CAN MOODLE BE USED FOR STRUCTURAL GAMIFICATION?

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Abstract

The use of the information technologies is nowadays more and more common in the learning-teaching process. As a consequence, the research on instructional design has been reactivated paying special attention to its adaptation to this new digital world. Task based instruction has proved to be effective for customized systems and student-centred learning. In these models, the motivation and the active role of students are definitely the key. In fact, this is one of the main challenges in education and, in particular, in online education. Precisely, motivation, progressiveness and instant feedback are the pillars of gamification. This fact makes gamification a promising research line in education. Gamification can be approached in two different ways: structural and content gamification. Besides, we have access to the appropriate technology that can make these pedagogical theories come true, creating real technological learning environments. Despite being conscious of the inconveniences they still have, teaching platforms are widely used in the educational world nowadays. In this paper, Moodle has been analysed in order to study its suitability to implement structurally gamified teaching proposals. It has been identified what can be done with the existing tools and what new functionalities could be added for a successful approach to gamification, taking into account that the main aim is to maximize learning.

Keywords: Instructional theory, task based instruction, learning platforms, gamification.

1 GAMIFICATION AND EDUCATION

1.1 Active learning

Learning is a vital ability of human beings. Teachers can create an environment to support learning, but in this case, the learner should take the active role. Student's motivation and compromise are the key points in learning process. It does not matter teacher's work; if the student does not work, he or she does not learn. Moreover, we know that each learner has particular skills and learns in different ways, with different paces and even could have some intelligent features more developed than others [1, 2]. Technology can definitely help us to personalize instruction and achieve active implication of students in their learning.

"One-size" teaching, coming from the industrial era and series production, is not appropriate for the digital world [3]. As Reigeluth explains [4, 5] it is necessary to define a new instructional paradigm for the Information Society. Reigeluth instructional theory is learner-centred, and student progress is based on learning rather than time. This model is supported by Merrill's work, who proposed that there is a set of five prescriptive instructional principles that enhance quality instruction [6, 7]. These principles have to do with task-centeredness, activation, demonstration, application and integration.

All human activity is carried out taking into account the reward earned once done (motivation) [8, 9]. Intrinsic motivation is particularly important in the information age paradigm, in part due to importance of lifelong learning. Given that, the learners' appreciation of learning is crucial. According to Csikszentmihalyi, when the challenge is appropriate to our abilities we are in the state we call flow [10]. If the challenge is too difficult for our abilities, we get into anxiety. And, finally, if the challenge is too easy for our abilities, we get bored. The way to overcome anxiety is improving our skills. The way to overcome boredom is to face more difficult challenges. Learners should be placed in their flow state, and step by step, as long as their skills improve, the difficulty in challenges should be increasing, and vice versa. In order to enhance the intrinsic motivation, learning by doing should be included in the learning methods. In other words, using interesting task for students and provide opportunities to collaborate. This makes especially important task based instruction [11, 12]. We use this term in the widest sense, including learning based on projects, problems, topics, cases and questions. Intrinsic motivated students choose and do activities just by curiosity or by the challenge they suppose; intrinsic motivated students are ready to make a significant mental effort during the

task, to be committed to richer processing and to use deeper and more effective learning strategies. On the other hand, extrinsic motivated students are only committed to activities when they are externally rewarded (getting good marks, recognition by other, avoiding failure, etc.); in addition, it is also possible that these students choose easier tasks to assure the reward. Generally, extrinsic motivation is easier to induce than intrinsic motivation. This is the reason why teachers work, mainly, extrinsic motivation. But, idealistically, the goal of an extrinsic motivated instruction should be to become the beginning of an intrinsic motivated instruction. This is the only way to make lifelong learning come true, taking into account that we live in an extremely changing and uncertain high-tech society.

