GAME-BASED LEARNING AND ITS APPLICATION TO FOREIGN LANGUAGE LEARNING IN MONTENEGRO

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Abstract: This paper deals with some practical aspects of game-based learning (GBL) in terms of foreign language acquisition. The main premise of this paper is that game-based learning is inherently more suitable for language learning than a traditional classroom, since it is based on the concept of playfulness, which is an integral part of the personalities of virtually all learners and especially young learners. Therefore game-based learning can be used to remove the linearity and negative predictability of the traditional classroom paradigm and introduce a novel way of teaching students in Montenegro. Another benefit of game-based learning is that it can be applied to just about any subject in our schools and faculties with the caveat of first implementing appropriate adjustments to the curriculum design depending on the specific nature of the subject in question. First, we will introduce the concept of GBL, then provide an overview of the overall theories this paper is based on and introduce the outcomes of our GBL study with a game called Portal 2 and show how game-based learning can be practically applied to foreign language teaching and learning. Our study was designed to function as longitudinal research containing the Target and two Control groups with the aim of investigating whether game-based learning can be an effective tool for foreign language learning. We found that GBL may provide an interactive and engaging environment that encourages active participation and immersion in the language, which helps learners develop their communication, vocabulary, grammar, and cultural awareness skills in a fun and motivating way.

Keywords: game-based learning, digital classroom, scaffolding, foreign language learning, new teaching methodology

1. Introduction

Game-based learning (GBL) is an immensely popular technology-based type of learning which has led to a change in basic assumptions in terms of education in the 21st century. GBL can be defined as the utilisation of games and the pertaining features to achieve more or less specific learning outcomes. A game can be defined as a structured form of play that contains goals, rules, feedback system and is based on voluntary participation (McGonigal 2011). In this paper, we will focus on digital games, even though GBL also includes "physical" or

traditional games. In addition to the definition of GBL, it is noteworthy to differentiate it from gamification. Gamification involves the use of game elements to achieve a task which players would otherwise not find appealing. So, in a sense, GBL is an all-inclusive approach to learning using games, both as a learning environment and its substrate, whereas, gamification is about using a specific part of a game, for instance, game incentive system, in order to embellish tasks pertaining to, for example, traditional classroom. This all-inclusive aspect is a particularly important feature of GBL since it involves multiple sources of stimulation (audio, visual, olfactory, etc.) which is of the essence in terms of child development since various kinds of appropriate and controlled stimuli positively affect almost all learners and especially young children's brains. Those children very early on also learn that games can go beyond simple entertainment and can be used for educational and/or training purposes. GBL also promotes critical, creative, or unconventional thinking, which is especially important for young learners due to their increased neuroplasticity. Additionally, GBL incorporates simulation-based learning, the development of games for educational purposes, enhances students' motivation which makes them primed and better suited to understand complex concepts via feedback, trial and error, or independent learning (Squire 2006). GBL is not only limited to schools and academia, but it can also be used for incidental or recreational learning, where the learners do not acquire new knowledge in a formal environment. Furthermore, GBL can be used to promote open learning, i.e., learning that is open to everyone, through location flexibility, learning on demand and ready-to-use education via smart devices. This can be done, for instance, through MOOCs (Massive Open Online Courses) which could be attended by anyone and could incorporate several distinct aspects of GBL. An additional benefit of GBL is that it is almost equally appealing to both boys and girls, with a slight difference in terms of which gender prefers which game genre (Homer et al. 2012). Moreover, GBL can be used to bridge the generation gap in learning (sometimes there is more than a 20/30/40-year age difference between teachers and students). What is more important for our paper is that numerous studies (Kwah et al. 2014; McGonigal 2011; Plass and Kaplan 2015) found no significant gender difference concerning the motivational and learning outcomes, which makes GBL fully educationally compatible with both genders. Since GBL provides such an engaging environment suitable for a wide spectrum of individuals, it should become an inextricable part of the Montenegrin educational system because of all the above-mentioned benefits. This paper is, hopefully, one small step towards that.

