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**Gamification in Hybrid and Multimodal
Coexistence Spaces: Design and Cognition in
Discussion**

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Gamification in Hybrid and Multimodal Coexistence Spaces: Design and Cognition in Discussion

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Abstract

The paper emerges from the research "Gamification in Hybrid and Multimodal Coexistence Space: an Experience in Higher Education" and objectively understands and discusses the cognition-design relation in teaching, in the context of configuration of Hybrid and Multimodal Coexistence Space, from the Gamification perspective. The research is in exploratory and qualitative approach, using Design Research and Cartography as methodology and as instruments: observation, digital photographic records, digital video records, digital audio records and written records. For data analysis it uses discursive textual analysis. The main results show that the design - cognition in teaching , occurs when the teacher is an active builder subject of design and is central to assign senses to an innovative practice, precisely because then s/he "being in the situation" and can speak "from inside", in his/her own learning process. So we can say the cognition-design relation in teaching, mainly linked to configuration *Hybrid and Multimodal Coexistence Spaces the perspective of Gamification*, occurs when the teacher's and students' configuration of these living spaces in the other is recognized as legitimate in the interaction and therefore as someone with whom they can learn.

Keywords: Anti-forensics, IconCache.db, Portable Applications, USB forensics

Introduction

Living and coexisting is increasingly in hybrid and multimodal contexts where different analog and digital technologies integrate physical classroom space and online, providing new spaces to learn. It is in these spaces that the subjects in nomadic movements, interact, build knowledge, learn, what makes us think that a new culture may be emerging, not a dichotomy between analog and digital culture, but a culture that puts these elements and people related, in the coexistence perspective.

From early works, the game is present and has been studied as part of human development (Piaget, 1964), present in the root of culture (Vygotsky, 1994) in this living and coexisting. According to Huizinga (1993) game "is a function of life ... free activity, consciously taken as "non-serious" and outside the ordinary life, but at the same time capable of absorbing the player intensely and full way" (pp. 10, 16). The concept of gamification arises in this living and coexisting, that is to use elements present in the mechanics of games, game styles and ways of thinking of games, in non-game contexts, in order to solve problems and engage the people. This concept has been appropriated for the education, enabling the construction of teaching and learning situations to engage the subject in a pleasant way in defining and solving problems contributing to rethink the formal educational context.

Thus, to investigate the design-cognition relationship to understand that design, "cognitive" emerges in the construction of hybrid¹ multimodal² living spaces in the gamification perspective, to be discussed in this paper.

The paper is linked to research entitled "Gamification In Hybrid And Multimodal Coexistence Spaces: An Experience In Higher Education", funded by CNPq, with the locus in the academic activity "Cognition in Digital Games".

The Academic Activity "Cognition in Digital Games": the Locus Of Research

"Cognition in Digital Games" is an optional 60-hour academic activity in the curriculum of Technology in Digital Games, at UNISINOS. The activity was offered in the first half of 2014 for 28 male students with 18-37 year-old.

The activity methodology was inspired by the cartographic research method, during teaching practice and gamification; associated the methodology of learning projects, adapted to higher education³, in connection with concepts

¹ with integrated digital and analog technologies

² involving the physical presence and digital virtual modalities - *mobile learning, immersive learning e ubiquitous learning*

³ (Schlemmer 2002, Schlemmer & Trein, 2009)

of Flipped Classroom and BYOD⁴, from the perspective of building hybrid multimodal spaces of coexistence. The methodology involved also seminars with participation of experts.

The evaluation of learning prioritized the understanding and formative character. Successive productions of each subject were monitored / assessed in terms of increasing quality. The following is the theoretical and methodological framework for the development of research.

Theoretical and methodological context

Learning

According to Maturana and Rezepka (2000), the way subjects learn is proper to the human condition, because they are autonomous and autopoietic, in congruence with the environment in which they live. This congruence with the environment may cause disturbance in the structure of humans, promoting learning processes in the extent to which the structure is to produce itself to compensate for such disturbance. So, according to Maturana and Varela's (2002) cognition is effective action, is the structural coupling process that makes interactions with internal and external world emerge. Maturana and Varela (1997) report that to live is to know, and to know is to live, so that each subject has his/her own path, rendered by couplings s/he performs in his/her living and coexisting.

