Applying DMC in a gamified teacher training course on gamification

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Abstract— **This paper deals with the Dynamics, Mechanics and Components (DCM) implemented in a gamified language teacher training course on gamification. First, the DMC framework is established and then a description of its design and implementation is included together with the teacher trainees' perceptions of how the DMC elements were encountered during the online phase of the course. The analysis shows that the dynamic of narrative is central and glues together the gamification elements of the course design, and the mechanic of cooperation predominates throughout the course. Both of these elements were highly valued by trainees.**

Keywords—gamification, course design, teacher education, DMC framework

I. INTRODUCTION

Gamification is an approach to foster motivation, engagement, learning, or problem-solving activities in non-gaming contexts [1]. The fundamental idea of gamification is to apply game design elements in non-game contexts [2] such as in education. Typical game elements are levels, points, badges, leaderboards, or avatars [1], [3] which are meant to entertain players and can help to provide the appeal of games for the engagement of students in learning tasks. This paper will focus precisely on these elements of gamification which supposedly contribute to gameplay and lead to a successful gamified learning experience.

To gamify learning experiences is not an easy task. On the contrary, the intertwined elements that are involved in the design make it challenging and time-consuming but very worthwhile in terms of raising students' motivation. It is the interaction between different elements which constitute powerful gamification environments [1]. In any gamified design, not only should the provision of meaningful goals be present but also coherent game elements that provide novelty, encounters of surprising elements, opportunities for action, and constant feedback about the progress, together with the provision of information in the form of narratives to help enticing curiosity and thus raising motivation and engagement.

It is in the selection and implementation of the game elements where the secret of a successful gamified learning experience lies. Therefore, this paper wants to examine the selection and implementation of the game elements on a gamified teacher training course on gamification. This play-within-a-play approach of designing the course helped teacher trainees to have not only meaningful information on the topic but also to experience a meaningful gamified model in which some of the elements were integrated to serve the purpose of exemplification.

There is no agreement on the classification and description of game elements [4] and there are several design frameworks of gamification such as Mechanics, Dynamics & Aesthetics - MDA [5], [6], Mechanics, Dynamics & Emotions - MDE [7] and Dynamics, Mechanics & Components - DMC [3], [8]. The latter is the framework adopted in the design of the course and will be described in the following sections.

II. THE KEY ELEMENTS OF GAMIFICATION: DYNAMICS, MECHANICS AND COMPONENTS

In any gamifying process, the elements of a game act as the essential particles of the design and planning of a gamified activity. These elements are the basis of all gamified systems and have their origin in the basic triad of game design proposed by Hunicke, LeBlanc and Zubek [5]: mechanics, dynamics and aesthetics (MDA) that form the core of gamified design and shape the playful experience, both from the point of view of the course designer and the end user. The MDA model was revisited by Werbach and Hunter [3], [8], who propose a specification of the elements that can configure a gamified system distinguishing between dynamics, mechanics and components (DMC) ranging from the abstract (the dynamics) to the concrete (the components); being the mechanics the elements in-between. The hierarchy that is established between the different elements is significant to create and design coherent gamified didactic tasks. By moving between these three levels of abstraction, teachers can conceptualize the dynamic behaviour and interconnectivity of the gamified system.

Firstly, dynamics, which do not have a direct application in the gamified system, are characterized by being elements that make up the reality of the gamified activities and provide the motivation that moves the players to participate, Werbach and Hunter [3] indicate five dynamics elements: *Constraints, Emotions, Narrative, Progression, and Relationships*.

Secondly, mechanics are the basic processes that drive users to engage with the content and help continue the action forward. In this sense, the mechanics are the fundamental

elements to foster the necessary motivation to carry out the action involved, to advance in the gamified system and to become engaged. Werbach and Hunter [3] establish ten different mechanics that may be involved in all gamified action: *Challenges, Chance, Competition, Cooperation, Feedback, Resource Acquisition, Rewards, Transactions, Turns*, and *Win States*. Whichever mechanics element is chosen as part of the gamification system must match the objectives and goals of the learning task.