However, all this transformation in the educational world will require advances in both theory and technology. New proposals to teaching have emerged, using new technologies although they are based in old pedagogical principles. Flipped classroom or reverse teaching emerge for blended learning system where students get knowledge by watching online videos at home and, later on, doing activities, problems and debates in the classroom helped by teachers [13]. This is an integrated approach combining direct instruction with constructivism methods helping students to be committed in the course and improving their conceptual comprehension. It is usually combined with just-in-time teaching (JiTT) [14] that allows teachers to get feedback from students the day before the lesson so that teachers can adjust the lesson flow preparing new strategies and activities centred in students' difficulties to understand the content. Therefore, before the lesson takes place, students are assigned videos and readings and they answer some online quizzes to know their actual situation. These techniques allow teachers to apply student-centre learning methods.

As we have already stated, on one hand IT provides massiveness but also customization, allowing teachers to pay attention to students' diversity, fostering an adapted, progressive and autonomous learning process in students. At the moment, it seems that Massive Open Online Courses (MOOC) are taking the lead although there are important gaps both in the pedagogical and business model. We can learn from these new experiences in order to apply them in our lessons (transfer from *massive* to *small*): active-learning, in their own pace, with instant feedback, gamified and taking advantage of peer learning.

1.2 Technological ecosystem for learning

Technological progress, particularly in information and communication technologies (ICT), has led us to a digital world where we have tools that connect with others and foster collaboration, tools that make less hierarchical team work easier and, finally, tools that allow us to create social networks. In our every day, we are used to receiving information from several different sources, in different formats and in different media and instantly. Nowadays, university cannot be set aside to the constant technological evolution and, particularly, the learning-teaching process must reflect directly this technological evolution [15]. Using technology in teaching offers new possibilities, complementary to traditional teaching. There are two key aspects to be considered in quality teaching using technology: teaching methodology and the technological platform. Some pedagogical points have already been addressed in the previous section. Now, we are going to study technological aspects.

The increasing complexity of ICT and the high use in all areas, make necessary we address technological aspects from an integral point of view, understanding problems, challenges and paying attention to the increasing importance of ICT developing strategies, implementing and managing. The main aim should be to improve the overall efficiency and profitability in the organization using ICTs. Switching to a digital world requires reengineering all the process and even rethinking the aims. Rogers analysed why some ideas and products become new trends while others become out-fashioned quickly. He proposed his diffusion of innovations theory [16], where he states different user categories (innovators, early adopters, early majority, late majority and laggards) following a normal distribution. According to Moore [17] one innovation succeeds when crossing the chasm and it is able to reach majorities (early majority at the beginning and late majority afterwards). Another feature of technological innovations is that early users drop out new products as soon as the mainstream accepts it and the new innovation appears. Gartner hype cycle [18] provides a graphic representation of maturity and adoption of technologies, and how they are potentially relevant to solving real business problems exploiting new opportunities. Each hype cycle drills down into the five key phases of a technology's life cycle. It starts with a trigger where a new technology breakthrough kicks things off reaching a peak of inflated expectations. Later on, interest wanes as experiments and implementations fail to deliver, falling in disillusionment. Then, second- and third-generation products appear to get the slope of enlightenment. Finally, plateau of productivity is reached. Forecasting the

way a technology spreads means to foresee a high level of passing trends and social contagion, which we can even consider not useful from an objective point of view of the technology (*information cascades*) [19]. Practices that rely on ICT in this global world, connected and complex and increasingly recursive, are usually featured by behaviours like the Black Swan [20], not the behaviour of a normal distribution we are used to. But changes in the education world cannot depend on trends nor continuous changes since the effects can only be assessed in a long-term. Therefore, serious research works are needed about the use of the new technologies in education and their behaviour.

