Gamification as a Concrete Strategy for Teaching in a Vocational Education Setting

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Abstract

This Gamification has emerged in the latest years as an alternative support and assistance for the process of learning. Our goal with this experience was to bring the concepts related to the concepts of gamification and game-based learning to provide motivation for students in basic computer learning. Through an exploratory research and the qualitative approach using the cartographic research method, we developed a specific workshop for students enrolled in a technical background course. The main results found in this study confirm the research carried out by Schlemmer [10], in which design-cognition concepts are used in teaching, in a context of configuration of Hybrid and Multimodal Living Spaces, from the perspective of Gamification.

Keywords: Gamification; Cyberculture; Education Professional; engagement

1. Introduction

The challenges that education has been suffering due to the great social changes, especially in a global and technological world with a view to the world of work, go through new forms in the process of learning of students who long for an education that is in harmony with their way of life and within its reality, in which it can give immediate answers, thus fulfilling its desires within this instantaneous and connected context.

The inclusion of subjects related to information technology in technical and technological courses at the Federal Institute of Education, Science and Technology, has become a necessary practice in the various areas of knowledge of this institution. But the simple inclusion of these curricular components does not guarantee by itself an effective learning of its students in the context of digital inclusion. In practice, these curricular components are offered in an instrumental format and this methodology does not provide an adequate motivation for learning.

In this sense, the objective of this work is to propose, from a practical workshop, a dynamics of learning based on gamification for a computer discipline of instrumental format of the technical course on Safety at Work of the Federal Institute of Education, Science and Technology of Rio Grande do Sul - Campus Porto Alegre, seeking to provide a playful and enjoyable learning in which the student can have a greater motivation in teaching digital technologies.

This paper is structured in this and five other sections. In the second one the theoretical reference is presented on the importance of gamification with teaching and learning method. It demonstrates the

importance of vocational training courses in Brazil and, finally, the research method used. The third section shows the problem that you want to investigate. Workshop descriptions and methodology are also presented in this section. In the fourth section the mechanics and dynamics of gamification are presented. In addition, final dialogues are presented on the experience of the participants. In the fifth section are presented the results of the workshop and, finally, the sixth section, where conclusions are made about the work done.

2. Theoretical Approach

Looking through the perspective of Cyberculture, people's lives are changing dramatically in their individual and social aspects. So, it's important to think how influential digital technologies are into the relation between us and other people and objects (increasingly smart). Lemos [6] refers to connections, people and network as "navigators in the network open seas, when distant from cities, must face three main challenges: the need of establishing a type of epistemology no longer systemic, but reticular and connective".

According to Schlemmer [12], biologists from 1920's were the pioneers of the systemic thinking for the human development by emphasizing the concept of living organisms as a whole integrated system. Piaget anticipated the importance of an interdisciplinary approach, based on the integration and relationship among the sciences in order to attain the overcoming of dichotomies that lead to compartmentalization and fragile theories with little power of explanation (Maraschin and Nevado, 1994).

For the systemic thinking, when the reality is perceived as a network of relationships, our descriptions don't rely on disconnected concepts, but on a network where the notions are interconnected. The criteria of the systemic thinking are all interdependent. Everything is seen as an interconnected web of relations, described by a system of concepts and models in which everything has the same importance and the identification of objects depends on the observer and the process of knowing.

Felice [3] highlights the need for a new understanding or rising of the concept of systemic epistemology represented by a set of interelated concepts which communicate each other into the same system in order to have a reticular and connective epistemology. Understanding this change is crucial to understand the new relational and communication processes. Lemos [6] says: "Humans communicate. So do things. And we communicate with things and they make us do things, whether we like or not".

This is the context we have in our contemporary society in which gamification is placed and managing these connections, relations and communications between the actants [6]. However, Hamari et al. [4] emphasizes that at the same time, the studies pointed to negative outcomes which need to be paid attention to, such as the effects of increased competition, task evaluation difficulties, and design features.

Finally, the gamification has been used, according to Shiralkar, Shreekant W [13], as motivational strategies in companies: "Business environments are rapidly changing, and information technology (IT) is at the core of such a change. Innovations in technology, along with completely new business models, are part of the rapid change that is forcing corporate and management professionals to learn, deploy, and adopt IT for survival and competitive advantage. IT is no longer just a back-office function, but a strategic business function as well."

