

Association for Information Systems

AIS Electronic Library (AISeL)

Proceedings of the 2019 AIS SIGED
International Conference on Information
Systems Education and Research

SIGED: IAIM Conference

12-31-2019

EDUCATIONAL GAMIFICATION USING MINECRAFT: A CASE OF LEARNING THE HISTORY OF AN ISRAEL CITY

Tai-Yin Chi PhD. Assistant professor
Information Systems, San Francisco State University, tchi@sfsu.edu

Iris Reyhav PhD. Head of Collaborative Learning Lab
Industrial Engineering and Management, Ariel University, irisre@ariel.ac.il

Karina Batat Instructor Technology Specialist, Head of Beta School
Center of Innovation in Education Tel Aviv District, Israel MoE, Karina@israel365.info

Follow this and additional works at: <https://aisel.aisnet.org/siged2019>

Recommended Citation

Chi, Tai-Yin PhD. Assistant professor; Reyhav, Iris PhD. Head of Collaborative Learning Lab; and Batat, Karina Instructor Technology Specialist, Head of Beta School, "EDUCATIONAL GAMIFICATION USING MINECRAFT: A CASE OF LEARNING THE HISTORY OF AN ISRAEL CITY" (2019). *Proceedings of the 2019 AIS SIGED International Conference on Information Systems Education and Research*. 3.
<https://aisel.aisnet.org/siged2019/3>

This material is brought to you by the SIGED: IAIM Conference at AIS Electronic Library (AISeL). It has been accepted for inclusion in Proceedings of the 2019 AIS SIGED International Conference on Information Systems Education and Research by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

EDUCATIONAL GAMIFICATION USING MINECRAFT: A CASE OF LEARNING THE HISTORY OF AN ISRAEL CITY

Tai-Yin Chi, PhD.
Assistant Professor
Information Systems
San Francisco State University
tchi@sfsu.edu

Iris Reychav, PhD.
Head of Collaborative Learning Lab
Industrial Engineering and Management
Ariel University
irisre@ariel.ac.il

Karina Batat
Instructor Technology Specialist
Head of Beta School, Center of Innovation in Education
Tel Aviv District, Israel MoE
Karina@israel365.info

Extended Abstract:

In a connected world and dynamic global workplace today, students must equip themselves with some critical skills to success. According to a study of 21st century skills and competences for new millennium learners, students today are recommended to have skills such as collaboration, knowledge construction, real-world problem-solving and innovation, and the use of Information Communications Technology for learning. However, learning activities that offer the opportunity to develop these skills continue to be far from the instruction that most students experience [OECD, 2009; Law et al., 2010; Shear et al., 2010; Trilling and Fadel, 2012; FPSPI, 2019], and teachers often report that they lack specific guidance and models for how to move these ideas from rhetoric to classroom practice [Ananiadou and Claro, 2009].

Many educators also face problems related to student interest and engagement in their classrooms. Gamification can be a good solution to help solve learner engagement and participation issues in the classroom due to its fun and playful nature. Gamification is to change something that is not a game through a game or its elements [Van Grove, 2011; Werbach and Hunter, 2012]. Researchers claimed that gamified learning can foster students' motivation and engagement [Hakulinen et al., 2013; Kumar and Khurana, 2012; Li et al., 2012; Nah et al., 2014; Su and Cheng, 2015]. The psychological and behavioral changes resulting from gamification for learning and education are not limited to motivation and engagement. Sitzmann [2011] revealed that gamification promotes self-efficacy and increased retention.

The present study proposes a gamified design of learning activities based on the 21st Century Learning Design Rubrics (21CLDRs) [SRI 2019]. The purpose of the 21CLDRs is to help educators identify and understand the opportunities that learning activities give students to build 21st century skills. These rubrics were developed and tested internationally for the Innovative Teaching and Learning Research project [SRI 2019]. Each of six rubrics of 21st century learning represents an important skill for students to develop—collaboration, knowledge construction, self-regulation, real-world problem-solving and innovation, the use of Information Communications Technology (ICT) for learning, and skilled communication. Minecraft, Microsoft OneNote, and Facebook were used as ICT for supporting the gamified learning activities in the study.

