Mednarodna konferenca

EDUvision 2019

»Sodobni pristopi poučevanja prihajajočih generacij«

Ljubljana, 28. – 30. november 2019

Organizator

EDUvision, Stanislav Jurjevčič s.p.

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Mednarodna konferenca EDUvision 2019

»Sodobni pristopi poučevanja prihajajočih generacij«

"Učenje je odkrivanje, da je nekaj mogoče."
Fritz Perls

Kako zelo pomembno je nenehno odkrivanje novih spoznanj in iskanje strategij reševanja izzivov, poleg tega pa tudi timsko sodelovanje in sodelovalno učenje, s čimer je res nekaj mogoče. Samostojno učenje in odkrivanje sta dragocena, toda učenje je odvisno od medsebojnih interakcij. Ob tem se nenehno spreminjamo, razmišljamo izven ustaljenih okvirjev in zremo v prihodnost ter se učimo prilagajati na nove situacije.

Vodilna tema konference EDUvision 2019 je »**UČIMO ZA JUTRI**«. Osnovni izziv konference pa je: **»Kako poučevati, katera znanja podati, katere veščine pridobiti in na kakšen način, da bodo otroci, učenci, dijaki, študentje dobro opremljeni s kompetencami za soočanje z izzivi v življenju?«**

Zato pedagoški delavci danes stojimo pred nalogo, da vse bolj postajamo motivatorji in navduševalci novodobnih generacij, ter otrokom, učencem, dijakom in študentom s kreativnimi in z IKT podprtimi učnimi okolji ter upoštevanjem ključne vloge čustev pri njihovih dosežkih omogočamo spreminjati stališča do učenja, sodelovanja, iskanja drugačnih pristopov, ki dolgoročno vodijo k bolj širokemu in trajnejšemu znanju.

 V zborniku so zbrani prispevki pedagoških strokovnjakov, ki predstavljajo sodobne pristope in izzive poučevanja ter vrednotenja znanja in veščin, ki bodo učencem, dijakom in študentom omogočali večjo motivacijo do učenja, jih spodbujali h podjetnosti, intenzivirali pridobivanje znanja, poglobili interakcijo z vsakdanjim življenjem in okoljsko osveščenostjo, jih navajali na smotrno rabo novih tehnologij ter nenazadnje izgrajevali osebnost učečega se posameznika.

V zborniku je zbranih **212 prispevkov** (in trije opisi delavnic) **240 avtorjev iz 6 držav** (Bosne in Hercegovine, Hrvaške, Madžarske, Severne Makedonije, Slovenije in Srbije).

Izmenjane ideje, raziskave in podeljene izkušnje, ki so jih avtorji izpostavili v prispevkih, bodo pripomogle k izgradnji kvalitetnejšega znanja in izboljšanju učnega okolja.

Programski in organizacijski odbor
mednarodne konference EDUvision 2019

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Gamification in Education and Learning

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Summary

Gamification is the application of game design elements in a non-gaming environment to promote outcomes, such as enhanced motivation, engagement, performance, and behaviour alteration. As such, it seems a valuable and innovative tool to implement in education and assist students in their learning process, especially when learning content does not inherently interest them. Although the concept is similar to game-based learning, simulations, and serious games, it should not be used as a synonym as in gamification no games are involved. The use of game mechanics, dynamics, and aesthetics is hypothesised to motivate students through satisfying their basic human needs of competency, autonomy, and relatedness, so the paper presents the self-determination theory as its theoretical framework. Despite its novelty, the approach seems to be increasingly gaining popularity and acceptance in both research and practice. Most studies report positive outcomes for students after the implementation of game elements, but more research is needed in order to clarify how they work and what is the best way to apply them to get to the desired results. Many game elements can be applied quickly and effortlessly to the teaching material but gamifying a learning process is much more complex than adding scoring and ranking systems. The paper summarizes the implementation methods typically used in educational settings and addresses some of their limitations.

Keywords: basic psychological needs, education, engagement, game elements, gamification, motivation, self-determination theory.