The professional and technological education in Brazil gained a great impulse with regard to the expansion

in the offering of vacancies, since the institution of the law 11.892 of December 29, 2008 that gave rise to the Federal Institutes (IFs). In order to get an idea of the importance of the expansion of the Federal Network of Professional, Technical and Technological Education in the last years, from a historical retrospective, from 1909 to 2002 were built 140 technical schools in Brazil. Between 2003 and 2016, the Brazilian Government built more than 500 new technical schools, making a total of 644 campuses [1].

In recent years, professional training has become an important development factor in Brazil, especially after the creation of the Network of Federal Institutes, increasing the number of places in technical and technological courses. Pacheco [7] sums up the spirit of this technical formation: "Our central goal is not to form a professional for the market, but a citizen for the world of work - a citizen who could be as much a technician as a philosopher, a writer or everything that."

As a research development methodology we will make use of cartography. Cartography or cartographic method of intervention research is considered as a research-intervention method. The orientation of the researcher's work is not done in a prescriptive way, but every action has a direction. Kastrup [5] defines cartography as a method formulated by Gilles Deleuze and Félix Guattari [15] who intends to follow a process and not represent an object.

3. Indentifying and undestanding the problem

Nowadays we live in a society that experiences different kinds of virtual or digital technologies, for work, for relationships and for studying, among several other dimensions of our daily life. These technologies are present everywhere: when you turn on the TV or call a friend, when you go to a bank or even buy through internet. However, the school curriculum and methodology still don't reflect this dimension and still reflect a formal model and a traditional pedagogical proposal.

Domínguez et al. [2] define gamification as the use of the logic of the games and the elements that are present in games, such as mechanics and dynamics in a non-game context, which goal is to engage and motivate people as well as solve problems and promote learning. Hamari et al. [4] presents several concepts in which we highlight: "Gamification has been defined as process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes" . Muntean [14] identifies that the level of engagement of the subject is preponderant for success in gamification.

Schlemmer [11] points out for the need of knowing and understanding the subjects of this context and for the existing gap between the generations that mediate the computational changing. On the one hand, we have people born under the rising of digital technologies and that use these almost as a physical extension of their body. On the other hand, in a former generation, people are still learning and acquiring a new language and its codes.

3.1 Empirical Field

Our goal with this section is show a general idea of the institution where the workshop was held. The Federal Institutes were created in 2008. Taking the Federal Centers of Technological Education and Federal Agricultural and Technical Schools as the focal points for a new proposal of Professional and Vocational Studies, the Ministry of Education rearranged these schools and promoted a great expansion in this field of

Education.

The Federal Institute of Rio Grande do Sul is located in Rio Grande do Sul in the South of Brazil and it has 17 campuses from the North to the South of the state. There are almost fifteen thousand students in regular programs. Campus Porto Alegre is one of its campuses and accounts for almost three thousand students in different levels and modalities, from qualification programs to master degree programs (Environmental, Chemical, Computing, Business and Work Safety). Porto Alegre is the capital of the state and the campus lies downtown.

3.2 The Program and the Students

The Work Safety Program is designed for students who have finished High School and want to specialize in this field of working or to get a better job or promotion. The curriculum of the program is varied and is designed to cope with different job positions in the market, being an employee or an entrepreneurial. One of the regular and mandatory course is Computing II, in which students are supposed to learn how to work with Excel.

The students, as said, finished High School and the class has a great range of age (young, middle-age and aged people). Other important issue about the class is its variety in terms of professional and cultural background. We can find people who are only students and trainees of the program, self-employed professionals, retail business workers and even retired people.

So, it's important to observe that this class had the typical gap between generations regarding the digital world. Beside this, the students face difficulties in getting the basic concepts of Excel, the main content of the course. In most cases, it's possible to identify the lack of interest for this course, either because it's not part of the central core of the program or even because the course is at night, when the students are naturally tired after a day of working (fatigue).

This way, the motivation of these students in the basic computer learning according to the presented context, is necessary so that they can appropriate the knowledge inherent in cyberculture.

