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Interactivia.ro – A study of a gamification framework using zero-cost tools

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ABSTRACT

It is a fact beyond doubt that humans, irrespective of race, age or gender, love to play, games being considered a tool for enjoying oneself and relaxing, but also for one's mental and physical development. The present paper addresses the concept of gamification, tightly connected to games and playing. The first part of the paper makes an introduction to this concept, with an emphasis on how it could bring motivation in education and learning. Gamification is considered critically, with reference to some problems that could occur for applications using gamification for learning. The second part deals with the zero-cost implementation process of the Interactivia.ro platform, which uses gamification to develop general knowledge, showing how a playful social experience is doubled by educational usefulness. We developed a list of features required for a successful implementation using open source or freemium modules and we applied them to several modules identified on the market. The statistical analysis of the data resulting from the implementation revealed that gamification increases web traffic. We also highlighted how Interactivia.ro can alter the virtual gamified experience into one applied in real life through partnerships and discounts offered to its users. The final part of the paper presents the conclusions and the possible openings for improving the current business model.

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1. Introduction

Recent years have seen a fast explosion of consumer applications and software that draw on one special category of games, i.e. video games. Usually condensed as “gamification”, this trend associates to a substantial group of existing research and concepts in human-computer interaction and especially in game studies, such as *serious games*, *pervasive games*, *alternate reality games* or *playful design* (Deterding, Khaled, Nacke, & Dixon, 2011).

The gamification concept has been defined as the use of game elements and game-design techniques in non-game contexts to engage people and solve problems (Deterding, Khaled, et al., 2011; Werbach & Hunter, 2012; Zichermann & Cunningham, 2011). As a research term, gamification began to be talked about in the media in October 2010 (Smith, 2011), having roots back in 2008 (Paharia,

2010), when it did not see widespread adoption, though. It has been argued that it aims to use mechanics and dynamics from video games to cause a parallel participation in non-game environments (Wu, 2012).

One of the elements which are present in games and which bear paramount importance for gamification is connected to the fact that games have clear objectives. These objectives can be subsumed to short-term reachable goals that give a smooth feeling of advancement to players, by offering frequent rewards as prizes that act as external motivators. Advances in software development have enhanced games by allowing their users to have instant connection with other players, as well as instant feedback, including rewards.

Gamification could be used in education as a tool to increase student engagement and to drive desirable learning behaviors (Lee & Hammer, 2011). Also, it has been successfully incorporated into commercial platforms, especially in social ones (Domínguez et al., 2013), as a way to define a connection between the platform and its users, while driving viral behaviors on them to increase platform popularity.

Nevertheless, in this context, the literature on gamification does

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not mention free or open source applications which are used for the formal, non-formal or informal education, even though open source is used in companies, universities and other organizations as a business model and not only because it advances science. Open source, seen as business model, together with freeware and freemium, allows its users to use software free of charge, provided licenses are complied with.

The present paper will show exactly how such software can be wisely and meaningfully used to develop educational platforms, so as to enhance users' knowledge and learning. To be more specific, the paper aims at making a contribution to the empirical evidence in the field of gamification by presenting the way a gamified learning environment was designed, implemented and evaluated in a non-formal educational platform for developing general knowledge using zero-cost software. And, given the context of gamified learning, the first aim of the paper is to present the Interactivia.ro platform as one that could be seen as a possible prototype to be used by anyone who wishes to develop a successful gamified web application with minimal or zero costs. But, without any shadow of a doubt, the success of such an application does not entirely depend on the software part, but, to an equal extent, on the content to be provided. We consider it worth emphasizing that this model can very well represent the basis for any potential web content business, bringing significant benefits for its developers. In this context, we designed a framework that could be used for choosing suitable gamification modules in the context of zero-cost tools: we analyzed and paralleled open source and commercial (with freemium business model) gamification tools, taking into account features such as platform and pre-integration, level of integration, integration with social media, analytics, mobile compatibility, widgets, license types and additional costs, active development and their support.

Another aim of our paper is to present the influence of gamification on the daily traffic recorded by Interactivia.ro, as revealed in our research. In this respect, a Multiple Regression model was applied, which showed a significant influence of two important variables as regards gamification: the introduction of gamification on the platform as a dummy variable, and the number of daily actions using the chosen gamification tool. These results were cross-validated using the specialized Forecasting & Time Series analysis software. Thus, at the end of our study, we had the statistical confirmation of our initial hypothesis, i.e. that gamification drives traffic.

Because gamification tools have just virtual features, the last aim of the paper is to show how these features can be brought into the real world by means of an algorithm, as a basis for a potential business model featuring partnerships in the cultural field. At this point it should be noted that the issue of gaming and gamification represents an important topic of discussion at EU level, as UE ICT-24-2016 tries to develop projects that apply gamification features for economic and social benefits (Horizon 2020 – Gaming and gamification, 2015). We consider that, from this perspective, we succeeded in attaining this European goal, although just on a small scale, by means of the Interactivia.ro project and its partnerships with conventional (non-virtual) organizations.

2. Literature review

Researchers consider that gamification is currently determined by the success of videogames, but that it also has sources in different psychological theories for motivational models. According to one such theory, i.e. the self-determination theory (SDT), playing games is the prototypical example for an autotelic, intrinsically motivating activity (Deterding, 2011). According to its authors, the self-determination theory is considered as the most well-

researched psychological theory of intrinsic motivation and it recognizes two types of motivation, extrinsic and intrinsic, with a path or continuum from one to the other (Ryan & Deci, 2000). Intrinsic motivation is the self-desire to look for new challenges, examine one's capacity, perceive and gain knowledge. On the other hand, extrinsic motivation mentions the performance of an activity in order to attain a desired outcome, being the opposite of intrinsic motivation. Based on SDT and on the concepts it develops, *gameful design* should be based on and lead to intrinsic motivation, i.e. the type of motivation in which the activity is rewarding in and of itself. Proposing and giving rewards is a type of extrinsic motivation which can be used to involve participants, but only as an instrument for promoting intrinsic motivation, so as for the activity itself to become the reward (de-Marcos, Domínguez, Saenz-de-Navarrete, & Pagés, 2014).