> "Additionally, gaming represents a domain of interest-driven learning that has low barriers to initial entry, and where kids can move along a trajectory of casual social gaming, to exploration and knowledge seeking, to more intensive forms of knowledge exchange and

production. We found many instances in our case studies where gaming became an entry point for a wider range of technical and interest-driven practices such as hardware hacking, video production, design, and coding" (Ito et al. 2009).

2. Theoretical background

GBL is usually perceived through two competing theories or approaches: psychological perspective and sociocultural perspective. The cognitive perspective as the name suggests, focuses on psychological and cognitive aspects of GBL, whereas the sociocultural approach pays more attention to social and cultural features of GBL. Despite this theoretical dichotomy, we passionately believe that a successful approach to this topic needs to combine both these aspects since GBL definitively affects both the cognitive and sociocultural aspects of learners' personalities. Thus, this paper will be based on a modified integrated design framework which views GBL through four types of equally important learner's engagement: affective, behavioural, cognitive and sociocultural. The supporting theoretical stance this paper is based on can be found within the realm of Theory of mind. We opted for this theory as our theoretical cornerstone since it incorporates and ties our paper to all four afore-mentioned aspects. According to Theory of mind, ability to play digital games develops in earnest when child's mind becomes capable of symbolic thinking and holding in his/her mind multiple mental constructs of the same object. Once this precondition is satisfied, a digital game becomes a mental being the child is ready to play with. It is worth pointing out that this cognitive development occurs within a social context (hence our rejection of the afore-mentioned dichotomy) exemplified by affective elements of reciprocity, empathy, and identification. For example, in a bidirectional and interactive relationship between a parent and his/her child smiling back is one of the first innate social and affective patterns expressed by that child, yet this pattern is supported by a developing neural mechanism tasked with processing social cues. This interplay of neurodevelopmental and affective/social elements is a clear indicator of why many, if not all, learning strategies, GBL included, should be viewed through this multifold prism. Furthermore, GBL also affects the affective/behavioural/social/cognitive side of learners' personalities through affective/behavioural/social/cognitive changes brought about by digital devices, new means of communication and digital games as well. According to William D. Winn, the director of the Learning Centre at the University of Washington's Human Interface Technology Laboratory, children raised with the computer "think differently from the rest of us. They develop hypertext minds. They leap around. It is as though their cognitive structures were parallel, not sequential." (Prensky 2001). This unique way of thinking, caused by a generational switch from print-based generation to computer or game-based generation was such a profound leap as the different

cognitive paradigm brought about the changes in sociocultural perspective as well. This is part of the answer as to why GBL is popular with all learners and especially young learners. It mimics their lifestyles and follows their ways of thinking. Therefore, GBL is such a powerful educational tool since learners feel almost no resistance to adopting GBL, its methodology and tools. GBL is also a social tool since the very essence of gaming is social. This is another strength of GBL since it is excellent at recreating out-of-school settings. This means GBL can combine both formal and informal elements of a learning environment, which is especially important for young learners. Apart from that, GBL is very successful at recreating "peer culture" pertaining to gameplay. This peer culture is developed among peers and usually encompasses collaboration, joint attentional frame, joint problem-solving and even a healthy dose of peer-generated competition. In this manner, learners can both individually and collectively solve a problem, which is a significant educational asset for all learners. They learn how to be team players and that success is maybe easier to reach if they collaborate with their "network peers, game teammates or digital peers".

3. Study groups

Our theoretical approach will be based on the above-mentioned concepts of GBL, combining its affective, behavioural, cognitive and sociocultural aspects. Our study was designed to consider all four aspects by using what we call "interactive cycles". An interactive cycle is a phase in learning/playing a digital game that promotes, in practical terms, all the components of GBL and we were encouraging our students to go through all those cycles while learning and/or playing a video game. The main aim of an interactive cycle is to allow students to reach a satisfactory academic outcome. Our study design implements five interactive cycles. The first cycle is related to gathering all relevant data and its main aim is to allow students to make an informed decision to complete a task at hand. Within this cycle, students learn about the challenge and try to get a rough idea regarding possible solutions. The second cycle is related to the analysis of the initially gathered data, the third one is problem-solving based on the analysis of the data, the fourth one is "trial and error" in terms of finding a solution and the fifth one is the formulation of a final solution or several solutions, if feasible. Our target group students, most of the time, went through all the above-mentioned cycles. We deliberately emphasise the phrase "most of the time" because we wanted to allow for some flexibility in our classes and allow students to skip some of the cycles if they felt ready to do so. But, in the absence of any other extraneous circumstances, all five cycles were present and utilised.