An increasing number of projects with open educational resources and the strong 'open' movement make creating open and collaborating systems easier [21]. Virtual campuses and LMS tools (Learning Management System), although powerful and useful in the relationship between teachers and students, since the beginning, are basically aimed to teaching management. They are rigid with communication flow, limiting the interaction possibilities. Therefore, they are being increasingly complemented by other tools, in the internet or given by the institution, creating a technological ecosystem for learning. There is a long list of technological tools that can be used for learning [22]. But this is not a matter of focusing in learning with a technological tool; this is about teachers finding a tool that suits their way of teaching, creating a learning environment. The integration of different tools let us create technological ecosystems for learning, going beyond the mere accumulation of trendy technologies [23, 24]. An ecosystem consists of a community of living organisms interacting with each-other and growing based on physical factors in the environment. By analogy with this definition, a technological ecosystem is defined as a community of educational methods, policies, regulations, applications, and work teams that coexist so that their processes are interrelated and their implementation is based on the physical factors of the technological environment [25].

In the past, that is, at the beginning of using information technologies in education, automation was the point that led to develop learning management systems (LMS). Nowadays, integration is the main point: connecting and establishing relationships between the different emerging tools that are useful in our task as teachers, creating what we call technological ecosystems. The analysis of the behaviour of the technological innovations and the advances in cognitive science and education show that, in the near future, personalization and adaptability will be the main features in information technologies in education [26].

In the meantime, Moodle comes (Modular Object-Oriented Dynamic Learning Environment). According to its developer community [27] the design and development of Moodle is guided by "social constructionist pedagogy". This research is based on theories of constructivist [28] and constructionism [29]. From a constructivist point of view, people actively construct new knowledge as they interact with their environments. Everything you read, see, hear, feel, and touch is tested against your prior knowledge and if it is viable within your mental world, it may form new knowledge. Moodle favour the interaction between different users by using forums and creating new knowledge. Constructionism asserts that learning is particularly effective when constructing something for others to experience. Moodle allows users to create knowledge and make it available to the rest, making you feel your work is useful. Social constructivism extends constructivism into social settings [30], wherein groups construct knowledge for one another, collaboratively creating a small culture of shared artifacts with shared meanings. Static task and shared task enrich the group. Separate behaviour and connected behaviours, too. Both behaviours, the one of someone defending his own ideas and the behaviours inside a group, which allows a deeper reflection, are possible in this platform, allowing the user to choose in each moment the appropriate behaviour.

Consideration of these issues can help to focus on the experiences that would be best for learning from the learner's point of view, rather than just publishing the information you think they need to know. It can also help you realize how each participant in a course can be a teacher as well as a learner. Your job as a teacher can change from being 'the source of knowledge' to being an influencer of learning in class, connecting with students in a personal way that addresses their own learning needs, and moderating discussions and activities in a way that collectively leads students towards the learning goals of the class. Moodle does not force this style of behaviour but designers believe that it can be support it.

1.3 Gamification

There are many and different lines of research connecting videogames and education. [31]. Videogames have changed the way our youth conceive reality and interact each other [32, 33]. The videogame industry is one of the highest in turnover volumes and increasing sales in recent years. In addition, videogames are used in learning in what we call game-based learning and as learning

objects in what we call serious games or educational videogames [34, 35]. But one of the last emergent trends is the application of the techniques and tools used to design videogames in other fields than leisure time, what is known as gamification [36]. Applying gamification to education is one of the most promising lines of research nowadays [37].

Gamification was included in Gartner hype cycle about *Emerging Technologies* 2011. In 2012, it was included in the peak of inflated expectations, expecting to get the plateau of productivity in a period between five and ten years. In 2013, gamification was considered in the peak of expectations but falling in 2014 in trough of disillusionment. Gartner consulters in their report *Gamification 2020: What Is the Future of Gamification?* [38], published in November 2012, were already considering that gamification was going to get to trough of disillusionment in 2013 and 2014, mainly because it is difficult to understand the design of videogames and the strategies that motivate players, resulting in fake applications of gamification due to superficial applications of the concept. They even forecasted for 2014 that 80% of applications based on this philosophy would fail to satisfy business needs due to a bad design. However, the correct application of the videogames principles will have a strong impact in many fields, becoming a transforming force together with other emergent technologies. As the report The Future of Gamification of Janna Anderson and Lee Rainie of the Pew Research Center says [39], "if the enjoyment and challenge of playing can be embedded in learning, work, and commerce then gamification will take off".