Given that humans are generally challenged in life with non-motivational activities and that everybody actually likes to play, gamification could be a process to bring motivation in these activities. Education, or the process of gaining knowledge, is a specific area with latent possibilities for the application of gamification, representing a progress from the application of Serious Games (Jorge Simões, Redondo, & Vilas, 2012). In their research, Lee and Hammer (2011) mention part of the motives to start using gamification in education. A good example of this approach in education is provided by the majority of MOOC (Massive Online Open Course) applications, like Khan Academy, Udacity, Codecademy, Coursera and others. They offer free materials and resources (text-pages, videos, images and even programming-learning environments) with the goal of a better education for all. All these platforms include game mechanics such as achievements, badges and points, while providing latest statistics of students' development. Therefore, gamification in the education domain uses game components in learning environments, all based on software applications. In practical terms, the addition of such features to non-gaming applications and services is mentioned as a "game layer" (Deterding, 2011).

Researchers in the field have emphasized that gamification in education is "a serious approach to accelerating the experience curve of learning, teaching complex subjects, and systems thinking" (Kapp, 2012, p.13). In their study, Fitz-Walter, Tjondronegoro, and Wyeth (2012) show that the gamification process is efficient in terms of attracting students in non-curricular activities, while also encouraging positive behavior changes during the tutoring sessions, which leads to an increase in students' involvement and a rise in the passing percentage (Decker & Lawley, 2013). Jorge Simões et al. (2012) presented *schoooooools.com* as a social gamification framework for K-6, with the aim of applying social gamification in education, with the results and validation of that application yet to be presented. Hamari, Koivisto, and Sarsa (2014) reviewed empirical studies on gamification, their research examining the current state on gamification, pointing out that it creates positive effects and noting that these effects are significantly dependent on the context in which gamification is implemented, as well as on those using it.

Gamification is obviously present in many other aspects of our lives, not only in learning, but also in innovation and research (Deterding et al., 2015; Roth, Schneckenberg, & Tsai, 2015), healthcare (Dithmer et al., 2016; Kappen, 2015; Kim et al., 2013), geographic information systems (Bockes, Edel, Ferstl, & Schmid, 2015; Martella, Kray, & Clementini, 2015), engineering (Baalsrud Hauge et al., 2015) and these are only some of the possible examples. Just like in education, these fields also have to cope with challenges related to mainstreaming the application of gaming technologies, design and aesthetics to non-leisure contexts, for social and economic benefits. As mentioned in recent EU calls for

projects, supporting the expansion of applied gaming and gamification will not only create new solutions and methodologies to address societal issues, but it will also help SMEs to seize new business opportunities. Thus, developers should create applied games and, consequently, gamification would be applied more easily, faster and more cost-effectively (Horizon 2020 – Gaming and gamification, 2015).

Nevertheless, apart from the clear positives gamification brings in all fields, there are several authors who have emphasized certain challenges. Thus it has been pointed that gamification, as the apanage of fun and entertainment, on the one hand, comprising simple and repetitive elements, on the other hand, could cause significant prejudices in fields which should stay serious and complex and which should never resort to oversimplified elements (Bogost, 2015, p. 65). Next, it has been underlined that the introduction of gamification in non-gaming contexts is not devoid of difficulty, as it requires both a lot of application from the part of developers, good command of the fields in which they want their product to operate and, more often than not, significant financial resources both at the development and the maintenance stages (Herzig, Ameling, Wolf, & Schill, 2014, p. 431). Then, reference has been made to the real benefits that gamification brings. Thus, it has been pointed out that difference should always be made between the different contexts in which it is used. As stated above, another recent study (Hamari, 2013) shows that gamification is much more efficient when it comes to “hedonic contexts”, whereas “utilitarian contexts” have not yet seen a real boost due to game elements. Another challenge is connected to the diversity of the game elements used. In this respect, Chou (2015) shows that the number of these elements leaves much to be desired, stating that, in order for game elements to have a greater impact on users, developers should go beyond the now traditional points/badges/leaderboards and find other types of rewards which can really make gamification actionable.

Most of the afore-mentioned challenges, as well as others, such as clearly identifying gameful activities that contribute to enhancing intrinsic motivation, detecting designs for improved user experience inside gamified applications or mapping game mechanics to the beliefs and values of the participants so that they could immerse into the “games”, are very likely to be successfully coped with in the future, as reputable specialists see gamification as a very promising field. Its proponents point to the fact that the success it has seen so far especially in the business field (Rapp, 2014) can logically explain an increase in its adoption in the years to come. This seems to be triggered first of all by the continuous development of the game industry, which, according to the same author, has surpassed the film industry entertainment market share. Secondly, the range of people favoring games and game elements has significantly expanded, statistics showing that the average age of game players is 35 or more and that women represent 44% of video gamers (Entertainment Software Association, 2015). Moreover, work on gaming technologies such as augmented and mixed reality, 3D audio and video, virtual worlds, interactive storytelling, narratives, modelling and data combined with learning and behavioral triggers such as pedagogical effectiveness, engagement, creativity, collaborative behaviors and social science aspects related to privacy, gender and ethical issues (Horizon 2020 – Gaming and gamification, 2015) would create gamified activities for enhanced long-life learning. Equally important for the successful future prospects of gamification is the place mobile technology has reached to have in our daily lives and which is on an increase (Peña & Natal, 2014), a fact which gives people more and more the possibility to access a variety of devices very conveniently. They also finds a meaningful connection between the development of neuroscience and the advance of

gamification. This is only natural if we consider the fact that, while studying the structure of the nervous system and the way it works, neuroscience is also interested in how the receipt of different stimuli impacts subsequent behavior and cognitive functions. This mechanism may be considered the bottom line of the success of game elements as regards the enhancement of users' motivation, engagement and pleasure, as the ultimate aim of the application of these elements is to determine users to be more efficient, with reference to utilitarian contexts, and more proficient regarding fields like education.