These cycles and the pertaining tasks that students needed to complete during/after the classes were structured in such a manner as to respect the

Vygotsky's Zone of Proximal Development and Scaffolding. For the sake of clarification, the zone of proximal development (ZPD) has been defined as: "The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers" (Vygotsky 1978, p. 86). Wood et al. (1976, p. 90) define scaffolding as a process "that enables a child or novice to solve a task or achieve a goal that would be beyond his/her unassisted efforts." As the authors noted, scaffolds require the adult's "controlling those elements of the task that are initially beyond the learner's capability, thus permitting him/her to concentrate upon and complete only those elements that are within his/her range of competence" (Ibid, p. 90).

To evaluate our hypothesis that GBL is intrinsically more conducive to foreign language learning than the traditional classroom, we designed a study that involved three groups of students where we tried to be as gender balanced, and representative as possible. We managed to include as many students as possible from all three years of their undergraduate studies. In total, 85 % of all students, 56% male and 44% female, form the Faculty of Mechanical Engineering participated in this study. The groups were as follows: Target group (TG) with eighteen students (six from the first, second and third year) from the Faculty of Mechanical Engineering who achieved an average result (grade C, 70-80 points out of 100 on their last exam from English) in the previous semester. This group was chosen to represent students with an average knowledge of English. Control group 1 (CG 1) contained fifteen students (six from the first, six from the second and three from the third year) who earned either an E or D as their final grade in the previous semester and Control group 2 (CG 2) contained ten students (three from the first, four from the second and three from the third year) who earned either an A or B as their final grade in the previous semester. These two control groups were chosen as two extremes. Hence, this study is modelled after what is known in statistics as a modified extreme groups design. CG1 and CG2 scores are situated in the sample outer tertiles and serve as a lower and an upper boundary to the score distribution. What does this mean for our study? We wanted to see if TG would make any progress and whether another variable (GBL) would stimulate them to be closer to the upper boundary (CG 2) or discourage them and “push” them closer to the lower boundary (CG 1) in terms of their result, after the completion of the study and application of the GBL methodology.

Our hypothesis is composed of two claims. The first one is that GBL will prove to be a positive academic stimulus which will increase the TG’s intrinsic satisfaction. Second, because of the afore-mentioned positive stimulus, we believe their academic results will be higher than their average and closer to the upper boundary, defined as CG 2. If both claims turn out to be true, this will be

proof that GBL has its merits and place in our educational system and must be more tightly integrated into such a system together with some technological and other improvements (better equipment in our schools such as more computers, tablets, smartboards, smart tables, better training of our teachers in terms of how to utilise this technology, etc.). If the results show that GBL made no impact on the results of the students, this would be an interesting starting point for a new study which would analyse as to why GBL made no impact.

The TG was tasked with learning how to: build a simple chamber inside a game called Portal 2, use the weighted companion cube, create an entry, and exit portal in order to build a simple harmonic oscillator. Apart from that, the TG group needed to explain in English how to plan and conduct investigations, analyse, and interpret data and design solutions. The same task was given to the CG 1 & 2. The only difference between these groups was that the TG would have to learn how to build a simple oscillator using the game (Portal 2), whereas the CG 1 & 2 would learn the same thing using traditional classroom methods (lecture, homework, presentation and a written test to evaluate their knowledge). All groups received detailed instructions of what was to be done and expected from them, but they were not informed about the main aim of this research ((dis)proving the hypothesis) in order not to skew the results, even though we were fully aware that the observer effect could not be eliminated. All three groups had ten weeks to complete these tasks and they would meet each week with an instructor who would observe their progress and support their activities. The initial GBL class was designed as an orientation course for the target group students, providing them with essential training on how to use/play Portal 2 and explaining the rules for completing their assignments. During this initial phase, the TG students learnt how their performance would be graded, how to orient themselves within the game, use the weighted companion cubes, portal gun and other items of interest. Speaking of the companion cubes and portal gun, a short description of the game would be in order here.