Education is one of the fields where gamification will become a disruptive innovation, and mainly in tech-based learning (eLearning) and lifelong learning. NMC Horizon Report is a series of publications designed to help teachers and educational staff to understand emerging technologies and also effects in learning, teaching and research; from a global point of view taking in consideration the next five years. According to *Horizon 2013* [40], gamification is one of the two technologies experiencing growing interest in education in a mid-term (two to three years). The report states that using gamification and games in a wide way are two sides of the same coin. It also proposes the further refinement of learning analytics. Their impact will be even bigger if they are approached at the same time, that is, games and gamification as gathering information platforms that feed data systems analysis (*educational data mining*). Using the results of this analysis allows us to adapt the educational gamified proposal to learners' special needs and pace in learning. The new revolution of educational software will come from applications learning the learning needs of the user and, so, adapt their advance to a custom pace, what we call adaptive learning.

Therefore, as international referenced reports say, we can conclude that the following years are crucial worldwide to determine if gamification, particularly its correct application to different experiences, will be able to consolidate the great expectations on it, in general, but also in education in particular, where it is expected that these years are the key point. That is why high doses of both research and clear justification of using gamification techniques are necessary, based on quality indicators. A lot of analysed experiences, reports and aspects reflect the interest in gamification, but the evidence and, perfectly clear for experts, is that we are in front of the first steps, just isolated items that overlap, but, in the end, not facing the core of gamification: gamifying all the learning process. Reengineering the whole process is needed, taking into account since the beginning the principles of gamification in order to design a successful gamified experience. Nowadays, according to Kapp, there are two types of gamification: structural gamification and content gamification. Structural gamification is the application of game-elements to propel a learner through content with no alteration or changes to the content itself. The content does not become game-like, only the structure around the content. Content gamification is the application of game elements and game thinking to alter content to make it more game-like.

2   MOODLE AS AN ELEARNING PLATFORM USING STRUCTURAL GAMIFICATION

Moodle is maybe the most used open source LMS nowadays. Many universities, companies and schools provide their teachers with this tool. Moodle is also very popular among teachers because it is free and, moreover, because teachers can create their own online courses. In addition, as there is a big community supporting Moodle, Moodle community tries to allow teachers to follow new trends in education, such as gamification. In other words, Moodle has evolved since 2002 as eLearning challenges have evolved since then.

In this article, as we have already stated, we are interested in how to apply structural gamification to eLearning using a tool like Moodle. Structural gamification focuses in the application of game-

elements in the learning process in order to motivate learners, taking into account that we do not modify the content. Motivation is the key concept when learning and games designers know how to engage players. Therefore, the main aim when gamifying in Moodle is importing game-elements to our online courses. As Moodle is widely used, if Moodle could apply gamification, Moodle would allow millions of teachers around the world to use gamification in their courses for free.

There are plenty of game-elements to use but, as learning should focus on students, game-elements in Moodle should motivate and engage students, not distract them. Student-centred learning should provide instant feedback and allow students to keep their own pace while learning, this is called progressiveness. Moodle includes tools to gamify a course, but setting a Moodle course is more than setting badges or conditions, it needs a plan or story for the students.

Eventually, the features we desire for online courses using gamification are:

- Progressive learning: adapted levels, "maps" to explore the learning, progression bars.
- Social: share activities, comments between teachers or students, social use.
- Instant feedback: remarks, suggestions, hints.
- Rewards: points, badges, leaderboards, certificates.

Latest versions of Moodle (>2.5) provide core (embedded) tools to deal with these features:

- Viewing conditions resources: restrict access.
- Conditions to activity completion.
- Badges and labels.
- Grade book.
- Activities: quizzes, assignment, workshops and lessons.
- Other activities: surveys, choices, forums and chats.

