ASSESSING THE USE OF FLASH CARDS IN THE HIGHER ENVIRONMENTAL EDUCATION CLASSROOM

Natasa Petrovic, Veljko Jeremic, Marko Cirovic, Nemanja Milenkovic, Jelena Andreja Radakovic

Faculty of Organizational Science
University of Belgrade
Belgrade, Serbia

Abstract

Considering the importance of information technologies and Internet in today's students' social and academic life, this paper will be focused on the scientific research of the online use of flashcards in support to teaching and learning objectives of higher environmental education. Bearing in mind that this particular way of studying enables modern game-based learning for students and makes handling the basic terms of the examined course more successful, we surveyed students of the University of Belgrade's Faculty of Organizational Science in Serbia, not only on their attitude toward flashcards as productive online tools for learning, but also on their achievement level on a selected environmental course. An analysis of the results was carried out using the SPSS 22 software package.

Introduction

Very few research papers and case studies have shown successful use of games in connection with education that has been happening for decades (Scullion, Stansfield, & Connolly, 2011). According to Connolly and Stansfield (2006) online gaming processes and philosophies present interesting analogies to modern pedagogical thinking around communities of practice. Harteveld and Bekebrede (2010) concluded that games could be seen as being appropriate for a wide range of learning objectives. Also, educators are beginning to realize the benefits of game-based learning, from the intellectual challenge to the provision of multiple learning styles, which have an immediate part in the process of learning. Consequently, many researchers have investigated the use of flash cards in education.

Further, environmental education is of particular importance in the field of higher education because higher education is one of the nation's most valuable assets (NACUBO, 2002; Petrovic, Jeremic, Petrovic, & Cirovic, 2014). This is especially important for Serbia, because the data about environmental educational curriculum and programs in Serbia has shown that there is an evident lack of formal and permanent environmental education at all levels of formal education (Klemenovic, 2004; Trumic, Petrovic, & Radojicic, 2009; Petrovic, 2010; Pavlovic, 2011; Sakac, Cveticanin, & Sucevic, 2012; Petrovic et al., 2014).

The uniqueness of higher environmental education lies in the fact that this education has to be student-centered, providing students with opportunities to

construct their own understandings through hands-on and minds-on learning. In addition, environmental education represents an umbrella for many forms of education that already exist, and new ones that remain to be created (Petrovic et al., 2014). Bearing this in mind it can be concluded that game-based learning could also contribute to the achievements of this kind of higher education.

In order to assess the use and educational benefits of flash cards in the higher education, especially in the higher environmental education classroom, we introduced students to an application called Flashcard Stash (http://flashcardstash.com) and a manual for using both the application and flashcards. The authors surveyed undergraduate students on their attitude toward the application Flashcard Stash as an effective online tool for learning. The students were enrolled in an Environmental Quality System course at the University of Belgrade-Faculty of Organizational Science, located in Serbia. An analysis of the results was carried out using the SPSS 22 software package. Our research, which had 57 participating students, sought to answer what students think about three questions:

1. Are flash cards easy to use?
2. Do flash cards help students study?
3. Do students feel that the faculty should implement the use of flash cards in other courses at the university?

Background

In recent years game-based learning research has matured and developed (Hays, 2005; O'Neil, Wainess, & Baker, 2005; Clark, Yates, Early & Moulton, 2009; Adams, Mayer, MacNamara, Koenig, & Wainess, 2012). Also, game-based learning has been studied from two different perspectives, focusing either on the informal learning that occurs during play (e.g., Steinkuehler, 2005;Williams, 2006), or on the integration of games in formal education (Bourgonjona, De Grovea, De Smet, Van Looya, Soetaert, & Valckea, 2013).

Many researchers agree with ascertainment that the benefits of game-based learning are numerous (Mann, Eidelson, Fukuchi, Nissman, Robertson, & Jardines, 2002) in comparison with more traditional educational media (Ebner & Holzinger, 2007). Two of them are:

• Providing students with the opportunity to reinforce the previous knowledge by repeating it in a more comfortable environment (Arslan, 2006; Yildirim, 2009).