Lastly, components are the specific manifestation of the mechanics and are used to achieve the objectives that are established in the dynamics involved. There are lots of components in a game or a gamified system but Werbach and Hunter [3] underline fifteen representative components: *Achievements, Avatars, Badges, Boss Fights, Collections, Combat, Content Unlocking, Gifting, Leaderboards, Levels, Points, Quests, Social Graphs, Teams* and *Virtual Goods*.

From this list, there are three key components, Points, Badges and Leaderboards (PBL), which are commonly used for helping motivate learners. Some authors, however, consider that the PBL are not enough to keep motivation in a sustained way beyond a specific gamified activity [9], [10] since they only affect the extrinsic motivation of students. In this respect, Marczewski [10] talks about two types of gamification: thin layer or deep level. The first one refers more to entertainment than engagement, which is precisely the objective that the deep level gamification aims at. When designing a gamified learning experience in which real engagement and problem solving are present, a more holistic approach is needed and other play elements beyond the PBL must be integrated to strive for long term deep level gamification.

III. OBJECTIVES AND METHODOLOGY

The analysis which is undertaken in this paper is the basis for any subsequent studies the research team[1] can carry out [11], [12] as the design of the course determines all the actions taken in relation to gamification processes by its participants during and after the course. Therefore, the objectives of this paper are to outline which dynamics, mechanics and components were implemented in the course design, to describe how they were applied, and to report how they were perceived by the teacher trainees after the first phase of the course.

The data reported on here was collected during the first iteration of a wider project that adopts a Design Based Research (DBR) approach [13] which serves a twofold purpose. On the one hand, DBR is used to analyse the innovation of a gamified teacher training course and make improvements to the course through a series of iterations. On the other hand, the project intends to encourage teacher trainees to introduce innovation into their own teaching practice and equips them with a means to analyse it.

Data in this study was collected in the form of pre-course and end-of-course questionnaires, observations from the online course, and qualitative feedback from tasks in face-to-face sessions. The pre-course questionnaire focused on demographics information, previous experience in teaching, gamification and new technologies as well as course expectations. The post-questionnaire focused on motivation, group dynamics and participant perceptions of the different gamification elements employed during the course. The data collected in the context of the study was also used as input for the improvement of the course–design for the next edition being offered in the fall semester of 2017.

IV. CONTEXT OF THE STUDY: COURSE DESCRIPTION

The course "Gamelex: gamification in foreign language teaching"[2] was offered between October 2016 and June 2017. Registered participants were 34 foreign language teachers from the Escuelas Oficiales de Idiomas (EOI)[3] in Catalonia. The majority of the trainees had ample teaching experience (average 18h.) but none of them had previous experience in gamification neither as students nor teachers. It should be noted that while most of the trainees had experience in using games in class, less than one quarter of them engaged regularly in games in their personal time. However, trainees' personal experience with playing games did not influence the way they design their gamification proposals [11].

The course was delivered in a blended-learning format in two phases. The first one was a five-week online component that took place between October and November 2016 with a face-to-face session at the end. In the second phase, trainees implemented their own design and attended a last session to present their gamified teaching experiences at the end of May 2017. The current analysis of the DMC refers to the design of the online course and its implementation in the first phase.

The online component was hosted in the Moodle on the online platform of the ICE - University of Barcelona. There are three different areas in the course interface: on the right hand lateral part, participants find resources and useful information (the hangar) and communication spaces (forums); the calendar is on the left-hand side and finally, in the central area are the contents of the course split into eight different sections, the introduction of the course, the space shuttle and six planets

Figure 1 is a screen capture of "Elemte", the third planet of Gamelex.

Fig. 1. Third planet of Gamelex

• First mission: visual synthesis in "Padlet".
• Resources on pdf to carry out the first mission.
• Second mission: Write report in Drive Docs.
• Inclusion of surprise material (video on PBL by Kapp)
• Modification of second mission dateline.
• Message of success in the accomplishment of the missions.
• Second mission feedback.