This desideratum can be attained in the field of gamification by the use of appropriate game mechanics and game dynamics. Game mechanics consist of rules and rewards projected to induce determined reactions over the player, while game dynamics are the desires and motivations leading to those reactions (Jorge Simões et al., 2012). We emphasize that the success of game mechanics in certain applications or games is dependent on their novelty at least partially. Some of the game mechanics and game dynamics which could be most frequently used for gamifying activities are shown in Table 1 (Bunchball Inc., 2010).

Badgeville (2015), an important US Gamification Technology Vendor, developed a comparable kit of gamification components that are used in their “Behavior Platform” for game mechanics. It comprises eight elements:

1. **Points** – Assign points for specific high value behaviors and achievements;
2. **Achievements** – Provide positive reinforcement for high-value user behaviors;
3. **Levels** – Signify levels of engagement across a company's ecosystem;
4. **Missions** – Create a set of behaviors for users to perform in order to unlock specific rewards;
5. **Contests** – Create a set of missions and reward those who finish most quickly or effectively;
6. **Leaderboards** – Show people where they stand as compared to their peers;
7. **Notifications** – Encourage engagement when users perform a desired behavior;
8. **Anti-Gaming Mechanics** – Set limits on how often a behavior can be rewarded.

Not all the above game elements are used in the existing commercial projects, as their choice is made according to the clients' needs. But the ones which tend to be used more frequently are by far “points”, “achievements” and “leaderboards” (Zichermann & Cunningham, 2011).

3. Criticisms of gamification from a learning perspective

Apart from the undeniable benefits that gamification is thought to bring, it has been pointed out that there are also certain failings, aspects that need to be reconsidered and improved, depending on the projects in which the implementation of the gamification

Table 1
Game mechanics and game dynamics according to (Bunchball, 2012).

Game elements	Game dynamics
Points	Reward
Levels	Status
Challenges	Achievement
Virtual goods and spaces	Self-expression
Leaderboards	Competition
Virtual gifts and charity	Altruism

concept is desired.

From this perspective, references go first of all towards the way in which behaviorist principles are applied in gamification under the form of reward or “punishment” for the player’s behavior. Reeve argues that “in behaviorist theory, a reward or positive reinforcer is anything that increases the frequency of a behavior. Equally, punishment or negative reinforce is something that decreases the frequency of a behavior” (Reeve, 2012).

A meta-analysis conducted by Deci, Koestner, and Ryan (2001) on 128 studies that examined motivation in educational settings established that virtually all forms of rewards (except for non-controlling verbal rewards) reduced intrinsic motivation. Later on, Nicholson, studying the connection between gamification and motivation, concluded that, once the former is used to deliver extrinsic motivation, the user’s intrinsic motivation drops (Nicholson, 2012). If an organization begins to use gamification, meaning the use of extrinsic motivation in the form of external rewards and then decides to stop the rewards, the behavior of the users in that organization will be less likely to return to the previous one without the external reward (Deci et al., 2001). In the book *Gamification by Design*, the authors state that the conviction in intrinsic motivation over extrinsic rewards is speculative and gamification can be used by organizations to regulate their users’ behavior by replacing intrinsic motivations with extrinsic rewards (Zichermann & Cunningham, 2011). However, they admit that “once you start giving someone a reward, you have to keep her in that reward loop forever” (Nicholson, 2012).

Based on the research presented, we note that the common causes for failed gamification projects include: emphasis on extrinsic motivators (e.g. badges, points, levels, virtual currencies), without including intrinsic motivators (e.g. belonging, curiosity, learning), no consideration of the players’ motivations (e.g. fun motivators like role playing, organizing, status and achievements, mastery of skills and learning), introducing competition (e.g. leaderboards) in an environment, where collaboration, creativity or learning was necessary, the use of gamification with a primary focus on managerial goals. For example, according to Kapp (2012), competition (displaying maybe a leaderboard or “Employee of the Month”) can wreak havoc with the success in learning. The researcher quotes several studies mentioning that competitive learning environments have a tendency to impede on the learning process (Goodman & Crouch, 1978). In addition, it has been pointed out that competition also has a negative effect on the learners’ self-efficacy (Chan & Lam, 2008), having the tendency to differ by culture and gender.

When the gamification-based application is used for acquiring information and knowledge, the authors must also pay attention to define the scope and goal of that application, because points and badges should not be awarded just for reading. Here several studies can be mentioned (Mangen, Walgermo, & Bronnack, 2013; Mayes, Sims, & Koonce, 2001; Noyes & Garland, 2003; Wästlund, Reinikka, Norlander, & Archer, 2005) in which users reported to have got more tired when learning using the computer, as compared to classical learning, just using pen and paper. For example, according to Wästlund, scrolling “took a lot of mental resources that could have been spent comprehending the text [enough to memorize it] instead” (Wästlund et al., 2005). Also, in non-formal learning, special attention must be paid to content (“the content is king”), so that this content would not include false information that users could subsequently transform into knowledge and then reproduce it. If the content is interesting, the users will remember it, even if with different levels of accuracy, because knowledge has value regardless of the medium through which it is acquired.

4. Implementing a gamified web application with zero-cost software

In order to avoid failures in the implementation process of a gamified web application, there seems to be an agreement regarding the stages that have to be taken into account. According to Ritter (2012), they are as follows:

1. Detect the desired and undesired behaviors;
2. Convert those behaviors into gaming features;
3. Define the way to include the gamification features into daily responsibilities. Among the examples, we may enumerate:
 - a. Building a competitive atmosphere by listing users’ scores publicly;
 - b. Using “goldfarming” for trading using virtual currency (awarded points for tasks could be used for obtaining real-world goods or services) (Sotamaa, 2009);
 - c. Creating interest by offering hints to encourage advanced exploration while further increasing the expectations/level of difficulty with the aim of keeping the users engaged.
4. Gather performance data in a central repository to be analyzed with the aim of setting lower or higher expectations in the game;
5. Provide immediate feedback to the “gamer” so that users stay engaged in the platform and want to come back for more.