Varela (2005) presents concepts of "emerging self" and "enaction". For the author, interpretation and knowledge are emergent results (in order to emerge) of the action in the world or performance. So the increased capacity of living cognition consists largely in making the relevant issues arising in every moment of our lives. These are not predefined, but enacted: they emerge from action in the world (performance) and what is significant is what our common sense judges as such, always within in the context (p 89). So, knower and known, subject and object, determine one another and simultaneously emerge. The enactive guideline proposes a middle way to transcend both extremes: subject and object are mutually defined and are correlative.

For Varela (2005), cognition is action-effective: history of structural coupling that (makes a world emerge), and this occurs through a network of interconnected elements allowing structural changes during the uninterrupted history of living. The central point of cognition is its ability to make meanings emerge, which implies regularities that emerge from own cognitive activities. So, cognition is not a representation of a world that exists independently, but rather the "production" of a world through the process of living. Importantly, the difference between the enactive approach and all forms of constructivism or biological neokantianismo is the emphasis on co-determination. Varela's

⁴ *Bring Your Own Devices* (BYOD) is a trend that emerges from the mobile world and, in education, it proposes freedom for students to bring and use their own mobile devices in educational settings.

embodied-enactive approach or enaction (and his notion of embodied mind) indicates a paradigmatic way in the cognitive sciences.

*Mobile and Ubiquitous Learning*⁵

Saccol, Schlemmer and Barbosa (2011) *mobile learning*⁶ refers to learning processes occurring with the use of mobile devices connected to wireless networks, whose key feature is the mobility of learners, which may be distant from each other as well as formal education spaces. In addition to physical and temporal, this mobility is also technological, conceptual and socio-interactional.

*Ubiquitous learning*⁷ refers to learning processes with mobile devices connected to wireless networks, sensors and geolocation mechanisms, helping to integrate learners in the learning contexts and in their surroundings, allowing to construct presential networks and digital networks between people, objects, situations or events in order to allow a continuous contextualized learning. From this perspective interfaces, providing human-computer interaction, tend to disappear, because the computer will be "embedded", in all locations and on different objects⁸ making them virtually invisible. In addition to mobility, the concept of ubiquitous learning indicates that digital technologies leverage the situated learning, providing the subject "sensitive" information about their profile, needs, environment and other elements making up his/her learning context anywhere and anytime. Geolocation technologies⁹; identification technologies¹⁰; sensors, etc. may be linked to this possibility.

The possibility of digital "embeddedness" in objects and places allows for a situation of "mixed reality" with "augmented reality", which combines a physical presence scene with a virtual digital scene, for the subject, and in this case an augmented reality, the digital reality adds information to the physical presential scene, enlarging it, i.e., it "enlarges the scene", and therefore increases knowledge about objects, places or events.

Gamification in Education

The gaming industry started to use the term gamification in 2008, and it became popular in 2010. Since then, it has been widely used in various contexts, including education. Gamification can be understood as the use of game design

⁵ the search for "Mobile Learning in the organizational context" (2006-2009) funded by CNPq and experiments developed with students of Learning Theories on mid-2012 in the context of BYOD are linked to this context.

⁶ Mobile Learning

⁷ Ubiquitous Learning

⁸ through communication networks allowing data traffic between different devices and networks scattered buildings, streets, cars, in short, everywhere.

⁹ GPS, navigation systems, staff location systems, mobile games that use geolocation

¹⁰ RFID (*Radio-Frequency Identification* - automatic identification method using radio signals, retrieving and storing data remotely using devices called RFID tags) and QRCode (Quick Response -. two-dimensional barcode that can be scanned using camera phones This code can refer to an (interactive) text, a URI address, a phone number, a georeferenced location, an email, a contact or SMS.

elements in non-game contexts. For Ziechermann and Linder (2010), gamification is the process of using mechanical games, game style and ways of thinking of games in non-game contexts to solve problems and engage people. What gamification does is to analyze amusing elements present in the game design, to adapt them to situations not normally rendered as games, proposing to create a game layer in an application or product, in the place to be a game, originally.