Portal 2 is a puzzle-platform game developed by an American video game developer Valve. The game received universal acclaim for its originality, design, music, and creativity. The main premise of the game is that players need to navigate through different puzzle-chambers and find their way out. Players are allowed to use a portal gun which creates an inter-spatial portal between two flat planes represented as visual and spatial connexion between two points within the game's three-dimensional space. If a player enters one portal it will exit through another one. An important concept of this game is the conservation of momentum which is used to successfully navigate through the above-mentioned puzzle-chambers. Precisely this conservation of momentum will be heavily utilised to observe oscillations. This game was chosen because it fulfilled several very important criteria: gameplay and mechanics are suitable for our learning goals; this game is flexible in terms of its difficulty settings and allows

for dynamic difficulty adjustments to be made during the gameplay, which allows for (when necessary) graceful failure; the game can be sufficiently personalised, which allows for personalised learning experience (different students may reach several different solutions, each equally valid); it helps in problem-solving because it heavily depends on causation and self-consistent logic and it can be played in solo or co-op mode. Since this is a language learning project, we will skip the majority of data pertaining to physics and focus on the findings related to language acquisition.

Thus, to summarise, the TG students needed to complete the following tasks:

- Build one chamber, with three walls, a ceiling and a floor, within which the oscillator will be constructed,
- One side of the chamber needs to be slightly elevated in order to gain a vantage point from which a portal gun will be used to open two portals and, later on, a cube will be dropped to evaluate the oscillator,
- Both portals should be on a flat surface at the same level,
- Import the portal gun from the library of items,
- Import the weighted companion cube from the library of items[1],
- Observe the behaviour of the weighted companion cube.

After the chamber and its elements have been created and properly placed, students need to place the weighted companion cube so that it can enter one portal and exit through another one. Due to gravity, the companion cube returns through the second portal and the entire process is reversed. So, the students need to determine the relationship between the height of a fall, the mass of an object, and periodicity of motion, friction, air resistance and consider the implications of different physical processes on game design[2]. At each class, all the aforementioned elements needed to be explained in English, both to the instructor and the rest of the group. The overall outcome of this study is the following: the TG students need to explain to their peers how they solved the problem and what were the challenges. After each class, the TG and CG1/2 students needed to complete a quick test and a questionnaire. The test served as proof that students understood the task at a deeper level and the questionnaire measured the level of enjoyment while completing this task. If the TG students can complete this task faster, with more quality and enjoyment, this will be an interesting proof of concept that GBL has a place in our classrooms and should be implemented as soon as practicable, with appropriate preparations. Thus, we also measured the results of the two control groups to see if they were in a "less advantageous" situation since they were only exposed to traditional teaching methods.

[1] http://www.foundry10.org/programs/games-and-learning/portal-2
[2] Ibid.

Although belonging to the same group (TG), students had the freedom to individually manipulate the test chambers and create their own or mini-group solutions. For the sake of clarity, "mini group" in this paper is to be understood as a smaller group within a larger one (TG) brought about due to group dynamics (Ivanović 2019). Thus, it was interesting to observe that, almost invariably, on each class there would be a mini group within the TG who would produce a slightly different solution from each other although the initial conditions and requirements were identical to all of them. This is one of the exceptionally practical and useful benefits of GBL. Even though students were given the same tools, same instructions, same conditions, almost as a rule, some of them would be more creative and produce something novel, more interesting, unusual and ingenious. This "building" phase was followed by a "look-back" phase, where the students needed to explain the intricacies of their individual solution(s). The students were given ample time to explain their concrete design and the strategies used. They were asked if they were satisfied with their solution, if they would change anything, or if they would adhere to their original solution. After that, there was a "peer engineering phase" in which students would try to recreate each other's solutions based on each other's instructions, since by explaining something to somebody else, both sides learn, by sharing and acquiring knowledge, respectively. This was followed by a "discussion" phase, where the students discussed among themselves the pros and cons of different solutions. It is particularly important to mention that advantages and disadvantages related to somebody's solution are relative since what is a drawback for someone (for example, not strictly adhering to the initial instructions) may be an advantage for someone else (for instance, broader interpretation of instructions may be a sign of advanced lateral thinking). During the whole discussion, students used English and were almost always able to convey their messages and exchange ideas. If they did not know a word or some phrase, they were instructed to ask their peers or to use descriptive language/mother tongue. At the end of each session, students would vote for the best design, providing arguments for their decision.