3.3 The workshop

For this experiment we used the gamification concept. Following the different dimensions for gamification, we developed an educational practice which has the goal of instigate and engage students in specific learning, considering the perspective of m-learning and u-learning [9] in interactions that promote collaboration and cooperation between members of the group.

According to Saccol [9], u-learning corresponds to a broader concept than m-learning. U-learning corresponds to a third wave computing where several digital processing units are manipulated by a single person, ie individuals are always connected through these computational devices. And this third-wave computational structure transports us and enables us to use new pedagogical methodologies such as gamification. Therefore, the concept of u-learning transcends technology itself and makes us broaden its concepts, using logical knowledge of technology, in this case computer games, in areas of knowledge such as education, business, among others.

Although there are differences between the traditional games and the gamified systems, in the definition of

the latter, researchers and professionals have been based on formalized concepts of theoretical game design, such as the mechanics, dynamics and aesthetics (MDA). Mechanics are described as rules and the specific components of the game in terms of the actions players can take; Means the laws governing the actions of the players. Dynamics describes how rules manifest themselves during the game in realtime, according to players' system inputs as well as interactions between players. Aesthetics describes the results presented by the users when they interact with the gamified system.In this way, we use these concepts in our experience [8].

The problem posed for this workshop arose from the need to encourage the interest of students during the classes of Computing II – Excel and to enable students to experience the gamification in order to engage them, give them new possibilities of connexions and meanings regarding the Work Safety Program and the Computing II Course – using Excel as a tool.

The main issue of the class is related to the difficulty students have in understanding and relating the contents with real life tasks. They are not able to work with simple data sheets and basic operations in Excel. It's not unusual they ask two or three times for the same explanation about tasks. It means that either they don't understand or don't give meaning to the content, trying to learn it by heart or memorizing it step by step. They only realize that something is wrong when the memorized action doesn't lead them to the solution for the task. This behaviour could be related to the application of teaching traditional approaches to digital technologies learning which are based in empiricist epistemologies [9].

Our practice had the goal to engage students into the learning process and to make them understand the importance of the contents in their professional activities. It was really important that this process could take place in an environment of collaboration and cooperation and based in exchanging information and sharing experiences.

The gamification process involved elements from IT area (like Excel tools and techniques, use and management of QR-code apps for cell phones), from Work safety (basic knowledge) and also some dynamic work techniques that could put the students into the right pathway for reaching the goals of the workshop.

The Excel contents related to the workshop were extracted from the Computing II course curriculum, which were: formatting, formulas and functions, conditional formatting, IF condition, PROVC, validation, subtotals, graphics, auto-filter and protection. It was also mandatory that the students got the QR-Code app for cell phone and got familiar with it.

In our proposal we also wanted to reach some goals related to competence and abilities development. As important as these, we emphasize the desired competences for the workshop: understanding the proper use of Excel, identifying potential problems/issues for solution through Excel and solving everyday problems through Excel.

3.4 The methodology

Although gamification is not a game itself, it arises from the implicit way of thinking that is present in the games and its styles, strategies, mechanics, dynamics and aesthetics (MDA) [8] in a non-game context. According to Schlemmer [11], gamification in an educational setting consists basically in using the way of

thinking in games, the game styles and the elements of the games as a mean to engage subjects in solving problems. Muntean [14] also reinforces that motivation on the part of students is an essential factor for the success of gamification. Our goal is to have the learning subjects motivated, engaged in the process of the knowledge building through interactions between human actors and non-human actors. "The actor is the network and the network is the actor, both mediators into an association" [6].

Due to the time we had and the practical aspect of the workshop, we chose a set of mechanics and dynamics that started with a narrative and to which were linked the others M&D, such as: clues, puzzles, pathways, challenges and missions to push the students towards the solutions of the problems and obstacles and also the self organization into clans and guilds.

The workshop was developed in a computing lab of Campus Porto Alegre (IFRS). The students group themselves through negotiation and affinities. After this step, they were asked to solve a set of four missions, which led them to four challenges. These challenges were available in a Virtual Learning Environment called Moodle Platform (a free software with a system of online learning management used by educators for supporting their courses).