• Helping students to learn and to develop their problem solving skills by using their wish and enthusiasm to play (Cankaya & Karamete, 2008).

In addition the remarkable improvements in information and communication technologies and increase in the use of the Internet have brought numerous opportunities to different fields and especially to distance learning (Aydin & Tirkes, 2010; Demirci, 2010; Petrovic, Jeremic, Cirovic, Radojicic & Milenkovic, 2013). "The spread of computer use in education and increase

interest in computer games bring to the mind that using computer games in learning environments can be useful" (Donmus, 2010, p. 1497). Educational computer games provide learners to surf "in the virtual environment in which rich discovering opportunities are available and creates appropriate content for transferring exercising skills into real world" (Wheeler, 2009, p. 80). Computer based learning represents "the result of students' existing interest in computers and computer games" (Donmus, 2010, p. 1499). Kuzu and Ural (2008) noted that the combination of games and education give educative games entertaining environments for learning.

Flash cards are one of the most common tools that learners can use to study facts about a particular topic (Kornell & Bjork, 2008), and one of the best methods for studying and memorizing information. Flash cards can be used for learning information about specific issues, terms and definitions or main ideas and subjects.

Methodology - Research Context

The course selected for this research was Environmental Quality System, which is a mandatory course in the final year of undergraduate studies at the Faculty of Organizational Sciences. The classes consisted of two hours of lectures and two hours of exercises each week for a 14-week semester. The course program is based on a strong pedagogical methodology, requiring participants to turn their environmental knowledge into appropriate environmental actions and into behavior change (Petrovic, 2010; Petrovic et al., 2014). The course has sections on ecology, environmental issues and protection, environmental management, eco management systems, ISO 14000, sustainable development, and practices of sustainability (Petrovic et al., 2014).

Bearing in mind the fact that the high numbers of social network users are students, the attention is drawn to the necessity for educators to use social network sites such as Facebook as a possible educational and communicational tool for students (Grant, 2008; Petrovic et al., 2014). Due to the importance given to enhancing learning environments (Donmus, 2010), it is beneficial to determine the effects of educational computer games and, in authors' opinion, Flashcards applications, and social networks together. This is especially important considering the fact that despite the widespread recognition of the advantages in the use of games in elementary and secondary education, there is little evidence of their use in higher education (Ebner & Holzinger, 2007). This motivated us to put our research in motion and we encouraged students to use the Flashcard Stash application dedicated to the selected course. This application is accessible from their Facebook accounts. Along with the link to the application, they were given a manual on how to use the application and the flashcards themselves (Petrovic et al., 2014). Screenshots of this application are provided in Figures 1-4.
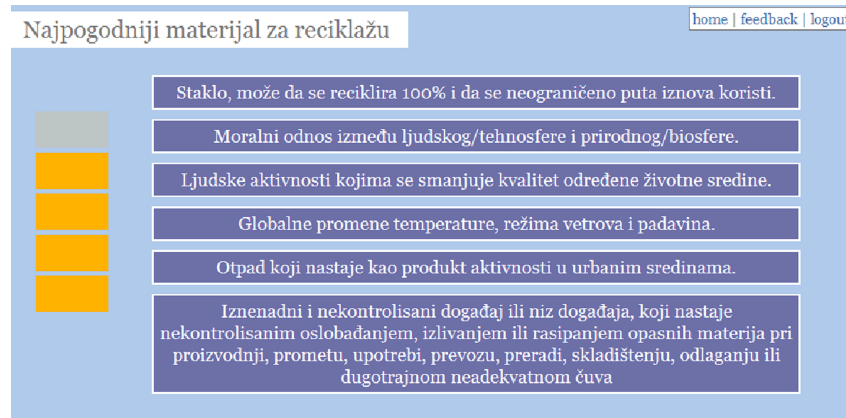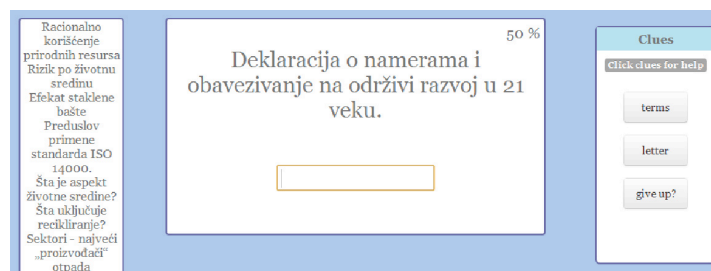
Figure 1. Multiple choice questions.
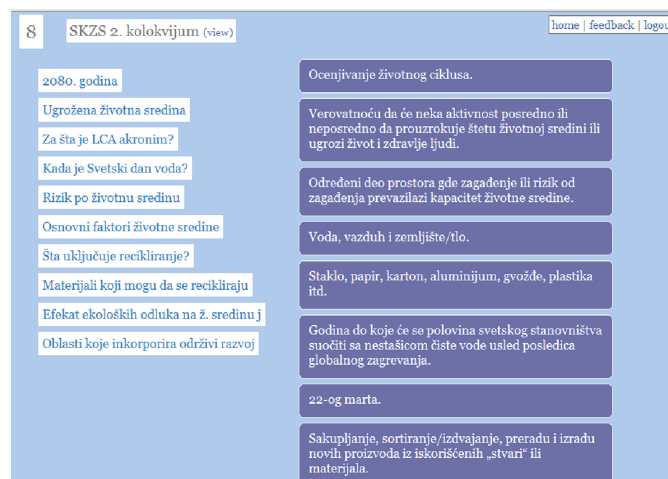