2.1 Core elements in Moodle for gamifying

2.1.1 Viewing conditions resources: restrict access

It allows activities to be greyed or hidden until some requirements are accomplished:

- Activity completion: require students to complete (or not) another activity, even with a pass grade.
- Date: prevent access until or from a specified date and time
- Grade: require students to achieve a specified grade.
- User profile: set conditions depending on the language or country, etc.

Activity completion should be enabled by Moodle administrator on the site. There are two features in advanced settings called "Default completion tracking" and "Enable conditional access". It also has to be set in the Course completion settings. Activity completion is what we can use to set maps to explore the content, including Easter eggs, and set different levels. This feature is available for all the activities and resources we add in the course.

2.1.2 Conditions to activity completion

The combination of conditions to restrict access to an activity and the condition to activity completion builds a strong system to create several learning levels and implement scaffolding in education.

It shows a completion tick box to show if the activity is completed or not. It is also available for students to manually check the activity (in case teachers allow it). Activity completion is available for all the activities and resources we add in the course.

2.1.3 Badges and Labels

To inform about achievement, labels and badges can be used. Badges are new in Moodle 2.4 and they should be used to celebrate big achievements and progress. When adding badges to the course, Moodle allows teachers to set criteria, an activity completion rules as well as a message to inform the student why he or she got the badge.

2.1.4 Grade book

Grade books are the tools that Moodle has in order to show grades to students, so grade books are the best way that students have in Moodle to track their progress. Teachers can edit grade settings and allow students to show their rank, which is the position in relation to the rest of the class (similar to a leaderboard in terms of gamification) or the percentage value of each item (similar to a progress bar). Pay special attention when there are hidden items in the course in case we need to hide them too in the grade book.

2.1.5 Activity: Quizzes

This Moodle activity allows teachers to build quizzes with several types of questions: multiple choice, true-false, short-answer questions and others. When setting the quiz, Moodle lets us choose between different types of feedback either in general, in the particular question or in the answer given. The feedback system allows teacher to set a great number of possibilities. Quizzes have a grade, which is available for students in the grade book.

2.1.6 Activity: Assignments

This Moodle activity allows teacher to collect work from students (files), review it and provide feedback in terms of grades and comments.

2.1.7 Activity: Workshops

This Moodle activity allows students to grade other students or carry out self-assessment. They will get two marks: one for the work they sent and the other one for their assessment of the peers' work. Therefore, teachers assess the work and the way students assess. Workshops, in terms of peer assessment, increase student responsibility and autonomy and provide more relevant feedback to students given by other students. Both grades are available in the grade book.

2.1.8 Activity: Lesson

Lessons were the best way to add several learning paths before Moodle 2.0. However, conditions are stronger than lessons, so from Moodle 2.0 on, conditions took the lead creating several learning paths in Moodle

2.1.9 Activity: Surveys, choices, forums and chats

Forum and chat are Moodle activities that allow students' interaction, in other words, forum and chat allow students to socialize in the course. Teachers can also answer questions that students ask in forums. Surveys and choices provide an ungraded feedback from students to teachers. There are only five pre-designed surveys to choose from and you cannot write your own survey at present. The choice tool allows you to ask any question you like, as long as it is multiple-choice question.

2.2 Other Moodle plugins for gamifying

As it was previously stated, Moodle has a big community of teachers and programmers including new functions to Moodle almost every day. These add-ons are called plugins and in some cases they provide interesting game-elements to the online courses. Nevertheless, only the site administrators can install add-ons and it is important to pay attention to the reputation and conditions of these add-ons especially when the site is in production in case they are not stable enough.