The gamification can be considered from at least two perspectives. Persuasion stimulates competition with a scoring system of rewards and awards (PBL, Points, badges and leaderboards) that reinforces an empiricist epistemological perspective in the educational point of view. Now as it is stirred by challenges, missions, discoveries and group empowerment, collaborative and cooperative construction leads to an epistemological interactionist/constructivist/systemic perspective (e.g., inspired by elements in Massively Multiplayer Online Role-Playing Game - MMORPG,).

The gamification in education occurs when using game mechanics and dynamics to engage the subject in solving problems. An example of gamification usage in education can be found when using of game design elements to reframe and draw in another perspective, that of gamification, the curriculum, practices and pedagogical mediation processes.

The Hybrid Multimodal Coexistence Spaces

The concept-technology Hybrid Multimodal Coexistence Space amplifies the concept-technology Digital Virtual Coexistence Space (ECODI, Schlemmer et al, 2006) after results of the latest research¹¹ developed in the Research Group on Digital Education - GPe-dU UNISINOS/CNPq.

Research shows participants' significant reference to the importance and contribution that different integrated¹² DT used also from phones and tablets, in connection with analog spaces, can bring to learning, so referring to coexistence and the need of overlapping the physical presence world with digital virtual worlds. With regard to the particular research "Anatomy in the metaverse Second Life: a proposal in i-Learning", we found that the immersion of avatar in 3D environments, when associated with challenges/problematizations /tracks¹³, provides student's greater involvement with the object under study, which was manifested in reports as "it looks like a game, we learn playing, it's fun, we didn't not see the time go by."

Another result of the research has highlighted the importance of 3D environment for students when combined with books, anatomy laboratories and

¹¹ "Digital Virtual Coexistence Space in the Stricto Sensu Graduate Program – ECODI-PPGs UNISINOS: a proposal for the training of teachers-researchers " (finalized in 2013); "METARIO - Network of Research and Teacher Training in Metaverses: Skills Development for teaching in Management", funded by CAPES (finalized in 2013), and; "Anatomy in the metaverse Second Life: a proposal in i-Learning", funded by FAPERGS, finalized in June 2013

¹² Mainly in Web 2.0 and Web 3D

¹³ elements present in game mechanics

particularly the teacher's presence. This suggests digital technology does not replace traditional technologies: instead, both are complementary and coexist in the educational universe. These results indicate that experiments in gamification-linked Immersive Learning can enrich the learning environment, constructing hybrid environments from a multimodality perspective.

These clues made us think about the possibility the configuration of Hybrid Multimodal Coexistence Spaces (HMCS), which implies overlapping Digital Virtual Coexistence Spaces (DVCS) with other analog spaces, as well as opportunity for multimodality, integrating mobile learning, ubiquitous learning, immersive learning, gamification Learning and physical presential modality. The hypothesis is that this HMCS allows, us to find elements to construct new methodologies and pedagogical practices in the higher education.

Methodology

The research is of exploratory nature and qualitative approach, using cartography as a method for its development.

The cartography method proposed by Deleuze and Guattari (1995), have been investigated in Brazil from Passos, Kastrup & Escóssia (2010) among others, has emerged as a possible way for this research, as it takes the dimensions of human subjectivity as pointing to the need of methodologies to track and record paths of individuals and communities in a particular context.

It uses observation, digital photographic, digital camcorder, oral, digital áudio, and written, records in different interactive spaces in contexts of hybridity and multimodality. For transcripts and video analyses we used Transana¹⁴.

The methodology for data analysis makes use of textual discursive analysis (GALIAZZI and Moraes, 2011), and data are organized into subsystems information, categorized and stored with NVivo¹⁵. Interpretation of the produced data is conducted taking into consideration the theoretical framework underlying the research.

The subject-participants in this research are teachers and students at the Cognition in Digital Games in the course of Technology in Digital Games, at UNISINOS.