The implementation of the aforementioned stages should lead to gamified applications which, according to Ritter (2012), should exhibit four basic and compulsory features: goals, rules, a feedback system and voluntary participation. These features are shared by all games or applications involving gamification, irrespective of their type. Goals must be defined very clearly each having feasible steps to be achieved. Rules describe the states that must be followed for accomplishing the goal, thus making the goal more stimulating. A feedback system has to be in place in order to provide information on the evolution on the way to meeting the goal. Lastly, and most important, it is considered that voluntary participation imposes that everybody playing and using the game accepts the goals, rules and feedback system knowingly and willingly (McGonigal, 2011, p. 30). This means that the “gamer” chooses to carry out the “work” in order to achieve the goal based on the defined constraints.

Apart from the above-mentioned characteristics, it has been underlined that any platform needs to respond to the strong requirement for a social learning environment, which should be appropriate for any audiences (J. Simões & Aguiar, 2011). These platforms must meet three important requirements: they should be simple, easy to use and safe for learning. Existing open source learning management systems (LMS) like Moodle are not designed to be used by any user because of their not-so-user-friendly user interface. Various educational institutions have implemented their own LMS based on open source software or they have bought it. But these platforms lack adoption at the teachers’ level or, even if widely used inside the institution, they cannot be accessed remotely from home. On the other hand, LMS could be integrated in social networks that everyone uses, but they usually have age limitations for their users (e.g. Facebook, with over 1 bln mobile users, does not accept users younger than 13 years old). Therefore, the adoption of these platforms in the communities supporting primary and lower-secondary education is more difficult than what would be expected by digital native students and educators with computer skills.

4.1. What is Interactivia.ro?

Considering students’ interest in cultural and educational

websites, on the one hand, and the paradoxical lack of free non-formal educational platforms in Romania, the extremely low competition on this market, on the other hand, we thought of developing a platform which should meet these needs. Thus, Interactivia.ro reached to be a non-formal education platform for young people, which we decided to base on gamification components, with a view to achieving a greater engagement. The idea for this platform has arisen during an E-Business postgraduate class at the Faculty of Economic Sciences and Business Administration, TRANSILVANIA University of Brasov, following discussions related to culture and knowledge in the contemporary digital world, inspired by the specialized literature (e.g. Fisher, Goddu, & Keil, 2015; Sparrow, Liu, & Wegner, 2011).

The initial goal of the platform was to implement the advertising business model with minimal costs, i.e. by developing a content system that would attract and keep users in the platform, while financing the application to be made by displaying advertisements in the application. After discussions with the potential participants and implementers of the idea (students), we have conducted a small market research where we looked for similar applications and their business model. Among the potential competitors in the Romanian internet marketplace, we have studied those displaying a web portal structure and content that attract users by their rich and diversified content, while keeping the users in the application for a long period of time (for the benefit of the portal's stakeholders). The result was a pivoting towards the current implementation of the application, which is materialized in an in-depth study performed by students using modern learning methods and, eventually, in the development of the general culture. The business model is a mixed one—a combination of advertising for books and advertising for sports equipment, all this involving selected partners from the corresponding areas, with whom bilateral agreements have been concluded. The development of the general culture will be accomplished as our users would follow our content and by means of partnerships with cultural institutions (philharmonics, theatres, museums etc.).

From a conceptual point of view, the application is a dynamic

web site (Fig. 1), where the users can:

- Learn additionally to the formal education;
- Make interactive exercises for a thoroughgoing study. The exercises can be preceded by videos;
- Listen to or watch again the teacher's explanations for the subjects and themes they desire;
- Make a horizontal development in other domains than formal ones by accessing subjects that combine many taught disciplines.

At the same time, it offers a combined support of other users, which is essential to encourage, guide and ensure the accuracy and quality required in the learning process.

All these take place interactively, based on:

- Text and pictures, including interactive animations;
- Videos, including videos interrupted by short multiple-choice questions for verifying the important notions presented within the video;
- Multiple-choice questions and answers at the end of each text for verification and thoroughgoing study;
- Comments for each discussion topic;
- Closed social platform, restricted to the application members.

The zero-cost for an application could be reached initially by using open source software or software distributed with a free (mium) business model (e.g. software as a service). These latter applications offer part of their features for free (core-features), while non-core features are sold. This kind of applications initially have minimal or zero costs for their users and they could be used until the threshold established by their producer is reached; afterwards a commercial account could be bought.

As regards the use of free and open source software in education, it has been highlighted that its aims are mainly to (Arslan, 2014; Warger, 2002):



Fig. 1. Interactivia.ro - main page displaying an auto-rotating list of articles.

- allow freedom in education;
- enhance the quality of teaching and learning;
- produce a state-of-the-art learning and teaching environment.

Given that the open source software is developed and managed by a community, being also regarded as a movement (Ljungberg, 2000), the premise behind this community-provided and maintained software is that community-source approaches result in better quality, better fitted, more sustainable and mission-critical software for higher education (Fuchs, 2010), while the output should be software that is cheaper to install and customize and also far more financially convenient over time to maintain and enhance.

4.2. A framework for implementing an application with zero costs

Being involved in the open-source movement, for Interactivia.ro we have tried to identify an open source content management software platform (CMS) with the following features:

1. To be often updated by the community with new features that should answer the users' requirements;
2. To have a well-developed and mature community that could rapidly answer the possible bugs identified;
3. To have a large number of modules, which ideally allow data exchange between them;
4. To be able to have a nice graphic aspect that could be rapidly changed by themes/skins and there should be a large number of themes having open source licenses;
5. To allow fast (and visual) development for new features;
6. Easy content editing by using tools similar to office-editing ones;
7. Because the application is intended to be one for the development of the general culture, we also considered it important to have tools/modules for testing the acquired knowledge and for further identifying the progress made by the user; these tools are useful irrespective of the knowledge level;
8. To keep users in the application, to create a community and to increase the engagement, we consider the existence of open source or freemium gamification tools as paramount; all this starts from the group competitive psychological analysis and, at the same time, looks for increasing the level of knowledge by engaging in competitions.