The course design was organized into three phases which at times took place simultaneously. The three phases were: a) definition of objectives and content selection; b) learning design sequencing; and finally, c) definition of gamified elements of the course, including illustration features. A team based approach was adopted with a multidisciplinary team which included experts in gamification, instructional design, technology-enhanced learning, foreign language teaching and illustration/graphics. The design process, which was a more complex task than initially expected, through a number of iterations allowed for a gamified experience of both theoretical and hands-on principles of gamification as a pedagogical approach.

The premise of the narrative line for the course is the following "In the Gamelex Galaxy a vaccine that can cure difficulties in language learning has been developed. Your mission is to travel to Gamelex to get the formula for this vaccine." The course has seven levels, the introductory level in the space shuttle and the other six conceptualized as planets which are becoming visible as participants complete the previous level. On each of the planets the learners face an alien who pose a number of missions in order to get their part of the vaccine formula. The formula is encoded in a rare code which changes throughout the intergalactic journey. As well as formula fragments, learners can also gather clues to decipher the alien message when they complete successfully a mission.

From top to bottom in figure 1 the following gamified components of the course can be identified:

• Image of the third planet: "Elemte".
• Alien Avatar.
• Message in "elemtian", language similar to Spanish but triples the occlusive sounds (p, t, k) and the r at the end of words.
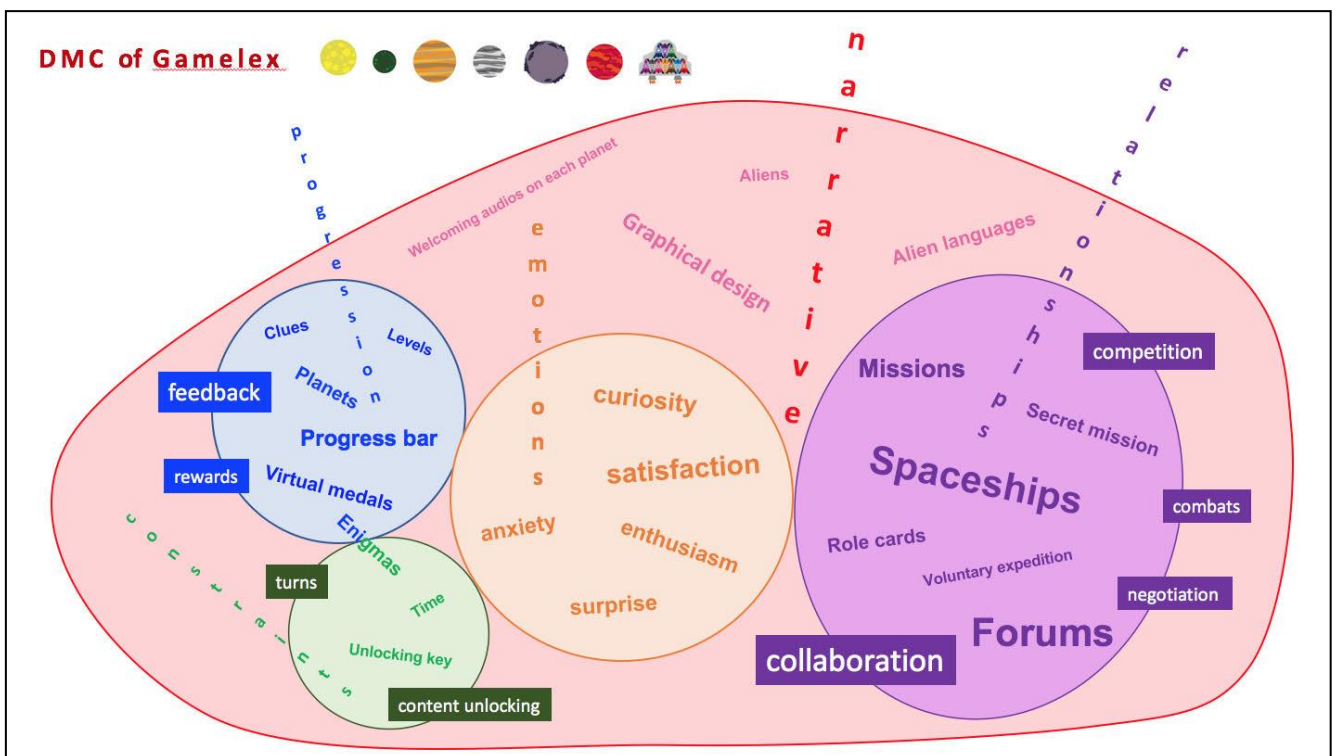• Request of the key to unlock Elemte's missions.