4. Results and discussion

After ten weeks of learning with Portal 2 and as many weeks of observation/data collection/analysis, we obtained the results which proved GBL is a very convenient, efficient, and effective method of supplementing or even replacing traditional classrooms with this kind of teaching methodology. Let us first begin with a more subjective side of the obtained results. Overall, it is positive to notice that a considerable number of students are satisfied with both traditional and non-traditional classrooms. With regard to students' satisfaction in terms of methodology, teaching, problem-solving and critical thinking, the TG showed a higher level of satisfaction. Students' satisfaction in the TG is by some

12 and 15% higher than in the CG 1 and CG 2, respectively. For our study, the first and the last column (of the chart below) are a telling example of the benefit of implementing GBL into our classrooms. Just a relatively simple change in methodology can increase students' satisfaction and almost eliminate dissatisfaction among students. Another interesting set of data, which cannot be seen in this chart, is related to the reasons why students responded the way they did. In terms of the TG, the two main reasons were that this was something new and interesting for our students, which allowed them to show a more creative side while solving a problem. In terms of the CG 1 and CG 2, the students responded that their satisfaction level almost invariably correlated to the manner in which the teacher presented this task to them. This goes to show that in a traditional classroom, teacher is the main protagonist and the success and/or failure of a subject in students' eyes largely depends on the teacher and his/her knowledge and the manner of presentation (Lin et al. 2013). In GBL, teacher is mainly "removed" from the teaching process and serves as a "steering authority" which helps students achieve the goal, but aims at being "invisible", which allows for greater autonomy of students, which is usually beneficial in terms of critical thinking (Mayer and Johnson 2010). An additional element that increased students' satisfaction in the TG was the process of getting closer to the solution or solutions. Almost all students highly praised this trial-and-error method since it allowed them to show and express creativity because the solution was not served to them, but they needed to invest more or less effort to find the solution(s).