Minecraft is an award-winning game, originally created by Markus Persson, developed by Mojang in 2009. An educational version, MinecraftEDU, was developed in 2011. Players create and build

in this sandbox-style game, using three-dimensional (3D) textured cubes in various gameplay modes: survival mode, creative mode or adventure mode. Players can build alone or together, on a shared server, through exploring, gathering resources and crafting. Daly [2012] explains that Minecraft is an open-ended creative computer game which has potential for teaching just about anything from math concepts and computer programming to geography and storytelling. Minecraft has been used as an educational tool for different topics all over the world such as sustainable planning [West and Bleiberg, 2013], language and literacy [Bebbington, 2014; Garcia Martinez, 2014; Hanghøj et al., 2014], digital storytelling [Garcia Martinez, 2014], social skills [Petrov, 2014], computer art application [Garcia Martinez, 2014], project management [Saito, Takebayashi, & Yamaura, 2014], and chemistry [Hancil, 2013]. Minecraft was used as the primary game environment to support learning in the study because of the flexible customization of game tasks in which students worked together to solve problems, learn the city history in Israel, and plan the future to create a sustainable community.

The game designed in this study was based on the background of celebrating the 70th anniversary of the State of Israel and 140 years of the city of Petah Tikva. The objective of the game was not only to help participants learn history, geography, and citizenship about the country and the city, but also to develop a new way of teaching and cultivate students' creativity, collaborative learning and communication skills. The game consists of two active environments—OneNote notebook and the world of Minecraft. The notebook was used for team members to cooperate with each other, plan their tasks, document the processes, and write the task resolutions. The world of Minecraft was the virtual world where the teams conducted construction to fulfill the mission requirements in the game. The game consisted of a lobby and four stages. The lobby was a collaborative space where the game started, from which each team moved to the next stages. In each stage (including the lobby), each team received a task in the notebook of the project that included questions, inquiries, finding information, and a construction mission. When a team completed the construction of the selected product and the documentation in the notebook, each team was advised to upload a picture/screenshot of the deliverable to the project's Facebook page in tagging #MPTX2.

The game was designed for the students to learn the past and present of the city and the country and plan for the future to create a better world. For example, the first stage of the game was designed to help students learn the past of Petah Tikvah. The city has historical landmarks in many areas. Each team chose one of the fields to restore in Minecraft world. At the final stage, the teams were asked to decide together and chose one of the seventeen United Nation Global Sustainable Development Goals (UNGSDGs) [UNGSDG, 2019] that they would like to promote in the city. Students discussed which UNGSDG to choose based on what they knew or learned about the city. Then, the students negotiated their ideas to shape their work together.

We sought to determine: (1) How Minecraft can be used to support gamified learning activities following the 21st Century Learning Design Rubrics; and (2) How effective the gamified learning activities are in terms of promoting teamwork and empowering students to be involved, creative and active.

300 students and 28 teachers from twelve schools in Petah Tikva participated in the project. The 21st Century Learning Design Student Work Rubrics (21CLDSWRs) were used to examine whether students exhibited the important skills in the work they did. The 21CLDSWRs describe six dimensions of students' 21st century learning, each of which represents an important skill for students to develop. Both 21CLDRs and 21CLDSWRs have the same six dimensions of the learning skills. The difference is that the 21CLDRs are used to help educators to develop learning activities, while the 21CLDSWRs are guides to help determine how strongly the student work demonstrates the related skill. The OneNote notebooks which documented each team's work during the game were the primary data for analysis. The responses of two questionnaires from the participants during the game was also analyzed.