Based on this theoretical and methodological conceptualization and foundation I introduce the design of "Construction of hybrids multimodal Coexistence Spaces from the gamification perspective" in construction process in the action-reflection-action teaching, inspired by cartography method

¹⁴ Developed at the Wisconsin Center for Education Research (University of Wisconsin). Transana (<http://www.transana.org/>) allows transcription of audio and video files and creation of analysis categories into the database, allowing to select the digital material cutouts to organize analyses.

¹⁵ This software allows to categorize data in different formats and sources, such as URL, pictures, written text, audio, video, tables, charts, etc. This is an important analysis tool to generate links and significance in the overlapping analysis categories based on different data sources.

research, as an possibility for pedagogical practices and teachers' and students' learning.

Construction of Hybrid Multimodal Coexistence Spaces and the Gamification Perspective: The Design of The Experience in Construction of Action-Reflection-Action

Nowadays there is a host of design theories, including: instructional design, educational design, interaction design, emotional design, co-design, design thinking, among others.

Design in the context of this paper is based on Schön (2000), who posits the idea of an intuitive reflective practice, where objectives are not fixed and the problem is not completely defined. In this context, it is necessary to think of what we are doing while we are doing it, which shape a kind of reflection in action, and this occurs in single, uncertain and complex situations in which the problem is not given and there is a problem to find a problem.

Schön's theory provides a vision of the design process that has a reflective, intuitive, fluid practice, and open goals. But what happens in the process of "drawing and thinking"? For Maia (2011)

" There are clear aspects of the design activity determining its configuration as a dimension of thinking with unique characteristics. The nature of design problems makes one to learn about the problem in a trial-and-error approach, where experience is the safest fator in the process. There is no single way of conceiving, but rather a possible configuration for a way of thinking that reflects on itself along the design process and is based on every uncertainty and unfamiliarity, venturing new possibilities in search of solutions. It is a dialectic occurring between the designer and the problem, and between the problem and the solution (p. 298).

Thus, understanding design in this research, starts with Schön's (2000) perspective and seeks inspiration in the concept of Design Thinking as a proposal to "draw thinking," focusing on the way of thinking of those involved in the process. The proposal is to focus the project (here understood as the academic activity, Cognition in Digital Games) on the thinking of the main participants in this activity. Now, it is possible to understand we are talking about cognitive design. In this paper, we will analyse the point of view of teachers in the process of constructing their action and, therefore, the focus is on people, their experiences and how they deal with problems arising

throughout the process. So, from the initial design of the activity, teachers have developed an initial planning, including only details of the first meeting¹⁶.

At that first meeting, a dialogue was started to better understand students and their expectations¹⁷. Then teachers introduced the initial proposal of the activity, and the research linked to it for discussion. All agreed that a community in Moodle and a group in Facebook would be created for weekly physical presential meetings where everybody could bring their mobile devices (BYOD).

After that, analog, digital, or hybrid learning projects, especially games or gamified situations, were triggered off. Groups were formed according to common interests for particular type of games or gamified situations to be developed and themes, and responsibilities for each member in the group were defined. It was decided that students in the academic activity would be the very test subjects in the projects.

It was also agreed that the evaluation will be in the monitoring of each student's learning process, going through different stages allowing to conquer power (constructed knowledge). The possibility of gaining more power occurs as they expand their observables while playing (depending on the giving meaning to the studied theory); they seek and indicate relevant search results (text, audio, video, game, app, etc.); suggest autonomy and authorship in interaction and construction of the project; they create networks of interactions in group and across groups; they pose questions, socialize reflections and conduct challenges; they share knowledge, collaborate and cooperate with each other; identify the of test subject's interest and involvement with the game or gamified situation created. At the end of the meeting, students filled out an informed consent form to participate in the research.

The process and results for this first meeting were considered in terms of the initial design of the academic activity. At this point, we found the opportunity to work with achievements¹⁸ (observer¹⁹, explorer²⁰, actor²¹, weaver²², cartographer²³, problem-solver²⁴, collaborator²⁵ and cooperator²⁶),

¹⁶ It is worth noting that when the initial planning of an academic activity is developed, one does not know who will enroll in the activity.

¹⁷ Was also provided a questionnaire on Google Forms to know the students' profile.