In order to identify the platforms that could be used to meet the above requirements, we started from the premise that most popular open source CMSs could accomplish them, the most important and differentiating requirement being in fact represented by the existence of gamification tools for that platform. To verify how this requirement was accomplished, a research study was conducted. Its aim was to identify the open source and commercial (with freemium business model) gamification tools. Thus, we considered it necessary to quantify as a framework the following features:

- Platform and pre-integration - is the gamification application a platform itself? If not, on what existing CMSs does it run? If the gamification application is a separate platform, are there pre-integrated modules with various CMSs?
- Level of integration - API access for easy integration with other software—important because the gamification tools/applications could be written in various programming languages and different platforms, while the interoperability between the platforms could only be assured by a gamification API that could be called from the CMS;
- Integration with social media—Social Media is very popular among young people (our target), with over 35% users on

various platforms in Romania (Kemp, 2014) and over 8 M Facebook users. Thus, the minimal requirement in this case is that the gamification plugin together with the platform to have “Login with X” where X is one of the popular Social Media platforms;

- Analytics—in order to identify and quantify key performance indicators, the gamification tool should have at least logs/events that should show how the game elements were used, at user and global levels;
- Mobile compatible—according to certain studies (e.g. Biggs, 2014) over 30% of the whole population owns a smartphone in Romania and the penetration rate of the mobile broadband is over 25% of the entire country population, while the Mobile Social Penetration measured in monthly active users (MAU) is over 21%. The most active users are young people (our target). Thus, the gamification platform has to be compatible with mobile devices;
- Widgets—the gamification platform has to have widgets or other integrated modules that, ideally, ought to respect the theme/skin or to be customizable chromatically;
- License types and additional costs—there are many applications that have dual-licenses (open source and commercial), with many interesting or advanced features only available in the commercial version;
- Active development/support—any developer that uses an open source application has to be assured that the code he uses is under development/supported for adding new features/correcting bugs.

The result is visible in Table 2.

When choosing the platform, we used the Jaccard method and applied importance indices for the above-mentioned characteristics, the result being the combination of Wordpress (open source license) and CaptainUp (commercial license with freemium/developer business model). Among the gamification platforms that we examined, CaptainUp and MyCred (open source module running on Wordpress) offer most of the features. From our point of view, MyCred, with its on premise installation, provides one important benefit over software as a service applications (SaaS) such as CaptainUp, through the fact that “my data are **not** also their data”. Initially we chose CaptainUp because it has more features as compared to MyCred and because the initial 1000 MAU has not been reached yet.

The platform is hosted by TRANSILVANIA University of Brasov and it is considered as a “student2student” or “student for student” application, the initial content being initially created by students.

The platform was launched in April 2014 and until now we have developed over 250 articles classified into 5 main categories and over 20 sub-categories. The article length is about 3000 characters, including representative pictures and videos, or interactive tools. Each article is written by students and then reviewed by teachers, to be subsequently posted on the Facebook university main page and in three personal profiles.

The application also includes a private social network with features similar to other social networks, like Facebook. This private social network is a safe environment without the age restrictions of other similar social applications. In the platform's social network, users can build a network of friends, communicate with them (by messages or chat), watch and comment friends' profiles and watch and comment shared images, photos and projects built with the platform's collaborative editor. Users can also share their recent activity with friends, answering the question “what are you doing?”, as in Twitter.

Table 2
Open source gamification modules for various platforms.

	Achievements for WordPress	Gamification-server	MyCred	Gamification platform	JomSocial	Alpha User Points	User points	User Infuser	Open badges	BadgeOS	CaptainUp
Platform	Wordpress	separate server application	Wordpress	Joomla	Joomla	Joomla	Drupal	client library	Wordpress	Wordpress	client library
Programming language	php	python	php	php	php	php	php	python, php, ruby, java	php	php	N/A
Description	Gamifies an WordPress site with challenges, badges, and points	badges + configurable rules engine to translate actions performed by users into awards	points management + badges		Social networking to your own website	referral user points system that can distribute or assign points to registered users according to some of its actions and activity	an incentive for users to participate in the site, and be more active	badging, points, live notifications, and leaderboards		earn and display gameplay badges through shared architecture	game mechanics and social tools for maximizing engagement, retention, virality and monetization in your web and mobile apps
Site	https://wordpress.org/plugins/achievements/	https://github.com/ngageoint/gamification-server	www.mycred.eu/	http://itprism.com/free-joomla-extensions/ecommerce-gamification/game-mechanics-platform	http://www.jomsocial.com/	http://www.alphaplug.com/	https://www.drupal.org/project/userpoints	https://code.google.com/p/userinfuser/	http://www.openbadges.org/	http://badgeos.org/	https://captainup.com/
Rules	Simple rules	Rule engine	Simple rules, based on points. The user gets a certain badge/rank/level based on the number of points	Simple rules, based on points. The user gets a certain badge/rank/level based on the number of points	Simple rules which allocates points based on predefined Joomla events (e.g. user uploads profile image, liking a photo etc.)	Simple rules based on predefined Joomla events and custom rules. Complex rules can be added by developing additional modules	Complex rules based on Drupal's rule engine	No	No	Basic rule-engine for granting badges	Complex rule engine based on predefined and custom properties, combined with custom conditions for awarding badges
UI widgets	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Communication	Integrated	RPC	Integrated	RPC	Integrated	Integrated	Integrated	RPC	RPC	RPC	RPC
Level of integration	API + modules for Wordpress	API	API + modules for Wordpress	API	API and modules	API for third-party modules	API for third-party modules	API	API	API + modules for Wordpress	API + modules for various platforms
Delivery model	On-premise	On-premise	On-premise	On-premise	On-premise	On-premise	On-premise	SaaS	SaaS	On-premise	SaaS
B2b interaction	N	N	N	N	N	N	N	N	Y	N	N
Pre-integration	Module for Wordpress	Integrated web application delivered with the web service	Module for Wordpress	Joomla	Joomla	Joomla	Drupal	N	Via third-party modules	Wordpress	
Game mechanics	points, badges, leaderboard	points, badges, leaderboard	points, badges, leaderboard	Points, Badges, Ranks, Levels, Notifications, Activities, Leaderboard, points monetization	Points and activities (pre-defined Joomla events and events defined in other modules), points monetization	Points, Badges (medals), Level, Ranks, points monetization by using third-party plugins	Points, levels, badges, leaderboards, points monetization by using third-party modules (contributed modules)	Points, badges, leaderboards		Achievements and Badges	Points, badges, levels, leaderboards
Documentation	Basic	N	Basic	Basic	Y	Basic	Y	N	Y	Y	Y
Active development	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y

4.3. Analyzing the implementation results

Since the application was launched, the average daily page-views have been about 170. The time spent in the application is about 2 min, which means enough time for reading an article. The bounce rate is about 75%, similar to other application blogs. We may explain the small number of users through the fact that the visits have Facebook as main referrer, due to the shares which are obtained when a new article is published.

