation present a positive influence on the learning process. The students of this generation tend to show a natural capacity for using technology, not attempting at apprehending and mastering it, but instead they experiment with it and achieve great success, they appreciate being considered as co-experts in their courses, achieving results through cooperation and they get deeply involved when producing contents available for all. The “digital natives” appreciate horizontal hierarchical interactions and stop considering the professor as the only source of knowledge, and see him as a more experienced person with whom to cooperate.

Whether we use the term Student 2.0, the Now Generation², Generation Y, the famous «theorized digital natives” so-called by Prensky (17), every professor will immediately pinpoint the idiosyncrasies. For such students, the act of thinking has become more important than knowledge itself, beliefs take the upper-hand on facts, the attention span has decreased dramatically, collaboration during the learning process reaches out world-wide, authority has no genuine hold on them.

¹ Quoted in this document as HES-SO

² The young generation, everything and right away

New competence

In the HES-SO environment, the crossroad for some of these features (horizontal interacting between professor-student, high level of computing literacy, little appetite for theoretical reasoning) results in a strong demand from the students to have access to modeled methods, directly transferable into the practical world, thus avoiding preliminary reflexion, which is time consuming and which generates insecurity and risks.

In a professional environment, a number of situations involve strict and common-to-all applications of procedures, in order to secure the excellence of the job to be achieved. Thus, it is highly recommended that nurses performing a health care action all undergo the same steps. It seems logical to solve a physics or maths problem by applying the same method and similarly the security rules in a firm must be applied in the same way by all.

However, the real professional environment for which the UAS students are trained, reaches way beyond the simple application of pre-established formulas. The main difference between an adapted professional and a competent professional lies not only in the application of principles, but also in “engaging or activating several types of knowledge, in a particular situation and in a given context”, as analysed by Le Boterf (3). Thereby he distinguishes three factors resulting from competence, the will to act concerning context and individual motivation, the power to act referring to work organization, and the action taking which “implies knowing how to combine and rally pertinent resources. The latter constitutes a relevant theoretical frame which guides the transfer of knowledge from the professor to the student, the future professional.

Additionally, the current complex and changing world, requires active professional to dispose of a range of know-how in order to build a solid future (15). Among the know-hows required, we can identify the ability to comprehend problems arising in hitherto unseen contexts, the ability to identify, hierarchize and select relevant information, the ability to imagine alternative processes, even iconoclastic ones, and the ability to take adequate decisions, which all represent a central asset, in the process of choosing among critical items when taking action. Nevertheless, problem solving applied to cases closely related to real life, suitable strategy elaboration and decision communication, are seldom taught as such in the Swiss UAS curricula.

Therefore, we decided to create a serious game intended to train students to surpass their spontaneous approach when applying procedures and to develop their sense of analysis, as well as their ability in taking decisions.

Gaming as a tool for alternative learning

Truly there is a consensus that serious games represent an efficient means for learning, although thorough studies on this matter remain insufficient. Some studies aim at demonstrating that gaming and its resulting pleasure make it a tool unsuitable for knowledge acquisition, quoting for example the philosopher Alain, who assumed, in 1932, that only what is painfully learnt can be memorized. This belief has evolved, but remains significant in tertiary education. University is still considered as a place where effort must be endured, where knowledge is transmitted vertically by an expert professor addressing the students-learners, who listen. In tertiary teaching, a vector for elitist perspectives, basing its laurels on fundamental or applied research, where reason and pure logic prevail, gaming as a means for learning remains a hard to imagine orientation.

However, the public, its expectations and capabilities having greatly evolved, it seems beneficial that pedagogical objects should equally evolve.

Learning factors

The quality of the learning process, its transferability from a theoretical to a real situation is multifactorial.

Several writers have pondered about the importance of motivation in the learning process. Thus, Nuttin (14) considers motivation as « any emotional tension, any feeling likely to trigger and support an action towards a goal ». His theory differentiates between two types of motivations :

- ✓ *intrinsic motivation* : when only interest and pleasure in the action drive the individual
- ✓ *extrinsic motivation*: when circumstances external to the individual underpin his action: positive or negative reward, pressure from the group etc.
- ✓ *amotivation* : when the individual, overpowered by uncontrollable factors, has the impression he cannot predict the consequences of his actions.

The coupling of need-interest also provides a better response: a learning object becomes more interesting when responding to a need, a desire, an urge, a pleasure etc.