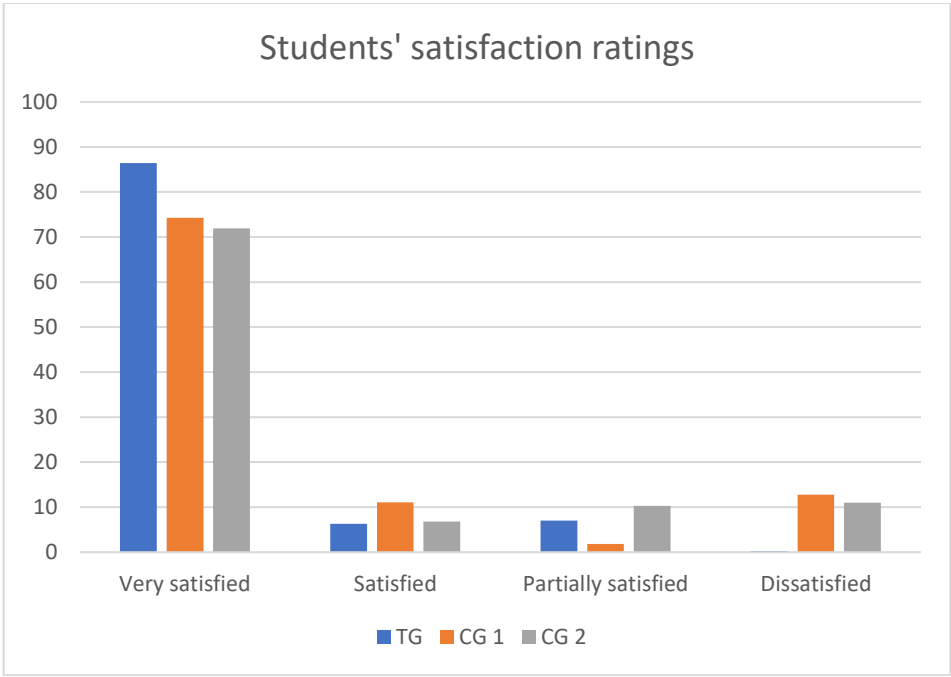

Chart 1: Students' satisfaction ratings

The more objective set of data was related to the three variables that we tested for. The first was related to the time and number of attempts needed to find a solution or solutions and the second one was the overall grade obtained for all the effort invested into the completion of all tasks. Interestingly enough, the TG, on average, needed more attempts to find a solution. Nevertheless, they were able to complete the task more quickly than the CG 2 and, especially than the CG 1. This was due to several reasons. The reason for the existence of more attempts in TG was due to the psychological effect of GBL. One of the numerous benefits of GBL is that it allows for "graceful failure", i.e., it enables the students to attempt a solution much more quickly and easily than in a traditional classroom. The affective cost for these students is not too high, which is partially due to the flexible game mechanics. Game mechanics are rule-based systems/simulations that facilitate and encourage a user to explore and learn the properties of their gaming space through the use of feedback mechanisms[3]. This encouragement, combined with a lower affective cost, are responsible for more attempts, since students become less afraid of failure, knowing that, if they do not succeed, they will need to tweak some elements next time, but there is nothing to be ashamed of (Watson et al. 2011, Young et al. 2012). Another reason is the visual nature of GBL, since all the mistakes made by the students

[3] https://lostgarden.home.blog/2006/10/24/what-are-game-mechanics/

belonging to the TG would be almost instantly visible to them because, companion cubes or other elements would not behave the way it was expected of them to behave. For instance, poorly constructed or positioned portals would transfer the game assets to a wrong location, thus preventing the students from completing the assignment. Students would tweak the faulty element and add some fine-tuning if necessary. Feedback was almost instantaneous and more interesting. Mistakes created funny results because the game elements behaved awkwardly. Contrary to them, the CG 1 and CG 2 would have to go through the whole process "manually" and the mistake may not be so obvious or may be more difficult to spot until the teacher would point it out and then, more often than not, they would have to return "back to the drawing board", which may be somewhat discouraging for students.

Finally, the graph below also answers one of the most pertinent questions of this paper. Are the TG students going to be closer to the CG 2 in terms of their academic achievement i.e., grade, or they will slip behind and be closer to the CG 1? The graph answers that, while the TG was unable to be academically better than the CG 2 group, which consists of the best students (the academic gap was too wide to close), the TG was able to partially close the gap and perform admirably, especially taking into consideration that this project lasted only for ten weeks and more time would most probably level the playing field.