1. Introduction

In education, motivation and engagement are extremely important. A meta-analysis showed that motivation is positively linked to student achievement (Orhan Özen, 2017) and a literature review highlighted the connection between engagement and several academic and well-being outcomes, such as task completion, academic ability, academic performance, school retention, obtained level of education, anxiety, depression, self-esteem, and delinquency (Hughes, 2012).

Although children are naturally curious and motivated to learn and explore their environment, most of the knowledge needed to function in today's society has to be learned

through the formal educational system. Such knowledge can be considered biologically secondary (Geary, 2008) – humans have not evolved to acquire it but need to because of cultural demands. In contrast to biologically primary information that can typically be obtained easily and unconsciously, such as talking and reading facial expressions, acquiring biologically secondary knowledge, including reading, writing, and arithmetic, often requires conscious effort, instruction, and external motivation (Sweller, 2008). No wonder educational researchers and practitioners have been consistently interested in encouraging motivation and engagement in the learning environment.

The development and wide adoption of technology in both personal and professional contexts has expanded the repertoire of potential approaches to make learning more fun, engaging, and effective. Games can be entertaining activities that appeal to a variety of students no matter their age. Even though the use of games to facilitate learning is not a new concept, interactive multimedia learning environments support the possibility of implementing game elements in a variety of settings, including education. Gamification, the use of game design elements in non-game context (Deterding, Dixon, Khaled, & Nacke, 2011), has rapidly grown in popularity in the past decade because of its potential to motivate people to adopt particular behaviours and attitudes.

The purpose of the paper is to present gamification as an option to bring education closer to students by assisting learning and other processes in the classroom. The goals are to briefly present gamification in learning and education and to differentiate it from similar concepts, present the theory and empirical research behind it, and inform about its possible shortcomings.

2. Gamification

There seems to be confusion both in the scientific and professional community about what gamification is and what it is not. It is often used as an umbrella term or interchangeably with concepts such as serious games, simulations, and game-based learning. Game-based learning is the use of games to enhance the learning experience (Cózar-Gutiérrez & Sáez-López, 2016), and serious games (also educational games, games for learning, etc.) are games that are intentionally designed for learning, skill acquisition, and training (Boyle, Connolly, & Hainey, 2011), not just for entertainment. Similarly, in simulations users can train and apply their knowledge to practice in an environment that resembles real-world situations, for example when they learn about hospitality and destination management in a virtual environment with authentic activities and actual data from different countries (Istenič Starčič, 2008b). Gamification, however, is an approach that does not involve playing games but includes a set of activities and processes to solve problems by applying the characteristics of game elements (Kim, Song, Lockee, & Burton, 2018) in an environment that is usually non-game related, such as marketing, business, customer service, health, and education.

Both gamification and serious games combine game elements with learning, but what differentiates them is that serious games use a mixture of all or most game elements while gamification is adding a combination of limited game elements to an instruction (Landers, 2014). Furthermore, although serious games may affect learner motivation or engagement, its main purpose is to provide students with instructional content. In contrast, the goal of gamification use is to improve instruction by changing the learners' behaviour and attitude (Landers, 2014). Fig. 1 caption a represents a display of *BetterGeoEdu* – an example of using a game (*Minecraft*) for teaching about raw materials. It is a representation of a serious game where the authors added new features to a game (that is enjoyable and engaging by itself) specifically with the objective of increasing the players' knowledge of geology. Fig. 1 caption

b displays the interface of *Duolingo* – a mobile application for learning languages that implements several game elements to promote specific user engagement. Gamification, therefore, does not mean employing games in the classroom or learning environment but incorporating game design principles in the instructional material.

(a) BetterGeoEdu, a game for learning geology. Reprinted from About BetterGeo, in SGU Geological Survey of Sweden, n.d., Retrieved September 21, 2019, from https://www.sgu.se/en/geology-of-sweden/bettergeo-minecraft-with-more-geology/about-bettergeo/

(b) The interface of Duolingo, a gamified language learning application. Reprinted from Duolingo, n.d., Retrieved September 21, 2019, from https://www.duolingo.com/learn

Figure 1. Comparison between BetterGeoEdu, a game for learning geology, and Duolingo, a gamified language learning application.

There are different theoretical gamification frameworks to help apply game elements outside games. Zichermann and Cunningham (2011) proposed the MDA framework, including game mechanics, dynamics, and aesthetics.