Starting from these (unsatisfactory) results, we analyzed the following:

- The user's behavior in our application (using website analytics applications);
- The place inside the page where the users look while viewing the page (we analyzed, in fact, the users' mouse movements and clicks during the page views).

We expected that these analyses offer the answer to the time spent by users in the application. As a result, we implemented the gamification module (Fig. 2), because, according to some studies (Filsecker & Hickey, 2014; Hamari, 2015), it could increase the number of users and their engagement in the application and, as our hypothesis stated, it could increase web traffic due to its features (e.g. sharing).

As an example of a gamified activity, the following scenario could be considered: for obtaining a badge as reward, the user must perform some actions, for example obtain a minimal number of likes, shares, tweets, post comments, video views, all in a certain period of time. All the badges obtained by the users will be displayed in their personal profile in the private social network and its stream, allowing the users to share those achievements with peers and friends, who, at their turn, could comment on the achievement (e.g. using a “like” button). The users can obtain points after watching a video. Each individual level of completeness of the activity is displayed using a progress bar indicating the remaining points for attaining the next level. As a result of the obtained points, rankings could show the relative performance of each student.

In their study, de-Marcos et al. (2014) quantify the knowledge and skill levels reached by students in formal education. Because, according to Werquin's criteria, our application is a non-formal education platform (Werquin, 2010), measuring the users' level of

knowledge, the editors/post contributors could propose quizzes for users to answer after watching a video or reading an article, with different levels of difficulty. The gamification module produces statistics about the users' performance, which could also be used in the future possible marketing actions.

In order to increase competitiveness between users, badges are displayed in leaderboards, together with the points received for various activities within the platform. Thus, social gamification features comprise: receiving immediate feedback and rewards when performing learning activities, rewarding peers and appraising their achievements (e.g. using a “like” button), publishing achievements in the private social network's personal profile, sharing and gifting points to other users (and publishing this action in the private social network), notifying other users' achievements, commenting on those achievements.

4.4. The impact of gamification on the platform web traffic

In order to test the impact of gamification on the number of daily sessions (web traffic) opened on Interactivia.ro, we used a Multiple Regression model based on data collected with Google analytics. We collected daily data in the period 13.04.2014 and 07.07.2015 for two variables: number of sessions opened on Interactivia.ro (Sess) and number of actions using CaptainUp gamification (Capt). Aiming at stressing the influence of gamification, CaptainUp was included on Interactivia.ro after about 5 months from the activation of the educational platform (on 24.09.2014). The evolution of the number of sessions and of CaptainUp sessions is presented in Fig. 3.

In Fig. 3 we can observe that the number of sessions increases with the number of CaptainUp actions and decreases with this one, as there is a direct correlation between the two variables. We can also notice that there are both daily and seasonal variations. For example, there are lower than usual values in April and December. These periods overlap with Christian holidays when maybe people are less interested in educational programs. As for the majority of the time series, a dependence of the previous values has to be considered.

Starting from the above analysis, we can consider the following relation of dependence between the number of sessions and the factors that influence this number:

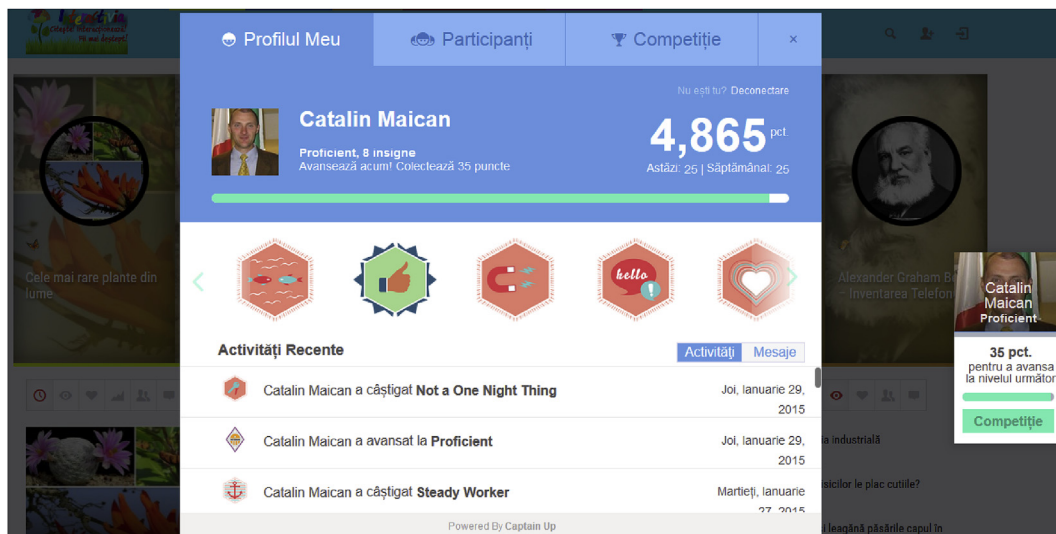


Fig. 2. Gamification profile for a user together with a list of participants and a leaderboard.