We also wish to quote Viau (23) to remind us of some conditions for motivation during the learning process

- make sense from the student's point of view
- offer variety, and bond with the upcoming scheduled activities
- represent a challenge which can be addressed and solved thanks to perseverance
- be authentic and represent a real situation in every day or professional life.
- spur a cognitive activity from the learner, in which he must find links with previous activities, organize material, rely on prior knowledge etc.
- give a sense of responsibility to the learner by encouraging personal choice making
- favour interaction and collaboration among the learners
- comprise clear instructions
- be feasible during the given time

Tardif (21) heightens that « Situated learning » fits into pedagogical environments which take into consideration the students' preoccupations, the logic of their questioning. The knowledge built-up and the competence developed in such a context are very significant and, rather than being an abstract learning process, become learning in the action and from the action.

As for Piaget's studies (16), they show that any new knowledge is the result of an individual learning experience, relying on adaptation and assimilation notions which shape the adaptation process. The new knowledge only becomes effective when it is reassembled to integrate the learner's ideational network

Giordan (2) postulates that this adaptation alters the thinking schemes and, very frequently, comes to oppose the learner's prior knowledge. The latter learns by solving the cognitive conflict.

Finally, cultural constructivism reminds us that cultural influences (customs, tools, languages, etc.) can influence the learning process. Generally, tools used by the learners, affect their way of thinking, and therefore all cognitive operations produced. The computer, the Internet, video games have contributed in shaping the habits and the acting and thinking behaviour of students currently enrolled in university curricula.

Prenzky (15), in his theory on serious games, remarks that « the "stuff" to be learned — information, concepts, relationships, etc. — cannot be just "told" to these people. It must be learned by them, through questions, discovery, construction, interaction, and, above all, fun.»

Again here we find the notion of interaction with knowledge, challenge and building-up mentioned by Viau (23).

This brief theoretical enlightening tends to show how serious games, as a fun tool, enables setting up trials, supports motivation and encourages the learning progression, as understood by the constructivism approach.

Subsequently, we wondered if students' expectations could meet with institutional conditions, to show sufficient ground for the development of such a tool.

The digital natives' expectations

The « digital native » student in Switzerland, as in Europe, spends part of his leisure time playing video games. The increase in platforms (smartphones, tablets, laptops, game consoles) has contributed to a widespread use of video games among a public reaching far beyond the intensive players.

A survey conducted in Europe in 2012 by the Interactive Software Federation of Europe draws up the profile of the European gamer, sampling 16 European countries and 15'142 persons aged from 16 to 64, among

which 650 people in Switzerland. The results for this country show that more than 25% of the gamers belong to the Y generation. Globally, 41% are gamers, among which 45% are women. 30% play on their smartphones or tablet and 20% game more than once a week.

In parallel, in May 2013, the e-learning centre HES-SO Cyberlearn launched a survey to gather digital native students' expectations in order to guide its future developments. The survey was launched early May 2013, on Cyberlearn's homepage during two weeks. The student population totals 20'000. We calculated the representative sample as follows: P (percentage): 50%, M (students population size): 17430, C (confidence level): 95%. E (error margin): 5%. Depending on the settings chosen, the size of the representative sample is of 376, and 800 students answered the questionnaire.

Most students generally study at a bachelor level (89%), a lower percentage is enrolled in master studies (8%) (3%: else). They are mostly between 18-26 years old (81%) (26-35 years old: 16%, older: 3%). 55% of them are women, 45%, men.

Among this student population, 59 % like to interact with their colleagues, 38 % get deeply involved in the class learning activities, and 31% prefer their professor to organize the learning activities.

When these students are asked as « digital natives », which items they wish to be made available to them in order to improve their learning process (in class or outside class), among a variety of possible answers, 10% choose serious games as a means for learning. It is relevant to link this answer to the one obtained in the European survey mentioned above, where 11% of the participants, when asked “what words do you associate with game?” attribute the words “informative/**educational**” to video games, thus pointing out the interest and evolution in the way gaming can contribute to a pedagogical input.

Thus, resorting to serious games makes it possible to take advantage of the distinctiveness of this new public in order to make it progress. As Prensky (18) points out: « students will not have short attention spans for learning if the approaches you take really engage them. It is possible to get learners of all ages totally involved in learning any subject matter ».

Prensky (18) adds that : « Using [serious games] may, however, mean re-thinking much of what you believe about teaching and training. » Indeed, this is where the shoe pinches, rather than arguing about true effectiveness issues in teaching or jeopardizing the academic reputation of a university delivering tasteless education, or being compromised by an amusing, light-hearted and entertaining teaching approach.