Figure 2. Fill in the blank questions.

Figure 3. Match game questions.

Figure 4. Waterfall game questions.

Participants and Design
The research was performed with students attending the winter semester of the 2013-2014 academic year. Only after students successfully completed the course, did they take part in a survey. The survey was conducted at the University of Belgrade-Faculty of Organizational Sciences, Serbia. Out of a total of 78 students that attended the course Environmental Quality System, 57 students (73.08 percent) submitted their responses. A large number of students - 73.08 percent provide us with a valid sample for further analysis of this case study. When it comes to the students who took the survey, 36 of them (63.16 percent) were female while 21 of them (36.84 percent) were male.

Instruments
In order to evaluate the results of the survey, we used a statistical software package, SPSS 22. Descriptive statistics have been used in order to analyze the characteristics of the sample. The Kolmogorov-Smirnov Test showed that the data is not distributed normally, which led to a restriction of using exclusively non-parametric method of hypotheses testing. The Mann Whitney U Test was conducted in order to compare two independent groups in regard to a observed scale variable. A p value is used to indicate if the differences between two particular groups that were in this research are statistically significant (where $p<0.05$ is considered statistically significant at the 95% confidence level, while $p<0.01$ is statistically significant at the 99% confidence level).

Results

Students were asked to provide answers on 15 closed-type questions. The first three questions where general questions regarding the students' gender, if they already passed the exam and which mark they achieved. Out of the next four questions, the last two were in regards to whether or not the student made and used flash cards with the application Flashcard Stash. The rest of the questions had the task of providing us the answers to:

- Are flash cards easy to use?
- Do flash cards help students study?
- Do students feel that the faculty should implement the use of flash cards in other courses at the university?

Students who answered with confirmative to the question whether or not they used flash cards were the only ones whose responses were taken into consideration for further analysis. Out of all the students, 51 students answered with yes (89.47 percent). We did not find a statistically significant difference in responses by gender ($p > 0.05$ for all of the 11 questions).

In order to evaluate the student's satisfaction with the use of flash cards, as well as their answers to the questions of whether the flash cards helped them in comprehending the material better and preparing the exam easier, the students gave marks on a rating scale from 1 to 5 based on the truthfulness of the statement, and we calculated the percentage of students that answered positively to these questions either with a 4 (I agree) or a 5 (I absolutely agree). The results based on the answers given by students to our 15 questions are shown in the Table 1.