In the OneNote notebooks, the teams (schools) documented how they worked together to solve the riddles and completed the missions, including their strategies and work division. The notebooks also showed the team members' active involvement based on their assigned roles. The deliverables that the teams made also demonstrated the students' creativities and problem-solving

skills. In 21CLDSWRs, analyzing student work is different from the grading that teachers usually do. When grading, teachers assign a grade based on the overall quality of the work. When assigning a number to student work for a given dimension, teachers should consider only the degree to which the student work demonstrates that dimension, not the overall quality of the work. Based on the 21CLDSWRs, the students' works were graded and the results showed that most of the twelve teams demonstrates a medium to high number (3 to 5) in each of six skill dimensions.

The purpose of the questionnaires was to get some feedback when the game was in progress. Students and teachers were not required to answer the questionnaires during the game, so the responsive rate was low. However, among the 29 responses, there were some common positive feedback from students about how they enjoyed the game and learned in a different way. A couple of teachers responded that their roles as a teacher changed. They acted more like a facilitator during the game. Although the responses from the questionnaires were not sufficient to draw any significant conclusion, the feedback from the students and teacher is still useful for future studies. For example, researchers can study to what extent the teachers' involvement during a gamified learning activity would affect the learning outcomes.

The game design in this study showed another case of using Minecraft as an educational tool. With careful planning and the 21CLDRs, the project team was able to use Minecraft as the primary game platform that allows students to learn various skills in the context of a city's past, present, and future. Unlike the traditional instructions, the gamified learning activities in this case were to promote respect and teamwork, and to empower students to be involved, creative and active. Students' work and feedback during the game showed that students were actively involved at different game stages. Each team's deliverables of the game missions also demonstrated students' creativity such as designing the logo for celebrating the city and proposing a solution to create a sustainable city in the future. The project was a pilot and the lesson-learned would be used to improve the future projects on developing Minecraft games in different learning context.

Keywords: gamification, Minecraft, 21st century learning design, teamwork, collaboration, knowledge construction, use of ICT for learning

REFERENCES

- Ananiadou, K., and M. Claro (2009) "21st Century Skills and competences for New Millennium learners in OECD countries", OECD Education Working Papers, No. 41, OECD Publishing. <http://dx.doi.org/10.1787/218525261154>.
- Bebbington, S. (2014) "A Case study of the use of the game Minecraft and its affinity spaces for information literacy development in teen gamers" (Unpublished doctoral dissertation). University of Ottawa, Ontario, Canada.
- Daly, E. (2012). "Explore, create, survive", *School Library Journal*, 58(5), pp. 24–25.
- Garcia Martinez, S. (2014). "Using commercial games to support teaching in higher education" (Unpublished doctoral dissertation). Concordia University, Quebec, Canada.
- FPSP. (2019). 21st Century Learning Skills. Retrieved January 10, 2019, from <https://www.fpspi.org/21st-century-learning-skills/>
- Hakulinen, L., T. Auvinen, T., and A. Korhonen (2013) "Empirical study on the effect of achievement badges in TRAKLA2 online learning environment". In *Proceedings of Learning and Teaching in Computing and Engineering (LaTICE) Conference*, Macau: IEEE, pp. 47–54.
- Hanghøj, T. et al. (2014). "Redesigning and reframing educational scenarios for Minecraft within mother tongue education", In I. C. Busch (Ed.), *Proceedings of 8th European Conference on Games Based Learning (ECGBL2014)*, Reading, UK: Academic Conference and Publishing International Limited, pp. 182-190.