Fig. 2. Visual representation of the analysis of DMC in Gamelex

The missions to be completed in each planet varied depending on the learning objectives. For instance, some missions involved the revision of bibliography in order to compile a visual in the form of an infographic; in other missions, participants were required to formulate questions for a *Socrative*[4] quiz. All these tasks had a twofold objective: familiarizing learners with the main principles of gamification as well as gaining hands-on experience in the use of online tools that facilitate the implementation of gamification in the teaching and learning of foreign languages in the classroom.

V. ANALYSYS OF DMC IN THE GAMIFIED COURSE

The Gamelex course employs a variety of DMC which are analysed in this section along with participants' comments on these. Figure 2 shows the gamified elements in the course, using font sizes to indicate degree of importance, using different colours and round shapes for each dynamic and using square labels for mechanics. Some components refer to more than one dynamics shown as intersections in the illustration.

As mentioned above, the narrative of the course places the participant in an intergalactic journey in search of a vaccine. This narrative framework provides unity and coherence to the activities in the course while also fostering the curiosity and engagement of the participant during the process of learning.

The course includes restrictions related to time assigned to the completion of a mission and the distribution of the roles within this mission. Different time periods are set depending on the complexity of the mission, and varying roles for each member are assigned from mission to mission. In addition, the third planet activities are locked and participants must have previously gained a key to be able to access them. When arriving at the third planet only learners who in their roles as crew members had volunteered to the additional expedition in the first planet were in possession of the key needed to unlock this planet. Most participants perceived this unexpected change of rules negatively as expressed in the following comments:

feeling of deceit

UNFAIR change of rules, if an activity is optional it should not be made compulsory.

In respect to relationships, the course is designed around collaborative group work. The use of PBL was intentionally set aside and emphasis was given to group work and collaboration in order to foster a deeper level of gamification experience. This was well received by participants:

A LOT OF FUN! Working in a team makes it possible to share the good and the bad!

Nevertheless, a few instances of individual work and competition were also present resulting in prizes such as clues or medals.

Emotions such as surprise, curiosity, anxiety, satisfaction or enthusiasm are expected to emerge from the design of the course. However, the level of euphoria and anxiety that some

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[4] *Socrative* is a classroom app for fun, effective engaging tasks: https://www.socrative.com/

participants reached was beyond our initial expectations. For instance, some technical problems with the use of Socrative prompted lots of messages expressing anxiety.

Regarding mechanics, the importance of cooperation to the course has already been mentioned above. Likewise, negotiation within work groups was also key in working together in producing texts, infographics, reports or quizzes. It was precisely the type of outputs required to complete the missions that caused a delay in feedback provision since all the missions except for one feedback was provided hours after submission, or even one day later in some occasions. The fact that feedback was not immediate seemed to reduce the expression of stress in the forums leading to a more relaxed, calm atmosphere in which to face the following challenge.

The prizes awarded during the course are virtual medals which are displayed in the winners' Moodle profiles. It was decided not to announce when a mission included the possibility of winning a medal with the purpose of focusing participants' attention on the actual task they were carrying out rather than on external rewards. Participant perceptions of these prizes were varied:

I was thrilled to get them

very motivating

not bad, semi-motivating but could do without them

they don't say anything to me

I don't like them at all!

These different perceptions suggest that it may be necessary in the future to revisit the role of medals and other prizes in a new edition of the course.