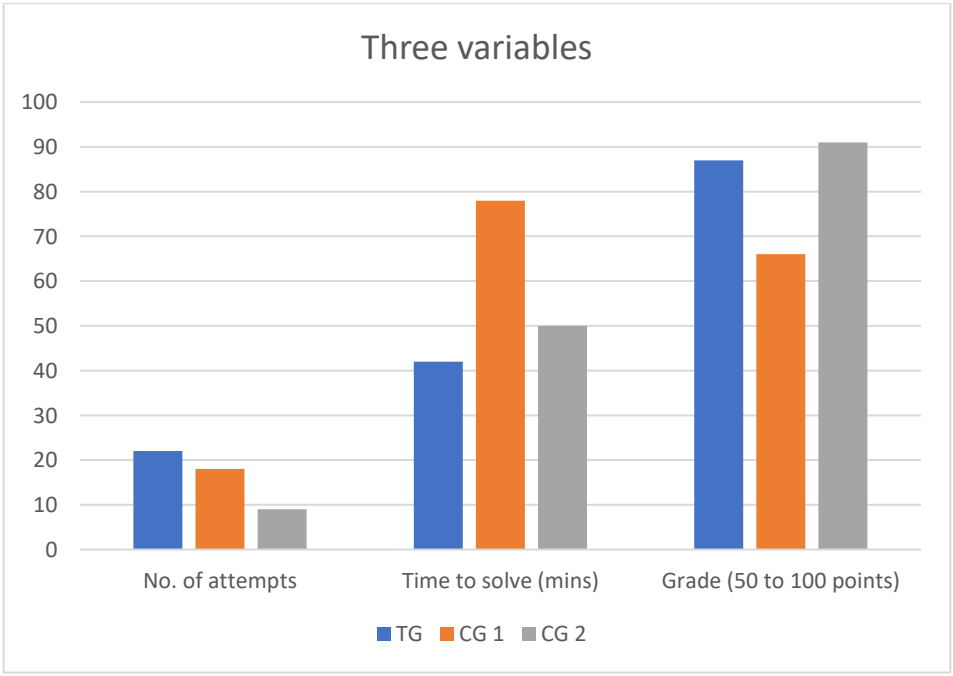

Chart 2: Three research variables

5. Conclusion

From our semester-long study, we can safely conclude that GBL should earn its place in almost all schools and faculties of different degree programmes. It is not too difficult to implement, expenses are not too high, and the results are easily measured. Almost all students from TG mentioned this was a remarkably interesting project for them and they would definitively apply to participate in the next one. This means it is possible to connect fun and academia without losing quality. It is necessary to point out this study lasted only for ten weeks, which is one of the main limitations of this research, so all the results have to be taken with a grain of academic salt and interpreted very carefully. Our interpretation is that these results are encouraging and show that GBL can be relatively easily implemented into our schools, but any more detailed and longer study would be more than welcome. In terms of its practical implementation, schools need computers, the number of which should, ideally, correspond to the number of pupils/students in that school. Minimally, this number should not be below one computer per three students. Additionally, schools also need a game or games adapted to the educational environment. Luckily, we have an abundance of choices with multiplayer online games, puzzle games, point and click games, etc. Finally, schools need an instructor trained in game-based learning and its application in schools and academia.

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SAŽETAK: UČENJE POMOĆU VIDEO IGARA
PRIMJENA NA UČENJE STRANIH JEZIKA U CRNOJ GORI

Ovaj rad se bavi praktičnom primjenom digitalnih igara u domenu obrazovanja i učenja stranih jezika u Crnoj Gori. Digitalne igre moraju da postanu sastavni dio našeg obrazovnog sistema, jer predstavljaju odličan način za izučavanje i usvajanje stranih jezika. Razlog za ovo se krije u tome što digitalne igre koriste urođenu ljudsku potrebu za igranjem i ta potreba, kroz digitalne igre, postaje sredstvo da se dođe do akademski zadovoljavajućih rezultata u pogledu izučavanja i usvajanja stranih jezika. Naša kratka studija sa ciljnom i kontrolnim grupama je pokazala da učenje pomoću digitalnih igara može da bude održiva dopuna tradicionalnog načina usvajanja stranih jezika, uz postepeno smanjivanje tradicionalne komponente učenja i srazmjerno povećavanje udjela učenja preko digitalnih igara. Važno je napomenuti da digitalna igra, koja se bira kao metodološko-praktični način obrade nastavnih jedinica, mora da bude usklađena sa nastavnim i akademskim potrebama studenata. Ciljevi digitalne igre moraju da budu unaprijed jasni studentima i oni moraju da vide jasnu vezi između napretka u video igri i napretka u usvajanju stranog jezika. Upravo iz ovog razloga smo odabrali video igru „Portal 2", jer omogućava studentima smisleno putovanje kroz igru koje je neposredno povezano sa usvajanjem propisanih nastavnih sadržaja. Drugi razlog je što je pomenuta igra dovoljno prilagodljiva našim potrebama i dinamici koja vlada u učionici, što je jako bitno, jer nastavnički posao uvijek podrazumijeva i nepredviđene okolnosti, na koja igra mora da odgovori svojom prilagodljivošću.

Ključne riječi: učenje pomoću video igara, digitalna učionica, metodološka „skela", učenje stranih jezika, nova metodologija