Each mission had the final goal of solving a challenge (find a password and solve a task). To reach this challenge, there was an intermediate step consisting in following a clue, i.e. each mission started with a clue. Understanding properly the clue, the students were guided to a specific place inside the campus where they could find a puzzle. They could solve the puzzle using the QR-code reader and then got a password. This password would lead them to the proper challenge. The Figure 1 below shows the guidance for the game. related to the workshop as they were presented to students:
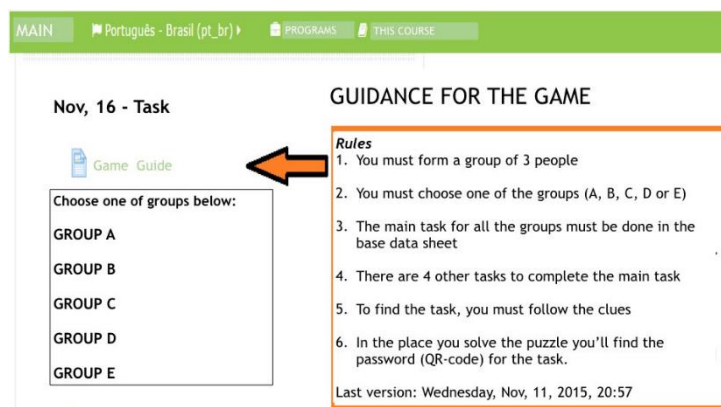

Figure 1: Guidance for the game (Mechanics)

Each group received four missions that had as objectives in the end the resolution of one task, each. Figure 2 shows the structure of these missions. Our intention was to have the groups solve at least three missions.
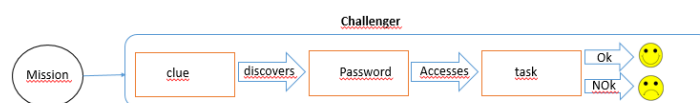

Figure 2: structure of these missions

In order to start the workshop and put the students into the context of the mission, we developed a narrative which was presented by the teacher at the beginning of the class. Below we can find a short version of this narrative:

Table 1: Narrative proposed to the students

Narrative structure	Presentation
Description of the general context	Some years ago, right after the invention of the computer system, three colleagues of the company SAFEJOB Inc. came to a conclusion that it was really tiring to perform some of the daily tasks they did always in the same way. They decided to use their knowledge to improve and ease their performance. The idea was to get more free time for talking, practicing sports, going to the movies as everybody did. In the end they got all day filling out forms and sheets by hand. They asked themselves if there wasn't any way to use the new technological machine that was coming to the market to improve the quality of the job they did. All they needed was to join their efforts and build a faster solution for the tasks. Do you want to understand how they did it and help them with your ideas?
Mission definition	So, you got a mission! First of all, you must form a group with two other colleagues and give this group a name. After that, get the QR-code app in your cell phone. THIS IS REALLY IMPORTANT TO HELP YOUR COLLEAGUES IN BUILDING A NEW TECHNOLOGICAL SOLUTION. You must use a base Excel sheet and start building a much better one from it. What do you think about it? Is it ok? Can we start? your challenge begins with searching for the password through the clues left by the campus. Once you've deciphered this clue from your safety knowledge at work, you'll find a password. With the password in hand you will discover your task that must be performed in the excel worksheet.

4. Pathways, experiences and sensations

As we have said before, we use the cartography as the research method and in this way, which are flexible and adaptable to the subjetcs' characteristics, culture and experience, take into consideration that the participants are curious and also that through colaboration and cooperation they can reach a good level of autonomy and authoring [9]. We can see below the relation between the mechanics, dynamics aesthetics used in this workshop:

Table 2: Relation between the mechanics and dynamics of this gamification workshop

Mechanics	Dynamics	Aesthetics
Students had autonomy for choosing the	From this choice, which was related to affinities or familiarity, they could	Students chose their groups based on

members of the group	enhance their personal relationships to have a better level of collaboration and also share their ideas and efforts.	affinities and friendships.
Each mission started with a clue. Without it students couldn't reach their specific challenge	Although it was related to IT tools, the gamification process needed the students' knowledge about Work Safety, their probable field of work, for solving the clues.	Even without knowledge of the technologies used, students used their life experiences to solve problems.
Gamification workshop was carried on both inside the computer lab (moodle) and the halls or the floors of the campus due to the need to solve the puzzles and follow the clues.	The groups used different strategies and showed distinct perceptions to solve similar problems. Some of them worked and solved their questions together. Others divided themselves by the expertise of each member. It could show them that there was not only one way to solve problems.	The answers varied according to the level of knowledge in technologies. Although everyone has solved the clues, each group solved in its time and according to its capacities.