Game mechanics form the functional components or tools (processes, control mechanisms, etc.) that control and guide the learners' actions through feedback. These are the mechanisms that "gamify" the activity (Bunchball, 2019). Some of those elements are (Kim et al., 2018):
- *Points*: (Numerical) rewards for specific behaviours (e.g., students get x number of points/balls in a jar for asking questions).
- *Levels*: By completing a certain task or collecting a certain number of points, students achieve another level (can be numerical or nominal) that indicates progress.
- *Leaderboards*: Rankings with names and scores to make comparisons.
- *Badges*: A note of achievement received after completing a task.
- *Virtual goods:* Things or services that can be attained, purchased, traded, or gifted.
- *Challenges/quests*: Giving directions and providing purpose to actions.

Game dynamics are participant interactions with game mechanics, such as reward, status, achievement, self-expression, competition, and altruism (Bunchball, 2019).

Game aesthetics are the outcome of the mechanics and dynamics and are expressed through the feelings and emotions of the participants (Zichermann & Cunningham, 2011).

2.1 Theoretical background

Research related to gamification is still in the beginning stages and findings are usually scattered across different domains, methodologies, and perspectives. As the number of videogames increases (Gough, 2019), the use of gamification is gaining in popularity and

development through practice and research. But even as the body of research grows, the basic question remains the same – why can gamification work? Why is the use of gaming elements effective at motivating certain behaviours even in a non-gaming environment?

A common theoretical approach for understanding gamification is **Self-Determination Theory** (SDT; Ryan & Deci, 2000; Ryan, Rigby & Przybylski, 2006), which addresses different types of motivation and the factors that undermine and promote them. The theory distinguishes between two types of motivation – intrinsic and extrinsic. *Intrinsic motivation* is the kind of motivation that leads people to an activity due to the inherent enjoyment it provides, not because of its consequences (Ryan & Deci, 2000). In contrast, *extrinsic motivation* is present whenever people participate in activity for its instrumental value, to achieve a separate outcome, and is influenced by environmental and external factors, such as punishment and reward (Ryan & Deci, 2000). For example, children may play games because they are having fun doing so, and they may read about animals because they are interested in the topic (intrinsic motivation) but may do their grammar homework to avoid a low mark (extrinsic motivation).

Additionally, SDT suggests that three basic and innate psychological needs – competence, autonomy, and relatedness – facilitate optimal functioning and growth and can, in turn, enhance or undermine intrinsic motivation, self-regulation, and well-being. Events that support those psychological needs promote intrinsic motivation and vice versa; factors that reduce feelings of autonomy, competency, and belonging inhibit intrinsic motivation (Ryan & Deci, 2000).

The need for competence refers to the desire to experience mastery and operate effectively, and it manifests in feelings of striving and curiosity (Ryan & Deci, 2017). We can boost feelings of competence by providing optimal challenges, opportunities for acquiring new skills, and informational feedback (Ryan & Deci, 2000). On the other hand, they can be easily hindered with challenges that are too difficult, persistent negative feedback, and comparison. Game elements that seem to directly address this need are points, badges, leaderboards, and other performance indicators, which provide the individual with instant and personalized feedback about their progression over time (Sailer, Hense, Mayr, & Mandl, 2017).

The need for autonomy is the need to self-regulate our own actions and experiences. It conveys volition and compatibleness with individuals' values and interests (Ryan & Deci, 2017). A teacher can enhance a sense of autonomy by providing choice, control over a task, informational feedback, and non-controlling instructions to their students (Ryan et al., 2006).

Finally, the *need for relatedness* indicates feelings of being socially connected to others, belonging, and having a sense of being part of a group (Ryan & Deci, 2017). In the gaming and learning environment, it can be promoted by cooperating and contributing towards a common goal as well as by adding avatars and meaningful stories to the content (Sailer et al., 2017).

The problem in educational settings is that learning content in schools is often not intrinsically motivating for students. Another issue is that research has shown that extrinsic reward can undermine intrinsic motivation (Deci, Koestner, & Ryan, 1999). A sub-theory of SDT, *Cognitive Evaluation Theory* (CET; Ryan & Deci, 2000), posits that the effects of external events on intrinsic motivation are mediated by perceived autonomy and competence. If the student believes that the reward or feedback is controlling, it will hinder their intrinsic motivation, but if the feedback is perceived as meaningful and informational, it can still support intrinsic motivation.