- Hancl, M. (2012, August 12). "Lego WeDo airplane controls Minecraft TNT (Computercraft)" [Video file]. Retrieved from <https://www.youtube.com/watch?v=qultrIPsd7s>
- Law, N., W. Pellgrum, and T. Plomp (2010) "Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study", Hong Kong: Comparative Education Research Centre.
- Li, W., T. Grossman, and G. Fitzmaurice (2012) "GamiCAD: A gamified tutorial system for first time autocad users", *In Proceedings of the 25th annual ACM symposium on user interface software and technology*, Cambridge, MA: ACM, pp. 103–112.
- Kumar, B., and P. Khurana (2012) "Gamification in education-learn computer programming with fun", *International Journal of Computers and Distributed Systems*, 2(1), pp. 46–53.
- Nah, F.F.H. et al. (2014). "Gamification of education: A review of literature", *Proceedings of 1st International Conference on Human-Computer Interaction in Business*, Crete, Greece: LNCS Springer, pp. 401–409.
- OECD (2009). "*Creating effective teaching and learning environments: First results from TALIS*", Paris: OECD Publishing.
- Petrov, A. (2014). "Using Minecraft in education: A Qualitative study on benefits and challenges of game-based education" (Unpublished doctoral dissertation). University of Toronto, Canada.
- Saito, D., A. Takebayashi, and T. Yamaura (2014). "Minecraft-based preparatory training for software development project", *In Proceedings of IEEE International Professional Communication Conference (IPCC)*, pp. 1-9.
- Shear, L., G. Novais, and S. Moorthy (2010) "*ITL Research: Executive summary of pilot year findings*", Redmond, WA: Microsoft.
- Sitzmann, T. (2011) "A meta-analytic examination of the instructional effectiveness of computer-based simulation games", *Personnel Psychology*, 64(2), pp. 489–528.
- SRI International (2019). "21st Century Learning Design [21CLD]", SRI International. Retrieved from <https://www.sri.com/work/projects/21st-century-learning-design-21cld>.
- Su, C., and C. Cheng (2015). "A mobile gamification learning system for improving the learning motivation and achievements", *Journal of Computer Assisted Learning*, 31(3), pp. 268–286.
- Trilling, B. and C. Fadel (2012). "*21st Century Skills – Learning for Life in our Times*", John Wiley & Sons.
- Van Grove, J. (2011) "Gamification: How Competition Is Reinventing Business, Marketing & Everyday Life," Mashable.com. [Online]. Available: <http://mashable.com/2011/07/28/gamification/#xwe7T7tjoukt>.
- UNSDG (2019) "United Nation Sustainable Development Goals". Retrieved from <https://sustainabledevelopment.un.org/?menu=1300>
- West, D. M., & Bleiberg, J. (2013). Education Technology Success Stories. In Governance Studies at Brookings. Retrieved from <https://www.brookings.edu/wp-content/uploads/2016/06/Download-the-paper-1.pdf>
- Werbach, K and Hunter, D. (2012) "For the Win: How Game Thinking Can Revolutionize Your Business", Philadelphia, PA: Wharton Digital Press.

ABOUT THE AUTHORS

Tai-Yin Chi, Ph.D. is an Assistant Professor in the Information Systems Department at San Francisco State University (SFSU). He received his Ph.D. in Information Systems and Technology from Claremont Graduate University, Claremont, California, USA. His research interests are in the areas of User Training, Virtual Communities, Technology Enhanced Collaborative Learning, Innovation in IS Education, and Gamification in Education. His current research projects focus on studying effective ways to train or engage people to learn computer skills such as programming, databases, software applications, web development, and cloud computing. He is also interested in developing and testing training modules/hands-on assignments to be incorporated into IS courses.

Iris Reychav, Ph.D. is a professor of Industrial Engineering and Management and Head of the Collaborative Learning Technology Lab at Ariel University. Prof. Iris Reychav holds an M.Sc in Industrial Engineering and Management, and has 10 years' experience at Motorola in the field of information systems. She earned her Ph.D. from Bar-Ilan University's Graduate School of Business Administration, and did her post-doctoral work at Tel Aviv University in cooperation with INSEAD. Her current research interests include knowledge management technologies, mobile learning and technologies in health and education.

Karina Batat is an Instructor Technology Specialist and appointed as the Future Classroom Lead Ambassador in Israel. She is an expert in integrating digital culture into education and into teaching, learning processes. Since 2015, she has been serving the Head of Beta School: Center of Innovation in Education, the Israeli version of the FCL. Beta's workshops and sessions provide an opportunity to rethinking & redefining learning and its main mission is to promote a new techno-pedagogical approach and new practices involving technological innovation among educators and students. Karina is leading innovation into education by workshops and courses promoting changes in teaching practices, and by innovative learning activities, which integrate new technologies such as Minecraft, 3D, and Mixed Reality into curriculum.