The Gademavo game

The e-learning Center HES-SO Cyberlearn has, therefore, decided to refer to an actual case in order to estimate the possible benefits brought forward by using games in some of its university courses, by developing a simulation game. We have developed a game centered on problem solving and decision making, in a context closely related to real life professional situations, which the students might come across after graduation. Our objective is three-fold:

- Engage the student,
- Contribute to the development of the student's ability to make decisions in a complex environment.

Gademavo enables students to be confronted to a practical case connected to the professional context for which they are training. It concerns UAS students and aims at spurring their ability to solve problems and take suitable decisions in a graphic environment calling upon their future professional insertion.

Gademavo is available in French and English and can be freely used by all interested professors by accessing this address <http://cyberlearn.hes-so.ch/gademavo>.

The case to be solved is presented with the help of numerous multimedia resources and different mechanisms enabling the student to ponder about the proposed issue, while providing different game options (scoring of points, of objects, etc.). The students can freely choose from a range of several different cases set up previously.

Every game is used in a blended learning context, thus in connection with classroom teaching. It is particularly suitable for teaching involving analysis in steps and problem solving.

The game itself comprises an administrative interface, where the professor can customize the game parameters for the desired professional context and for the gaming procedures he wishes to adopt (interface, awards, game mode) and a client interface, in which the students can play.

Integrating the game in the classroom

The game is used in a blended learning context. Gademavo is a multi-platform game, and can, therefore, be used on a computer, as well as a portable, a laptop, a tablet such as an ipad or even on a smartphone.

The professor needs no computing competence to generate a game customized to his teaching context. He designs the case, related to his teaching field, creates or re-uses resources possibly illustrating the case (with the help of the Cyberlearn center, if so wished), structures the game for a specific class and defines the parameters (layout adapted to professional context, choice of a mini-game where points can be scored, etc.). He then launches the game in class and lets the students use the game at their own pace during two or three class sessions.

The game takes place in four rooms (meeting room, oval room, situation room and decision room) and lasts about 6 hours altogether. The students are invited to work during class during 2 sessions and outside the classroom for the remaining time. The 3rd session is used by the professor for feedback, per group and per class.

Although this is not a multi-user game, the students work in groups. They choose the case to be treated, listen to the client/patient, select the resources which they think are appropriate, analyse further resources, score points and collect useful objects by answering questions on the topic covered by the game, or by playing a mini-game proposed to them by the professor. They can ask other groups for help inside the game. The group which provides help scores extra points, the group receiving help does not evolve.

In Version 1 of the game, the students must ask the right questions and analyse documents with the help of tools commonly used for problem-solving in a non-gaming environment. They can then send the produced documents to their professor directly from the game. In Version 2 of the game, some simple and efficient tools are proposed inside the game to avoid having to quit the interface and to proceed with the analysis, thus providing complete immersion.

Game procedure

✓ *First room : Meeting Room*

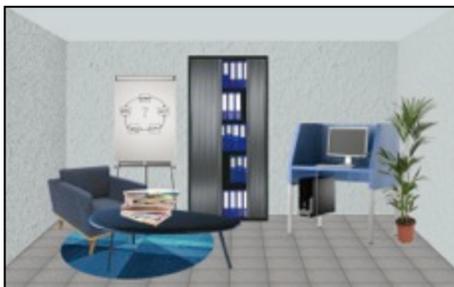


Figure 1 : Meeting Room

Once the game is launched, the student group finds itself in the meeting room, the first room in the game.

Pedagogical intention

As the game is a template which can be customized to various professional contexts (health, computing, communication etc.), we gave priority to the office metaphor which can easily be proposed for different professions (legal office, physiotherapist office, communication agency etc.). We have then parcelled

the different steps. The first room allows the game to start.

In this room, the students can :

- ✓ form the group,
- ✓ choose to purchase help from a « wizard »,
- ✓ choose the case they wish to analyse among the « clients/patients »
- ✓ score points and win objects by answering quizzes.

✓ ***Second room : Oval Room***



Figure 2 : Oval Room

Pedagogical Intention

In this room, the first expected action is to furnish the room, display diplomas on the wall, before the « client/patient » is willing to talk. These actions cost points. Once everything is set-up, icons appear when clicking on the « client/patient » who orally explains which actions must be taken. These icons give access to audio, video and text files which illustrate the case. Some of the information can be useless, some is without interest, but some is relevant. The students must select the three most pertinent information, which is automatically placed in a safe and remains accessible throughout the game. From here, access to the other resources is denied.