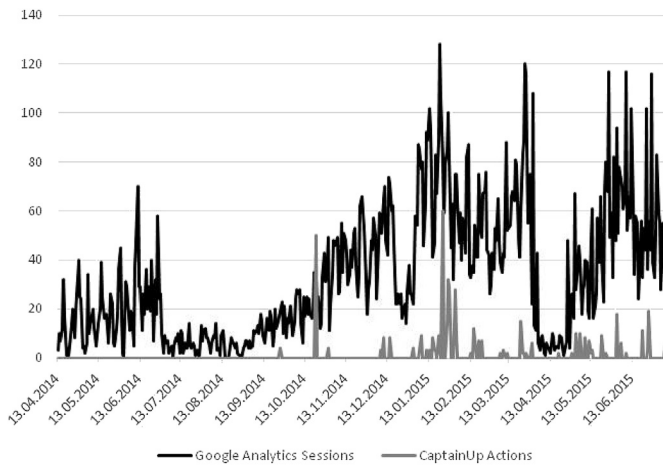


Fig. 3. Web traffic and gamification actions.

$$Sess = f(Autoregr, Capt, Change, Vac, Seas_{day(m)})$$

Where:

Sess = the number of opened sessions measured with Google Analytics

Autoregr = the autoregressive function of Lag 1 (Y_{t-1})

Capt = the number of CaptainUp actions measured with Google Analytics

Change = the effect of introducing the CaptainUp gamification

$Seas_{day(m)}$ = the seasonal effect on a daily basis (m -days of the week)

Vac = the vacation days in December and April

In order to highlight these dependences, we used the Multiple Regression analysis, in which the variables *Sess*, *Autoregr* and *Capt* were based on the daily observations provided by Google Analytics. For the other regressors (*Change*, *Season* and *Vac*), dummy variables were used. The following theoretical model resulted:

$$Sess = \alpha + \beta_1 \cdot Autoregr + \beta_2 \cdot Capt + \beta_3 \cdot Change + \beta_4 \cdot Vac + \beta_5 \cdot Seas_{day(1)} + \beta_6 \cdot Seas_{day(2)} + \beta_7 \cdot Seas_{day(3)} + \beta_8 \cdot Seas_{day(4)} + \beta_9 \cdot Seas_{day(5)} + \beta_{10} \cdot Seas_{day(6)} + \beta_{11} \cdot Seas_{day(7)} + \epsilon_t$$

Using the Stepwise Multiple Regression analysis in SPSS system, only the regressors with a statistically significant influence on the dependent variable have been retained in the model. The advantage of this stepwise method is the reduction of multicollinearity at the level of the independent variables. The final model, in which ϵ_t represents the specification error, is presented below:

$$Sess = 6.48 + 0.60 \cdot Autoregr + 0.34 \cdot Capt + 12.53 \cdot Change - 8.64 \cdot Vac - 8.13 \cdot Seas_{day(6)} + \epsilon_t$$

From the above model, it can be noticed that CaptainUp actions have a direct influence on the increase of the platform traffic, every three actions conducting to one unit increase in traffic. The

introduction of CaptainUp (*Change*) conducted to a significant increase of about 12.5 times in the platform traffic. The vacation periods and the 6th day of the week (Friday) have a negative impact on the traffic, every of these variables decreasing by about 8 times the traffic. This low interest during the vacation periods could be explained by the people's involvement in other activities than the educational ones.

The model was cross-validated using Autobox, a specialized Forecasting & Time Series analysis software. Autobox automatically tailors the forecast model to each problem by determining the window of response around each user specified input. It corrects for omitted variables by identifying pulses, seasonal pulses, level shifts and local time trends, and then enhances the forecast model through dummy variables and/or autoregressive memory schemes (Reilly, 2004).

According to the model provided by Autobox, a better explanation for future forecasts has been obtained ($R^2 = 0.87$) in comparison to the above model which has R^2 equal with 0.61. This is due to the advantages of Autobox, which quantified more effects like: monthly effect, the pulse intervention in certain days of the period, seasonal effect and level shifts in certain periods. As regards the variable CaptainUp, we have to underline that the β coefficient has almost the same value in both models: 0.34 in the Regression model and 0.324 in the model provided by Autobox.

Based on the above evidence, the hypothesis that stated that gamification has a positive effect on increasing the website traffic on interactivia.ro has been proven, emphasizing a direct correlation between the two variables, but also the positive level shift after the introduction of CaptainUp.

4.5. Partnerships

Over the last years, the Romanian culture market has been examined in several studies, the latest one being represented by the cultural consumption barometer (Croitoru et al., 2015). These studies made us believe in the necessity of creating Interactivia.ro as an application for increasing the general culture. In this study, several characteristics were noticed and these were the core of the idea for developing partnerships in our application:

- Most of the respondents prefer local celebrations (27,2%), trips (21,5%), music/film/theatre festivals (19,5%), music and entertainment shows (18%), going to malls (17,8%) (we do not consider this a cultural activity), walking in parks (16,7%) and visiting museums (15,8%);
- The number of respondents who participated in at least a theater/opera/classical music event increases constantly. However, the vast majority of these spectators view a small number of shows and from a restrained area, while not developing an interest in the artistic act. Thus, we consider that we assist to a consumption alphabetization and not to enhancing users' loyalty;
- The most attractive form among performing arts (Table 3) remains the entertainment/music show, 43% of the respondents having participated in at least one of this kind of events in 2014. Young people (age <35) represent an important part of the

Table 3
Evolution of the participation in performing arts shows.

Year/Type	Philharmonics	Opera/operaetta	Theatre	Entertainment/music	Music/film festivals
2010	7%	7%	19%	24%	N/A
2012	10%	13%	30%	32%	32%
2014	19%	19%	36%	43%	48%

public as regards performing arts (about 40% for all sub-domains);

- As in the other types of cultural consumption, young people visit museums to a greater extent (38%) than people in other age ranges, a fact which could be correlated to the educational dimension of museums.

The platform we developed aims to be one for developing the general culture, with the gamification modules playing the main role in attracting and keeping users in the application. We consider it an important step for further developing the platform the fact that we succeeded in concluding partnership agreements with cultural institutions (e.g. the first one was with the Brasov Philharmonics). Thus, our users will be able to change the points they obtain in the application for discounts for tickets/subscriptions sponsored by our partners. We consider this relevant because multi-annual research studies conducted in Romania (Croitoru et al., 2015) mention that the most important factors that could increase the participation in performing arts shows, museum visits etc. are those related to promotional tickets/discounts and better marketing for the shows, both factors being accomplished by our application.