Table 1

Percentage of Students With Positive Attitudes Toward the Use of Flash Cards

Question	Students with Positive Attitudes Toward the Use of Flash Cards [%]
Easy to use	93.55
Fun	87.10
Help with the comprehension of the material	93.55
Help with remembering the lecture	90.32
Raised environmental awareness	87.10
Increased my environmental knowledge	83.87
Motivated me to do better in class	80.64
Motivated me to learn more	77.42
Helped me with studying for the colloquium/exam	80.64
Encouraged me to a behavioral change and environmental actions	77.42
Should be implemented in more courses at the Faculty	90.32

For the needs of the research we divided the students into two groups. The first group was made up of students who made as well as used flash cards, and consisted of 31 students (60.78 percent). The second group was made out of students who used but did not make the flash cards themselves, and the group consisted of 20 students (39.22 percent). When we examined the difference in responses to the questions between these two groups our research has shown a statistically significant difference in answers on two specific questions:

- "Flash cards increased my environmental knowledge" – $p = 0.044$. The mean rank for the students who made flash cards was 18.45, while the value was 11.55 for the students that did not make them. One could conclude that the students who made the flash cards assessed their environmental knowledge as increased more than the students that only used the flash cards.

- "Flash cards helped me with studying for the colloquium/exam" – $p = 0.020$. The mean rank for the students who made flash cards was 18.80, while for the students that only used it, was 10.91. Once again, the students who made the flash cards felt that it helped them with studying more than the students that did not make the flash cards.

Discussion

Results show that a large number of students found flash cards easy to use (93.55 percent) and entertaining (87.10 percent), which means that students might easily adapt to them and accept their use. This means that if they were introduced as a regular learning method, they would likely have a high acceptance rate among students.

Also, an even larger number of students found that the flash cards enabled a better understanding of the material lectured on in class (93.55 percent), and that they enabled a better memorization of material (90.32 percent).

Additionally, if the environmental courses such as Environmental Quality System, besides their primary goals have an aim to increase environmental awareness and general knowledge about environmental and sustainable issues, then our research shows that flash cards could be a valuable asset for such purposes (87.10 percent and 83.87 percent, respectively). Such impact is useful if the intention of the course is to spark the change in behavior and make students take part in environmental actions as well (77.42 percent stated exactly such motivation).

Many students found the use of flash cards motivational for learning (80.64 percent), and 77.42 percent claimed that flash cards motivated them to learn more regularly. Finally (90.32 percent), the largest number of students who participated in the research had the opinion that flash cards should be introduced to other courses at the university as well.

Conclusion

Definitely end of course survey results showed a need, and encouraged us and other researchers to continue exploring this area. Game-based learning as a concept has yet to be fully investigated. But this specific research shows us that flash cards are without a doubt, tool of students' interest.

A growing number of educators are facing the challenges of modern higher education, such as keeping students motivated and increasing the knowledge and awareness of specific problems. These challenges need a response. Our specific case study was a first attempt to make students interested in core environmental issues by using flash cards. In the future such a need might demand from the educator and from the educational process employment of such game-based tools.

The students demonstrated positive attitudes toward the use of the educational flash cards as effective online tool for learning in higher education, especially in the higher environmental education classroom. Our results also pointed out the effectiveness of the proposed use of the flash cards application in improving the students' scientific environmental knowledge.

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Author Details

Petrovic Natasa   Jeremic Veljko Ph.D.   Cirovic Marko M.Sc.
petrovicn@fon.bg.ac.rs   jeremicv@fon.bg.ac.rs   marko.cirovic@fon.bg.ac.rs
          Milenkovic Nemanja M.Sc.   Radakovic Jelena Andreja
          milenkovic@fon.bg.ac.rs   jelenaandrejaradakovic@gmail.com