Universal psychological needs, therefore, play an important part in students' motivation and engagement. Playing games is usually voluntary and intrinsically motivated and can boost all three basic needs (Ryan et al., 2006), so implementing the game elements that satisfy them can, in turn, promote intrinsic motivation and enjoyment during learning. Gamification is meant to

harness this motivational potential of games and add it to a non-game environment, such as education (Deterding et al., 2011).

2.2 Gamification in education

Gamification in education is gaining popularity in different countries and can be applied across numerous topics (Subhash & Cudney, 2018). Although most of the research targets higher education, gamification is also applied in elementary and high schools (Dicheva, Dichev, Agre, & Angelova, 2015).

Several literature reviews and meta-analyses suggest that studies observed mainly positive results of gamification use in education (Dicheva et al., 2015; Majuri, Koivisto, & Hamari, 2018). Although, many studies report mixed findings, often stating that not every student benefited from the intervention (Majuri et al., 2018). A systematic review of the literature of gamified learning in higher education differentiated specifically between articles that focused on gamification without using games and papers that implemented other kinds of game-based learning (Subhash & Cudney, 2018). The authors found that both gamification and game-based learning yield similar results. The most widely quoted benefits of implementing gamification in higher education were enhanced student engagement, motivation, enjoyment, and performance. Included studies also reported that gamification had a positive effect on student attitudes, such as increased effort, participation, attendance, confidence, and interest. Although improved student performance was not always among the cited gains after gamifying the course, some studies reported gamified environment leading to higher quality projects, improved learning outcomes, reduced failure rates, and higher average scores.

A mapping study identified different options of how gamification was applied and implemented in education (Dicheva et al., 2015). Most case studies reported gamifying blended learning courses (combined face-to-face with online interaction), followed by courses without any online support, MOOCs (massive open online courses) or online courses, e-learning sites, and gamification support platforms. Regarding the type of implementation, the most frequent options were 1) development of a plug-in or extension for a Learning Management System or other online learning environment that supported gamification, 2) development of a standalone application for gamification, and 3) using a third-party software (e.g., Moodle) that supports certain aspects of gamification, while the least used alternative was 4) to implement gamification principles without any software or e-learning platform (Dicheva et al., 2015). When implementing gamification through a virtual environment, an important recommendation that stemmed from research is that for the game design elements to be effective, students must be aware of them (Sailer et al., 2017). Providing students with information on where to find, how to use, and how to interact with game elements can increase their perceived ease of use, which is an important predictor of students' acceptance and behavioural intention to use new technology (Bourgonjon, Valcke, Soetaert, & Schellens, 2010).

The most frequently implemented game elements in the education and learning domain are points, challenges, badges, and leaderboards (Majuri et al., 2018; Subhash & Cudney, 2018). A possible explanation for the predominance of these mechanics is that their application seems to be easy and quick. A study reported that points, badges, and ranking systems can improve user performance in easy tasks as they act as progress indicators that guide and enhance user behaviour (Mekler, Brühlmann, Opwis, & Tuch, 2013). However, implementation of only these elements did not significantly increase perceived autonomy, competency, and intrinsic motivation. On the other hand, a simulation study that also examined the effects of specific game design elements on the satisfaction of psychological needs reported that badges,

leaderboards, and performance graphs positively affected perceived task meaningfulness, a subcategory of the need for autonomy, and the competence need by providing instant feedback (Sailer et al., 2017). Perceived freedom of decision, another aspect of autonomy, was not affected by any added game elements, but avatars, meaningful stories, and cooperation with teammates heightened the feeling of social relatedness.