An example of gamified activity for a partnership is accomplished using the following algorithm:

1. We obtain marketing flyers from our partners. We also obtain interesting details about the performers (e.g. little-known facts about famous composers).
2. We quantify the number of Facebook users by using Facebook Ads, so that we could find out the number of potential users interested in our partnership. For example, for the Philharmonics partnership, we quantified the users from Brasov who prefer (like) pages with "Music", Live events (Concerts, Music Festivals), Arts and music (Guitar, Performing Acts) among the UniTBv and Interactivia.ro users. The smaller this number is as compared to the total number of users of UniTBv and Interactivia pages, the greater the following restrictions will be (this means there are interested users and therefore, they have to "strive" to reach their goal/to get the discount). If this number is insignificantly different, the restrictions will be fewer as regards the amount of activities to be performed, with a view to attracting new users.
3. We define special points and badges for the new types of content (new partnerships) and we associate them to the content originated from the partners.
4. Finally, we publish the new content and we promote it/share it on the Facebook pages (no paid ads).

5. Conclusions and future work

In a world definitely dominated by electronic media, in which the time spent in front of the screen, for professional or personal reasons, has seen a dramatic increase, we thought of conducting a study focused on how to incorporate elements from social games into a web application which should contribute to the enhancement of education and learning. Our study aimed at exploring how to include the distinctive elements from social games into a web application, with the goal of applying them to social learning environments in non-formal education. The core of our research was to see to what extent it is possible to use the combination of an open source platform with open source (or freemium) gamification modules, with minimal costs, to improve general knowledge, with users obtaining not only intangible benefits (points, levels etc.), but also tangible ones (ticket reductions, for example).

To accomplish this, we have studied several open source

platforms to see whether they offer gamification plug-ins or not, as well as other freemium plug-ins which should allow a starter with minimum costs. In order to choose a gamification plug-in, we devised several criteria which were applied on the open source and freemium gamification modules identified. Out of all the modules identified starting from the models, we made a choice for an open source one and a freemium one, which became integral part of the Interactivia.ro platform. This platform totally relies on an open source CMS, being developed and promoted by students and addressing students.

With respect to the content of the platform, this is interactive, classified in categories and sub-categories, focusing on information which enhances general culture. The platform also offers a tool for testing the knowledge acquired on the platform, but it has a limited design, not allowing for items to be devised as gameful design (Deterding, Dixon, Khaled, & Nacke, 2011), so as to be more appealing for students. In addition, it does not exchange data with the gamification plug-ins, as this requires specialized programming knowledge.

Users can access our content using key words on search engines and through the notifications received from the Facebook page of the university and from three personal profiles. The users are kept in the platform through the gamification instruments.

In the case of the open source plug-ins that we studied, we noticed that some of them were abandoned, generally because of the lack of a viable business model. However, due to the fact that the source-code is open, this can be taken and further developed, which represents one of the major advantages of such open source software. The freemium module studied is developed under the form of Software as a service, the greatest problem from our perspective being the fact that our data are shared with the respective provider. The major advantage resides in the fact that it allows the rapid development, without prior advanced programming knowledge and it can be used free of charge up to a certain number of monthly active users.

After one year since it was implemented and launched, we can say that the gamification instruments proved valuable both by keeping users in the application and by the fact that they come back, share content and positively influence the number of web traffic sessions, every three actions conducting to one unit increase in traffic. These results have been tested by using forecasting models in two statistics: Multiple Regression in SPSS and Autobox. Nevertheless, gamification cannot replace an aggressive marketing, given that the number of users has not increased as expected. All products need a very good marketing to be considered by the busy users nowadays, and Interactivia.ro makes no exception.

Regarding the potential impact of the platform in the field of education, learning and motivation, the system we proposed aims at completing the present education system by means of a training element which is unconditioned by the system, thus creating an environment which produces the users' need to know by means of an interactive and iterative circle of knowledge, similar to the relationship-based model of effective gamification proposed by Wilson, Calongne, and Henderson (2016). From an educational perspective, the system we presented attempts at indirectly leading to the enhancement of the knowledge level, as self-study triggers knowledge which is subsequently turned into points and badges, which, at their turn, can be turned into financial bonuses on the occasion of cultural events. Most of the times, these ones are conducive to new needs to know and research, although, at first sight, they seem to be determined by extrinsic motivation (Deterding, Dixon, et al., 2011). In actual fact, the issue connected to the kind of motivation developed by our application can represent the focus of further studies, which could also consider on the qualitative dimension.



We believe that the main advantage of the system we propose is represented by the fact that learning is an entirely voluntary activity which takes place online, as part of a game, and not as a consequence of the multiple conditionings the education system generally involves. In addition, the application we developed also meets the IT&C objectives of the UE, as set in the Horizon 2020 call for projects (Horizon 2020 – Gaming and gamification, 2015).

Although boasting significant benefits, the gamification system we propose has no intention to offer an alternative to the classical education system, but to facilitate the youth's access to knowledge, being complementary to the latter. The goal of both education systems (classical and gamification) is the same, but it should be noted that the results obtained are different, being determined by the different motivational elements involved. The present study has not envisaged to research/determine the level of knowledge attained by using the platform, and we consider this can represent the objective of a future study, subsequent to the development and inclusion of multiple tests for general culture in the platform.

The concept developed could also represent a starting point for a future business plan, which could integrate elements from the present model, as well as develop new ones. If funds were available, the online and offline marketing could definitely be improved and the open source plug-in could be developed in a direction we favor. On the other hand, the study could continue to research in more depth to what extent games prove valuable as learning tools, to see in more detail what their effects are on the learning process and whether those effects are better than those obtained with the traditional instruments.

Further research directions should also include the measurement of customer satisfaction among the users of the platform and the identification of their suggestions for future improvements. Such research could be put into practice as an electronic survey implemented on the platform, which can collect a large amount of data about the users' opinions and attitudes.

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