

# Guest Editorial II

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## Special Issue

### Gamification Ecosystems in Engineering Education

The popularity of computer games led to thinking about their application in education. Games become an integral part of modern society. They are the ideal platform for presenting new content and new technology; a lot of people play computer games and accept them as a normal form of entertainment. In contrast to all existing media, games have the opportunity to interact, allowing the user to actively participate, not just passively receive information. In recent years educational gaming has been progressively perceived as a very effective tool for improving teaching-learning activities in higher education.

After initial exploitation of the games in the educational area, new term of gamification emerged, as the use of game thinking and game mechanics in non-game contexts to engage users in solving problems.

According to the HORIZON 2020 call, given under ICT 2014 section, with the topic of advanced digital gaming/gamification technologies: “Digital games and gamification mechanics applied in non-leisure contexts is an important but scattered industry that can bring high pay-offs and lead to the emergence of a prospering market. Digital games can also make a real change in the life of a large number of targeted excluded groups, enhancing their better integration in society. This requires the development of new methodologies and tools to produce, apply and use digital games and gamification techniques in non-leisure contexts, as well as building scientific evidence on their benefits for governments, enterprises and individuals.”

The objective of this special issue is to bring actual theoretical and applied research in the field of gamification technology development in engineering education.

Engineering education could benefit from these new approaches in gamification field. For this special issue, we selected original theoretical, as well as practical, papers presenting research that describes and assesses methods and approaches to gamification focused on applications in the field of engineering education.

Lot of papers selected for this special issue are dealing with gamification in classroom. First one among them is paper “Gamifying an Artificial Intelligence Course in Engineering Education” where authors describe application of gamification principles on teaching topics in AI course. Basically, they implemented competition-based projects approach and feedback from students was very positive. They were eager to compete and improve constantly their projects in order to gather higher ranking in group. Consequently, acquired knowledge and programming skills in AI was higher than without gamified approach.

Second paper titled “Learning Gains, Motivation and Learning Styles in a Gamified Class” describes improvements reached by introducing gamification into database course. Research was focused on learning gains and final grades, conducted with control and experimental group of students. Even if learning outcomes were at similar level among groups, they found significant increase in intrinsic motivation of students.

Third paper titled “Evaluating the Effectiveness of Game-Based Learning on Improvement of Student Learning Outcomes within a Sophomore Level Chemical Product Design Class” presents application of gamification approach during chemical product design course. Authors noticed higher learning outcomes comparing with control group, and also better retention of material, confirming benefits of applying gamification in this engineering area.

Gamification applied for teaching supply chain management is presented in the paper “Supply Chain Education—the Contribution of Gamification”. Their approach was simulation based, where students could use supply chain simulator, in order to better understand the process and gather virtual experience. This way student can get hands on experience in a fun gaming environment. Finally, students were pleased by this approach.

Another one simulation based approach can be found in paper “Application of video game artificial intelligence techniques for design of a simulation software system for transportation engineering education”. The idea was to enable students in transportation engineering field to use simulation in order to actively learn about different important concepts in the field. Specific focus of this paper is on how to utilize AI approach while developing educative simulators.

Virtual simulator approach is applied also in paper “Improving motivation in a haptic teaching/learning framework”, where authors use it as an affordable alternative for teaching surgery skills. They are presenting SHULE, as a framework for integrating simulator with LMS, expert knowledge and gamification principles in learning process.

Computer programming, due to complex nature, represents often topic for application of gamification. One of accepted papers, focused on lower educational levels, titled “Using Games to Help Novices Embrace Programming: from Elementary to Higher Education”. Their major aim was to increase success rate of novice programmers in order to motivate them to continue with higher education in computer science field. Their gamification approach was based on students that build new computer game. Initial results were very positive.

In mechanical engineering there are very complex topics to be learned about. However, gamification approach can help student better understand and work with a set of complex ideas. Authors provides a hypothesis that gamifying the acquisition of cognitive and technical knowledge allows its complexity to be better grasped and matters to be simplified.

Motivation represents specific challenge when learning is practiced through MOOC. Authors of paper “New Challenges for the Motivation and Learning in Engineering Education Using Gamification in MOOC” propose gamification cooperative MOOC model (gcMOOC), which should be applied when designing massive courses. Their research investigated influence of different factors, such as motivation, collaboration and learning. They also provide set of practical recommendations and gamification tools for improving them.

Even if gamification is promising approach in order to gain student motivation, its noticed that lot of gamified systems fails to keep student involved over long term. In order to tackle this problem, authors of the paper “Enhancing the Engagement of Intelligent Tutorial Systems through Personalization of Gamification” propose higher level of personalisation. Their approach is to extend intelligent tutorial system, which has best ability to personalize, with gamification activities.

Virtual world approach is very suitable for learning about construction. Since defects often occur during construction process, the paper “A Virtual World Based Construction Defect Game for Interactive and Experiential Learning” is focused on teaching about defects through game based environment. Overall environment provide students with the real construction defect experience through learning by doing.

The paper “A Playful Affordances Approach to the Design of Gameful Learning” rethink about background theories about how to apply game elements in education. Their research results shows that motivational outcomes of playful experiences are better than to provide some extrinsic rewards to students. Based on acquired results, they propose playful affordances model as a tool for the design of gamification or GBL activities.

Interesting approach of “Educational website conversion improvement using gamification” is given. Research is based on quantitative data, gathered through Google analytics, and it’s applied on existing distance learning course. Experiment results show improvement of conversion, as well as better motivation and learning outcomes.

Last one paper, titled “Gamification of bioeconomic prey-predator model”, presents game for mobile phones, aimed at raising awareness of the need to protect nature. Game is focused on special reserves of nature, and apply some of gamification principles in order to motivate users to use it. Part of the game is simulator based on pray-predator model, in order to show behaviour of ecosystem with connected pray and predator species. Research conducted shows urgent need for building attitude about preserving nature and raising environmental awareness among population. Gamification approach combined with mobile technology proved to be very suitable for this task.

Finally, we wish to thank the authors who made a tremendous effort to prepare papers in a high-quality manner, and members of the Review Board on quality work and time spent which they dedicated to the review process.

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