¹⁸ Achievements are goals someone can achieve in a game. They may be explicit and/or secret, that is, what the subject learn while playing.

¹⁹ observe him/herself, children, adolescents, young, adult and even his/her peers while playing, trying to understand how this action occurs, what similarities and differences, etc., are. In other words, our goal was to learn what was observable and significant for students concerning playing.

²⁰ unraveling the clues, games+education+theories - search for references – autonomy.

²¹ Constructing the concept, the game and the evaluation model of games - creative authorship.

²² finding connections – observer+explorer+actor, networking.

²³ mapping the way - process analysis, self-assessment, reflection.

²⁴ instigator, who raises issues, reflections, critique.

²⁵ contributing with some reference.

²⁶ creating together with the other.

which would be released according to student's development in the gamified activity.

Thus, other meetings occurred weekly after a teacher meeting for the following week and monitored in an assessment of the experienced process.

At the second meeting, gamification process — STAGE I - The Explorer - in search of the theory ou Hunting the Theory — began, using QR Codes, clues were spread about the library building in four places, including outside. The clues contained information on particular theories: Maturana & Varela's Biology of Knowledge; Piaget's Genetic Epistemology; Siemens's Connectivism; and Latour's Actor-Network Theory. Each project group was directed to a specific geographical location, where there was a set of clues about a particular theory. So, each group knew the theory to support the development of each group's project. However, a group could not tell the other, what was its theory, as identifying elements of different theories, in the development of projects, was also part of gamification process. So the following were the initial stages of the game.

STATE II – THE OBSERVER – LOOKING FOR CLUES WHILE PLAYING. Students were given nine games to play, where they should find clues concerning their playing and on their playing with their peers. The goal was to know the observables identified by them, who were recorded in a daily trip to subsequently be turned to in light of the studied theories.

First Moment: 1) Each student chose three games to play; 2) action of playing; 3) analysis – search for clues – reflection about playing – registering observables (How s/he sees the game itself? How s/he sees the playing? How s/he sees him-/herself when s/he is playing?)

Second Moment: 1) Each student chose three games to observe three peers playing; 2) observation; 3) analysis - search for clues - reflection on the peer's playing - registering observables (How s/he sees the game itself? How s/he sees other's playing? How s/he sees him-/herself as an observer?)

STAGE III – THE EXPLORER – SOLVING MYSTERIES IN THE FIELD OF GAMES, IN THE RELATION WITH THE EDUCATION FIELD-Stage Live clues began with the participation of a visiting professor, through web conferencing.

First momente - was created in the Aurasma app, the geolocalized clues on campus, considering the diferent knowledge fields, of theoretical creators of the theories under study, as well as clues with information about the Live Clues, who will discusses with students about the theories . It is noteworthy that the name of the theory remained secret, except for the specific group was studying the theory in question, due to have done previous research about the theory;

Second Moment: realization of web conferencing with the Live Clues.

STAGE IV – THE WEAVER - WEAVING OBSERVATIONS - finding connections while observing games:

First moment: game group - students met in gro/ups, according to the observed game, to identify what was recurrent and divergent, to classify observables;

Second moment: discussion of each game in the large group, to begin to create a "model" to evaluate games, based on the classification of observables;

Third moment: project group (concept + theory) – students in each project group, met to identify what could be linked to the studied theory out of observations made in games;

Fourth moment: discussion in project groups - with observables linked to the studied theory.

STAGE V – THE ACTOR - CONSTRUCTING CONCEPT - construction of project concepts

First moment: work in project groups;

Second moment: filming each group presenting the concept of their project.

STAGE VI - THE CARTOGRAPHER - MAPPING THE WAY - each group examined the project development presenting it for the large group.

First moment - presentation of the project groups;

Second moment - discussion with the large group and questioning about the project development presentation, in relation to the "model" to evaluate games, in the creation process.

STAGE VII – THE ACTOR - BUILDING THE MAP AND THE GAME.

First moment – resuming the construction of the "model" to evaluate games, from the discussion and conducted questioning;

Second moment - developing group projects;

Third moment - self-assessment and evaluation of the academic activity in order to correct directions if necessary.