There are important previous works, like CICEI conditions from Las Palmas de Gran Canaria University for Moodle 1.9, which became obsolete when Moodle 2.0 included conditions as native. This work is a good proof that Moodle has a big, living and engaged community trying to improve what Moodle offers. Some plugins we recommend to improve structural gamification in Moodle are:

- Level up!: it is a block designed to score points as you are involved in the different activities.
- Progress Bar: it is a block that shows a progress bar to students
- Checklist: it is a block that shows a to-do list to students
- Quiz result block: it is a block that displays the highest and lowest grades for one of the quizzes in the course

3 CONCLUSION

Moodle is an open eLearning platform that provides tools to implement gamification. However, the big challenge is not the way teachers add blocks or conditions, the big challenge is the plan, the story teachers design to engage students in eLearning. We dare to say that this is another challenge for Moodle itself because Moodle is not quite friendly at all setting game-elements so teachers must make a great effort to learn how to set Moodle courses. The risk is that learning how to 'apply gamification' in Moodle hides the important thing: the student-learning-based course.

Regarding the options that Moodle provides in order to apply gamification, we stated that they are appropriate, especially conditions are strong enough to allow teachers to design several learning paths, but we would encourage Moodle developers to implement a visual way to design these learning paths. A visual tool would be interesting since teachers would make an effort thinking in the learning process and not caring about technical details with Moodle settings.

REFERENCES

[1]   Gardner, H. (2000). Intelligence Reframed: Multiple Intelligences for the 21st Century. Basic Books.

[2]   Gardner, H. (2011). "Multiple intelligences: Reflections after thirty years". *National Association of Gifted Children Parent and Community Network Newsletter*: Washington, DC

[3]   Robinson, K. (2013). Finding Your Element: How to Discover Your Talents and Passions and Transform Your Life. Penguin.

[4]   Reigeluth, C. M. (2011). "An instructional theory for the post-industrial age". *Educational Technology*, 51(5), 25-29.

[5]   Reigeluth, C. M. (2012). "Instructional Theory and Technology for the New Paradigm of Education". *RED, Revista de Educación a Distancia*. Número 32, septiembre 2012.

[6]   Merrill, M. D. (2007). "First principles of instruction: A synthesis". En R. A. Reiser y J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (2nd ed., pp. 62-71). Prentice-Hall.

[7]   Merrill, M. D. (2009). "First principles of instruction". En C. M. Reigeluth y A. A. Carr-Chellman (Eds.), *Instructional-design theories and models: Building a common knowledge base* (Vol. III, pp. 41-56). Routledge.

[8]   Rinaudo, M. C., Chiecher, A., and Donolo, D. (2003). "Motivación y uso de estrategias en estudiantes universitarios. Su evaluación a partir del Motivated Strategies Learning Questionnaire". En *Anales de Psicología*, vol. 19, nº 1, 107-119.

[9]   Tapia, J. A. (1995). Motivación y aprendizaje en el aula. Cómo enseñar a pensar. Santillana.

[10]   Csikszentmihalyi, M. (1990). *Flow. The Pshychology of Optimal Experience*. Harper & Row.

[11]   Markham, T., Larmer, J., and Ravitz, J. (2003). Project Based Learning Handbook: A Guide to Standards-Focused Project Based Learning for Middle and High School Teachers. Buck Inst for Education; 2nd Rev Spl edition.

[12]   Villagrá, C. J., Gallego, F. J., Molina, R., and Llorens, F. (2014). "ABPgame+: siete asignaturas, un proyecto". *Actas de las XX Jornadas sobre la Enseñanza Universitaria de la Informática (JENUI 2014)*.

[13]   Ronchetti, M. (2010). "Using video lectures to make teaching more interactive", *International Journal of Emerging Technologies in Learning* (iJET). Vol 5, nº 2.

[14]   Novak, G. N., Patterson, E. T., Gavrin, A., and Christian, W. (1999). *Just-in-Time Teaching: Blending active Learning and Web Technology*. Prentice Hall.

[15]   Illanas, A., and Llorens, F. (2011). "Los retos Web 2.0 de cara al EEES". En Suárez Guerrero, C., García Peñalvo, F. J. (Eds.), *Universidad y Desarrollo Social de la Web* (pp. 13-34). Editandum.