As far as gamified components are concerned, it should be noted the ones linked to the narrative such as the planets, the aliens and their alien languages were well received by the learners:

They help you get immersed in the game

Brilliant! All details carefully taken care of make you get involved

Fun idea to help you get into character

However, there were other components which went unnoticed, such as the audio recordings of the alien messages that greeted spaceships every time they arrived to a new planet. It is possible these components were overlooked because of a) the presence of an accompanying audio file was only indicated when moving the cursor over the image of the alien; b) the photo of the alien was also accompanied by a welcome written text.

Amongst the most valued components there are also the spaceships, role cards and forums. Participants expressed their enthusiasm for the spaceships (groups) on the grounds that they were able to work with participants they already knew, or that they did not feel alone during the course:

I honestly don't think I would have had such a great time had I not previously known the other members of my group

GROUP WORK WAS THE BEST PART OF THE COURSE!!!"

In relation to role cards opinions differed from positive to less positive comments:

THEY FORCE YOU TO DISTRIBUTE TASKS AND STIMULATE PARTICIPATION

they help you get better organized and feel part of the group

they didn't help much

Good idea, but could have been better implemented

Overall, trainees value the idea of roles but point out the fact that the implementation in the course could be improved. Finally, the forums were more valued as spaces of social interaction rather than tools for the coordination of group work.

The organization of the course into planets was successful in transmitting the idea of progression to the students and the progress bar placed at the top of the course site was useful for the participants to be aware of where they were and more importantly to them, how much was left to finish the course:

It's good to see the progression. Fun

It encourages to continue travelling

VERY INTERESTING. I like that the progress is so visual!

Finally, we mention here the components that presented most difficulty for the students and therefore were least valued by them. Enigmas and clues were included by the course design team with the intention of capturing the interest of participants. However, and despite the fact that they had been piloted with similar groups of learners, the enigmas turned out to be of excessive difficulty for most of the participants. In addition, participants reported being so busy, and at times overwhelmed while trying to complete the missions that they were not able to dedicate time to decipher the enigmas the aliens had posed during the journey. These are certainly aspects of the course that will have to be better attuned to the learners' abilities and time availability in future editions of the course.

VI. CONCLUSION

All of the three elements, dynamics, mechanics and components, employed in the Gamelex course contributed towards the development of a game-like narrative that was central to participant engagement and motivation. An intergalactic journey to several planets in colourful spaceships involving missions and enigma deciphering had participants engaging in collaborative work, negotiation of meaning and decision-making over theoretical principles of gamification. At the same time, teacher trainees were leading actors in a deep level gamification experience.

By and large, group work and collaboration prompted the most positive perceptions. Components closely linked to the narrative were also highly valued, crew member roles, spaceships, planets and missions all worked towards the

immersion in a story that motivated learners to keep progressing. PBL elements, nonetheless, failed to engage trainees; perhaps not surprisingly since the team designing the course intentionally steered emphasis away from them.

Aspects that got negative reactions included the lack of control over time management in group work given that missions were only disclosed as they progressed throughout the course and the deception involved in the unlocking of the third planet (an initially optional activity became a required one at a later stage). Interestingly, these both involved an element of surprise that is usually highly valued in gaming. The academic context outweighed the game appeal. Indeed, the element of surprise worked differently in this course where task completion and a positive evaluation are perceived paramount for a successful academic accomplishment.

From the student end-of-course questionnaire it also became very clear that the graphical design and illustrations backing up the narrative were key for the immersion of students in the narrative flow and subsequent engagement. The quality of the illustrations is important in a context in which learners have had previous experience with high quality visuals in gaming. Likewise, in relation to technology, the affordances of the communication tools available in Moodle fell short of expectations at times requiring more immediacy. This leads to our conviction after the experience that the multidisciplinary team approach for the design of the course contributed towards the success of the course. Illustration, technology, pedagogy and gamification features all need to be working together for a positive learner experience. Gamification requires not only expertise in several knowledge areas, but also a strong creative process if the DMC elements together with the narrative are to hold throughout the course. Such creative process is always best developed in a collaborative atmosphere that includes different perspectives and diverse affordances.

To sum up, the Gamelex course is valued positively and a second edition is under preparation which will include improvements coming out of this first experience following the DBR principle of iterative cycles of testing and refinement to enhance implementation.

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