The attentive recognition in the cartographic method [5] is constituted as the narrative writing itself of the attention of the researcher to the researched field. In this way, we can not close our eyes to pre-defined concepts and we must observe with greater attention and sensitivity what the students have provided. We registered it in a narrative form to give a better sense of what happened in class.Which were the true impressions left by gamification in this workshop? What couldn't we realize at some point in assessing the process of gamification? What was behind all this work? What was the meaning of this activity for students? We could have some hints or evidences. Below we report a dialogue promoted by the teacher at the end of the workshop with the whole class as a kind of assessment.

Table 3: Narrative based on the dialogue after the workshop, Inspired by the cartographic method.

After the workshop, the teacher talks to the students. Teacher says: it's almost 10:15 p.m. The students seem to be tired and worried about public transportation and safety in the bus stops. A student with a hopeful face and smile asks the teacher: It's time. Can we go? The teacher answers: yes. First he asks a question: what do you think happened in class today? Preparing their materials to go home, the students stop and look at the teacher. One of them asks: what do you mean, teacher? Are you talking about this competition? Another student says: I think it was very cool, we had an interation that is not common in our regular classes.

The teacher asks again: ok, but to what this class looks like?

The student's answer is: oh, teacher, as a game, isn't it? It was funny, although I've been worried to solve the puzzles, because if I didn't do it, I would be in trouble (laughs).

The teacher asks: But did you like or not?

And the student answers: Yes... At first I didn't like it very much because we have to go around the campus, but after this I liked it.

Another student says: I liked so much that I took some coffee to the teacher (laughs).

The teacher asks again: Someone didn't like this activity?

A student that seems to be one of the oldest in class answers with an inconclusive face: I don't know much about Excel and I don't like to leave my comfort zone either. But I got what the teacher wanted with this activity: he wanted us to learn how solving the problems even they appear in an unexpected way. That's what I got, isn't it, teacher?

The teacher answers: My goal with this class is going to depend on what each of you understand, on your interests, on your knowledge and your culture, but above all, our goal must be to have your class worth it.

They talk for more than ten minutes and they forget they had to go home. With or without understanding what happened in class, it seems that everyone was touched by the Excel workshop in different ways.

5. Results obtained

In this section we will describe the results obtained at the end of the workshop. The ultimate goal was for groups to solve at least 3 of the 4 challenges. In this item, all groups had their goals achieved. Groups A, C and D solved 4 challenges and groups B and E solved 3 challenges only.

This result demonstrates that its components were engaged in the proposed activities. This is possible to be observed because these students did not show interest in activities carried out before the workshop. According to the professor of the course, students with more domain in the information technology area were in groups A and E. In general, prior knowledge of information technology was not dominant in the final result.

From a careful recognition [5], we observed the dynamics of the groups in which each component collaborated in what was understood as the most expert, evidencing a natural engagement of the components in the various groups, without demonstrating competitiveness. Collaboration and co-operation were important aspects during the workshop and they forged complicity even between members of different groups.

6. Conclusion

Quantitative and qualitative research may constitute cartographic practices, since they are proposed to follow processes. Cartography as a research method is the drawing of this plan of experience, following the effects (on the object, the researcher and the knowledge production) of the own Research. In this spirit it was held a practice in the classroom that had the goal of trying to understand the strategies of gamification

process in a real educational environment. Digital culture is a movement without a turning point. Their strategies, behaviors, connections, networks and related technologies are increasingly integrated into our society. In education, this movement is also a reality. Much more important than quantifying an experiment is tracking the process. [5].