[16]   Rogers, E. (2003). *Diffusion of Innovations* (fifth edition). Simon & Schuster.

[17]   Moore, G. (2014). *Crossing the Chasm, 3rd Edition*. HarperBusiness.

[18]   Gartner, *Gartner Hype Cycle*.
(http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp)

[19]   Friedkin, N.E. and Johnsen, E.C. (2011). *Social Influence Network Theory: A Sociological Examination of Small Group Dynamics*. Cambridge University Press.

[20]   Taleb, N. (2007). The Black Swan. The impact of the highly improbable. Random House.

[21]   Llorens, F., Bayona, J.J., Gómez, J., and Sanguino, F. (2010). "The University of Alicante's institutional strategy to promote the open dissemination of knowledge". *Online Information Review*, 34 (4), 565-582.

[22]   Centre for Learning & Performance Technologies. *Top 100 Tools for Learning* (http://c4lpt.co.uk/top100tools)

[23]   Llorens, F. (2009). "La tecnología como motor de la innovación educativa. Estrategia y política institucional de la Universidad de Alicante". *ARBOR Ciencia, Pensamiento y Cultura*, CLXXXV EXTRA, 21-32.

[24]   Llorens, F. (2011). "La biblioteca universitaria como difusor de la innovación educativa. Estrategia y política institucional de la Universidad de Alicante". *ARBOR Ciencia, Pensamiento y Cultura*, 187, 89-100.

[25]   Llorens, F., Molina, R., Compañ, P., and Satorre, R. (2014). "Technological Ecosystem for Open Education". En Neves-Silva, R., Tsihrintzis, G.A., Uskov, V., Howlett, R.J., y Jain, L.C. (Eds.), *Smart Digital Futures 2014*. Volumen 262 de Frontiers in Artificial Intelligence and Applications. (pp. 706-715). IOS Press.

[26]   Llorens, F. (2014). "Campus virtuales: de gestores de contenidos a gestores de metodologías". RED, Revista de Educación a Distancia. Nº 42. Número monográfico sobre "Experiencias y tendencias en affordances educativas de campus virtuales universitarios".

[27]   Moodle: Community Moodle. http://moodle.org

[28]   Piaget, J. (1985). The Equilibration of Cognitive Structures: The Central Problem of Intellectual Development. University of Chicago Press.

[29]   Papert, S. (1989). "Constructionism vs Instructionism". Discurs of 1989.

[30]   Vygotsky, Lev (1990). *Vygotsky's Psychology: A Biography of Ideas*. Harvard University Press.

[31]   Gallego, F.J., Villagrá, C.J., Satorre, R., Compañ, P., Molina, R., and Llorens, F. (2014). Panorámica: serious games, gamification y mucho más. ReVisión Revista de Investigación en Docencia Universitaria de la Informática). Vol. 7,nº 3, pp. 13-23.

[32]   McGonigal, J. (2011). Reality is broken. Why games make us better and how they can change the world. The Penguin Press.

[33]   Turkle, S. (2011). Alone together. Why we expect more from technology and less from each other. Basic Books.

[34]   Prensky, M. (2001). *Digital Game-Based Learning*. McGraw-Hill.

[35]   Prensky, M. (2006). *Don't Bother Me Mom – I'm Learning!* Paragon House.

[36]   Werbach, K. (2012). For the win: how game thinking can revolutionize your business. Wharton Digital Press.

[37]   Kapp, K. M. (2012). The Gamification of learning and instruction. Game-based methods and strategies for training and education. Pfeiffer.

[38]   Gartner. (2012). *Gamification 2020: What Is the Future of Gamification?* Published: 5 november 2012. Analyst: Brian Burke.

[39]   Anderson, J., and Rainie, L. (2012). *The Future of Gamification*. Pew Research Center.

[40]   Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., and Ludgate, H. (2013). *NMC Horizon Report: 2013 Higher Education Edition*. The New Media Consortium.