This selection process constitutes the first step in a problem solving procedure: selecting pertinent information among a large range of choices.

In this room, the students can :

- ✓ furnish the room,
- ✓ watch resources which explain the case,
- ✓ select relevant resources.

✓ ***Third room : Situation Room***



Figure 3 : Situation room

Pedagogical intention

In this room, the students can access different, but minor scale, resources, which shed a new light on the case (e.g. medical context, blood results, x-rays, etc.). In order to look at these resources, the students need the appropriate devices (microscope, x-ray machine etc.). These devices can be won when completing quizzes. If the required devices are missing, the students can return to the meeting room and complete more quizzes with the hope of winning more devices, or they can ask other groups to lend them the missing devices.

This procedure boosts the students to go over some quizzes again and so to go deeper into the underlying theory of the exercise, and this provides a new opportunity to understand the case thanks to a new type of resource: the useful samples.

In this room, the students can:

- ✓ select samples,
- ✓ view the samples.

✓ ***Fourth room : Decision Room***



Figure 4 : Decision room

Pedagogical intention

In this room, the students must take a first decision to submit to the « client/patient » in order to find a solution adapted to his problem. The students must select some analysis items and link them to three questions: what is the problem, what is the objective aimed at by treating this case, and what are the actual measures to be taken to reach the objective and solve the case. This choice is then automatically proposed to the client/patient who will provide a brief feedback. If the choice is « perfect », the game ends and the scores, as well as the final decision taken, are sent to the professor. If the choice is not « perfect », the students continue their effort by working on two more decisions. When three wrong combinations are selected, the game is over and lost. The game was designed for 270 possible combinations from which the students can select their propositions.

This procedure enables students to modelize the case by synthesizing, structuring and organizing the disparate data they usually have to deal with, which represents a truly adequate method for problem solving and decision taking. In Version 2 of the game, this feature becomes more sophisticated, by asking students to describe in more detail the solution they propose concerning the decisional choice made earlier on.

In this room, the students can:

- ✓ select and organize the elements of the decision taking,
- ✓ select and send the professor the documents produced to achieve their personal analysis procedure (in Version 2, the students can create these documents in Gademavo)
- ✓ submit their decision to the « client-patient » three times.

We plan a follow-up of the game through an assessment to favour reflexion on the actual learning achieved (metacognitive process)

Acceptance and impact of the game on students

In a first phase, we tested the game with students and adapted it according to their remarks. From March 2013, we will conduct a study to assess the impact and acceptance of the Gademavo game with two classes of the second year Bachelor in Economics, as part of a course for communication inside the firm. The first class counts 60 full-time students, split into two groups, and the second class counts 30 part-time students.

We will assess the following features :

- ✓ game acceptance,
- ✓ interest in the game,
- ✓ full completion of the game,
- ✓ time needed for taking the correct decision,
- ✓ number of points scored
- ✓ competence improvement between the beginning and end of the test.

We also wanted to evaluate to what extent the knowledge proposed in a formal manner during the course is grasped better or differently when using a game, and to check whether it has turned into competence applicable on the field. Indeed, as Bellotti, Kapralos, Lee, Moreno-Ge and Berta (1) proclaim « An important aspect in the evaluation of serious games, like other educational tools, is user performance assessment ». At the end of the game, a questionnaire is sent to all students, members of the group to assess their expertise, to measure both, the theoretical level (linked to the quizzes completed in the game) and the competence level in problem solving and decision taking. Bellotti, Kapralos, Lee, Moreno-Ge et Berta (1) highlight that « the measure of the person's performance through a test is a more objective assessment of the game. ». Since the game is played in groups, it is enlightening to perform an individual assessment to find out if there are differences in the individual level of competence among the participants of a same group.

Conclusion

Serious game is merely one of the numerous resources, which encourages the digital native student to part from its regurgitation position, preferred in the traditional model « I tell you, you tell me, and I grade you ». The idea is not to replace the course with a type of resource adapted to the educational challenge raised by the students 2.0, but rather to vary the means used to address the acquisition of new knowledge.

By adopting a critical and engaged attitude, based on reflexion, on decision taking, on collaboration when addressing knowledge, a tool such as Gademavo plays its part in setting-up a tertiary educational teaching method, renewed, efficient and adapted to the current world and to the competence requirements of the future environments.

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