As every learning process and class is different, gamification is not a solution to every problem and not always the optimal way to address the situation. Glover (2013) identified several questions and issues to consider before deciding on implementing gamification and related these recommendations:
- What are the outcomes we want to encourage or discourage? Gamification can be used to encourage specific behaviours, but the effect may fade without constant incentives.
- Is motivation the main issue or is the learning design? Adding game elements cannot replace good instruction.
- Game design elements, such as a ranking system or points, should not be used to grade students but only to increase motivation.
- Participation should be optional as compulsory involvement can reduce the game-like nature of the instruction that gamification tries to add (Cahyani, 2016).
- Rewards should be chosen with care, so they are interesting for everyone.
- Some activities may draw too much of the students' time and attention, so we should think about setting limits, such as limited number of points.
- Challenges should not be too easy or too difficult to complete so that the added elements do not lose their motivational value.

Gamifying a class can be as straightforward or as sophisticated as desired. One can, for example, simply write students' names on a sheet of paper and reward stars for wanted behaviour. Alternatively, more complex approaches can be used, such as the *Classcraft* application. *Classcraft* is a computer and mobile role-playing platform that facilitates classroom management. The teacher acts like a game master and manages the class, while showing the results to the classroom. The students choose their characters (i.e., mage, warrior, or healer), set up teams, and collect (and lose) experience (XP) or health points (HP) after demonstrating favoured behaviours. When students collect a certain number of points, they can gain powers or privileges (e.g., an option to turn in an assignment after the deadline) or they can be penalised after losing points. The powers, behaviours, and XPs can be predetermined by the teacher in a way to encourage or discourage certain actions (e.g. the teacher allocates 50 XPs to a student who actively participates and subtracts 25 HPs from a student for chatting during class). In a qualitative study, high school teachers observed enhanced student motivation, engagement, and participative behaviour (e.g., answering questions, working on assignments) after implementing *Classcraft* (Sanchez, Young, & Jouneau-Sion, 2017).

3. Conclusion

Gamification can be a feasible approach to engage and motivate students through satisfying their needs of competence, autonomy, and relatedness. One of the main advantages of gamification is that it can be used both in real and virtual settings with the use of paper, blackboards, and other common objects, or we can gamify the learning experience with software that is free and easy to manage. Nevertheless, when developing gamified material, we need to integrate multiple perspectives, namely game design, content (subject) design, and educational theory (Istenič Starčič, 2008a). Be it virtual or physical environment, studies have

shown that gamification can positively affect student engagement, motivation, and performance, along with other desired outcomes, such as encouragement of specific behaviours.

Although using gamification in education looks promising, there are several limitations that need addressing in the future. The first is that research on gamification is still in its infancy, which brings several issues, such as the terminological confusion in both research and practice. Looking through the literature it becomes evident that terms, such as gamification, game-based design, serious games, gaming, and edugames are used interchangeably and make it difficult to fully understand. In the future, we need to define the terminology and differentiate between related but separate concepts to make it clearer and easier for scholars and practitioners to use the right design in their approach. The second limitation in the literature of gamification in education is the methodological shortcomings of the already limited empirical studies, including small samples, use of non-validated psychometric measurements, lack of control groups, and short-term interventions (Hamari, Koivisto, & Sarsa, 2014). As gamification benefits may result from the novelty effect and could fade over time (Hanus & Fox, 2015), we need more longitudinal and methodologically robust studies. Some studies reported mixed results (Majuri et al., 2018), which indicates that gamification is not a one-size-fits-all solution and can, in some cases, even harm the desired outcomes (Hanus & Fox, 2015). Another common critique is that gamification using mainly external rewards boosts extrinsic motivation, which can negatively affect intrinsic motivation (Deci et al., 1999). Results are still mixed regarding the matter (Majuri et al., 2018), but even if gamification does affect only extrinsic motivation, the concept still manages to help students engage with learning content that they otherwise do not find intrinsically interesting and enjoyable. Last but not least, as many gamified environments included many gaming elements at once, it would be useful for the upcoming research to explore the effects and mechanisms of single game elements and, with this, collect more specific information on how gamification can improve learning.

It is important to note that designing a gamified course requires careful consideration of the students and their needs as well as the learning process and objectives. Merely adding points, badges, and a ranking system to an already existing instruction may not be enough. Gamification is a complex practice that needs to include the understanding of psychological processes underlying learning, motivation, and engagement, and the theory behind it has to be expanded. Nevertheless, gamification has been shown to be a potential tool to facilitate learning through heightened motivation and engagement and should be further explored.

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Acknowledgments