In this context, we resolve to challenge in practice the concepts involving gamification, through a workshop. The answers are far more comprehensive than we can imagine. Gamification is a process where the focus is on the connections between the objects that are involved here. The artifacts used by the students are also part of the game and its end result will raise a new learning awareness for its participants, both teachers and students.

After this, we can say that there isn't a right or wrong path, or approaches, or tools that could be included or disposable. The pathway is open and the challenge of choosing a new knowledge building process involves some fear, distress and frustration because it's the new, the unknown. By the other hand, we hope and we are willing that using new strategies in class could be a different and joyful experience for us and for students, besides its own quantitative results.

It's also important for all the teachers to know that we have to face the challenge of integrating digital tools to these new generations that are arriving to school. Otherwise, the education as a system could just stand like it is today: a way to reproduce knowledge with no connections to the real life.

7. References

[1] BRAZIL. Ministry of Education. Expansion of the Federal Network. Brasília, [Online]. Available <http://redefederal.mec.gov.br/expansao-da-rede-federal>, November 20, 2016.

[2] DOMÍNGUEZ, A., Saenz-de-Navarrete, J., de-Marcos, L., Fern_andez-Sanz, L., Pag_es, C., & Martínez-Herr_aiz, J.-J. (2013). Gamifying learning experiences: practical implications and outcomes. Computers & Education, 63, 380e392. http://dx.doi.org/10.1016/j.compedu.2012.12.020.

[3] FELICE, M. (2012) Redes Sociais Digitais, Epistemologias Reticulares e a Crise do Antropomorfismo Social. [online] Revista USP, v. 0, n. 92, p. 6. <http://media.wix.com/ugd/e30c33_e9bf2bf59e6b4f84a403470a5fab1373.pdf>.

[4] HAMARI, Juho; Koivisto, Jonna; Sarsa, Harri (2014). Does Gamification Work? – A Literature Review of Empirical Studies on Gamification. Proceedings of the 47th Hawaii International Conference on System Sciences, Hawaii, USA, January 6–9: 3025. doi:10.1109/HICSS.2014.377. ISBN 978-1-4799-2504-9.

[5] KASTRUP, Virgínia (2012). O funcionamento da atenção no trabalho do cartógrafo. In: PASSOS, E.; KASTRUP, V.; ESCÓSSIA, L. D. (Orgs.). Pistas do método da cartografia: pesquisa-intervenção e produção de subjetividade. Porto Alegre: Sulina.

[6] LEMOS, A. (2013) A Comunicação das coisas. Teoria ator-rede e cibercultura. São Paulo: Annablume. Maraschin, C. and Nevado, R. A. de. (1994) O Paradigma Epistemológico

[7] PACHECO, Eliezer (2011). Institutos Federais: Uma revolução na educação profissional e tecnológica. Editora Moderna. São Paulo.

[8] RUHI, Umar (2015). "Level Up Your Strategy: Towards a Descriptive Framework for Meaningful Enterprise Gamification". Technology Innovation Management Review. 5. ISSN 1927-0321.

[9] SACCOL, A., Schlemmer, E., Barbosa, J. (2011) M-learning e u-learning: Novas perspectivas da aprendizagem móvel e ubíqua. São Paulo: Pearson Prentice Hall.

[10] SCHLEMMER, E. (2015). "Gamification in Hybrid and Multimodal Coexistence Spaces: Design and Cognition in Discussion", Athens: ATINER'S Conference Paper Series, No: EDU2015-1672.

[11] SCHLEMMER, E. (2014) Learning in metaverses: co-existing in real virtuality. Hershey, USA: IGI Global.

[12] SCHLEMMER, E. (2002) AVA: Um ambiente de convivência interacionista sistêmico para comunidades virtuais na cultura da aprendizagem. [Thesis on Computing in Education PhD Program]. Porto Alegre: URFGS.

[13] SHIRALKAR, Shreekant W (2016). IT Through Experiential Learning. ISBN 978-1-4842-2420-5.

[14] MUNTEAN, Cristina Ioana (2011). Raising engagement in e-learning through gamification. The 6th International Conference on Virtual Learning ICVL.

[15] DELEUZE, G. e GUATTARI, F.Introdução: Rizoma. Em Mil Platôs, vol. 1. Rio de Janeiro: Editora 34, 1995a, p. 11-38.