STAGE VIII - THE EXPLORER - SOLVING THEORY MYSTERIES - Live Clues began with the participation of visiting professors linked to different theories through web conferencing and physical presence. The four meetings that have integrated this stage was developed at the following moments:

First moment - clues on the campus were created in Aurasma²⁷ in light of different backgrounds of creators of the studied theories, as well as clues with information about Live Clues, who discussed the theories with students. It is

²⁷ Aurasma (<http://www.aurasma.com/>) is an application for mobile devices allowing one to create mixed reality or augmented reality. In other words, it enables one to add digital information in a physical, presential, and analog scene “enlarging” “reality”.

noteworthy that the name of the theory remained secret, but the particular group who was studying the theory in question, was well known as they conducted previous research about it;

Second moment - students explored the campus in search of clues;

Third moment - web conferencing with Live Clues to discuss theories (at the time of web conferencing, live clues started the conversation without, mentioning the name of the theory in question, which was revealed only in the end).

STAGE IX - THE WEAVER - WEAVING WITH THEORY - records made in the travel diary about observables in games (STAGE II - THE OBSERVER) were resumed in light of the studied theories to identify knowledge constructed about them. The "model" for assessing games, was resumed to verify the need enlarge it.

For the four subsequent meetings the proposal (created by groups) was to play (test) the games developed by them according to the "model" for assessing games. Moreover, to identify elements of theories studied in the semester the proposal was also to observe subjects playing games.

Analyses, Results and Final Thoughts

Upon the description of the experience design, the main results, show that the design-cognition relationship in the teaching process, mainly linked to Hybrid Multimodal Coexistence Spaces in the gamification perspective, occurs insofar as the teacher together with students shape these coexistence spaces, where the other is recognized as legitimate in the interaction and, therefore someone with whom they can learn.

A coexistente space is shaped in the educational context, from a space that is the teacher's in interaction with students' spaces, where both spaces students must move in a constant permeability, where both are co-learners and co-teachers at different moments.

So, there is the possibility of transformation of both, in this coexistence, which comes into being in the collaborative and cooperative construction and significantly contributes to learning. In the case of teachers, this learning, understood as meanings making, occurs in the teaching process itself, while this is shaped. However, this is possible only if the educational relationship is based on the principle of trust and legitimacy of the other in interaction.

Therefore the establishment of a hybrid multimodal coexistence space rose from: 1) integration of different analog and digital technologies, favoring different ways of communication, from a multimodal perspective (physical presential modality combined with online modality, including elements of mobile learning, ubiquitous learning and gamification learning); 2) flow of communication and interaction among subjects in this hybrid multimodal space and; 3) Flow of interaction between subjects and different means, namely the hybrid and multimodal space itself.

Thus, a Hybrid Multimodal Coexistence Space presupposes basically a type of interaction allowing subjects, to shape it collaboratively and cooperatively, through their living and coexisting.

From the point of view of teaching, instead of providing a sequence of activities related to teaching cognition in digital games, design experience presented earlier was built. The main goal was to encourage exploration, the experimentation, interaction of theoretical concepts, from the very student learning, with digital games in education, in its multiple perspectives, namely: - educational games; commercial games explored in different learning contexts; creation of analog, digital, and hybrid games, construction of interactive narratives, and the gamification, in a hybridity and multimodality context, including mobile devices, geolocation, mixed reality, augmented reality, Web Conferencing, Virtual Learning Environment, Social Media, among others. This exploration, experimentation and experiences of students, encourage meaning making signification, and therefore learning necessary for developing skills linked to the academic activity in question.

From the point of view of teachers it also allows, the exploration, experimentation and experience of new didactic and pedagogical possibilities, linked to a context of hybridity and multimodality, encouraging meaning making, the signification, and, therefore, learning necessary for developing technical, didactic and pedagogical skills related to current teaching allowing even creation of new methodologies, practices and pedagogical mediation in teaching action-reflection-action process, which occurs as one cartographer the process . Thus, being an active constructor is essential for the teacher to make meanings for an innovative practice, precisely because then s/he "is in the situation" and therefore s/he can speak "from inside", from his/her own learning process.

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