Student engagement in serious games development – experiences from EduDigi

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Abstract.

This paper describes several case studies where educational games have been developed in co-creation with university students or school pupils. The settings have been varied, as well as the results. The paper aims at giving insights into the collaboration process between universities, schools and other actors such as game companies. The learning outcomes and how to measure them are discussed.

Keywords.

Education, game-based learning, co-creation, games design

1 Introduction

The new National Core Curriculum in Finland emphasizes gamification, using games and digital media in learning (OPH 2014). They are considered to advance learning, as well as being a motivational factor in both ICT skills and in different subjects such as mathematics or languages. The benefits of game based learning and gamification should be incorporated in the learning processes. Moreover, gaming has been shown to motivate students, spark interest towards new things, as well as to build bridges between formal and informal learning (Plass et al 2015). Currently, most young people play mobile or computer games daily in all industrialized countries according to national and international surveys (ibid, Mäyrä et al 2016). According to the nationwide survey on playing habits in Finland in 2015, 80% of the population between 10 and 30 years play some kinds of digital games regularly (ibid). The most active age group is 10-19 years, and 52,2 % of respondents from that group play some kind of digital game daily and 81,6 % weekly. This part of the population plays digital games on average 12 hours per week. The modes of playing vary between ages and gender, as girls and young women play more mobile games such as Candy Crush, whereas boys and

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young men play more shooting and driving games on game consoles. Obviously, playing digital games is an ordinary activity among student populations, and young people tend to have a keen interest in games.

Games development process for educational games differs strongly from the entertainment game industry practices (Kangas 2010, Joensuu 2018). Very often the motivator is not business success but an urge to enliven education, and the initiative stems from the interests of an educator or group of educators. The process, the timeline, and the goals are not necessarily clearly defined, and the process may take many turns in the course of the development. The wish to include users in the process is very often present.

This paper describes several case studies where educational games have been developed in co-creation with university students or school pupils. The settings have been varied, as well as the results. The paper aims at giving insights into the successful collaboration process between universities, schools, science centres and other actors such as game companies.

2 Co-creating serious games in science centres

School teachers regularly bring student groups for a visit to a science centre, for students to learn about exhibitions and in order to enhance children's interest in science subjects. Science centre exhibitions are designed to support active learning and participation. One modern practice is tinkering: it means that challenges in the exhibition are open-ended and the visitor can create one's own solutions for them – there is not just one right answer. Therefore, a sci-ence centre is a natural place for a collaboration hub for co-creation and game development.

Two science centres in Finland, Heureka in Vantaa and Tietomaa in Oulu, have created a platform for facilitated collaboration sessions between learning game companies and schools. School groups can combine a co-creation session to the science centre visit, or they come particularly for a game development and evaluation session. Game companies bring their game idea or prototype for student evaluation, and for further elaboration of new ideas for new educational games. This way games companies can reach young people and get insights to their attitudes. Moreover, teachers give their views on the educational value of the products. The types of applications have been varied such as mobile applications, tablet games and virtual reality games. Students groups represent all grades from primary school to high school.

This service has proven to be popular among game startup companies because they can circumvent the efforts of contacting schools and coordinating the co-creating sessions. The facilitators of the science centre support the co-creation process by motivating the school group. Students learn about the innovation process by practicing it, and therefore different

kind of brainstorming tasks are key elements of the session. Students learn that they are the experts in the co-creation process, and their opinions are valuable. (Table 1)

Table 1. Structure of the co-creation process

1st visit:
Science centre facilitators motivate pilot users, give problem solving tasks, pilot groups' own innovation process begins
Introduction to co-creation session, startup presentation, co-creation and feedback
2-3 weeks break
Schools: Homework
Startup company: further development based on feedback
2nd visit
Pilot groups own innovation process continues, presentations
Introduction to co-creation session, startup's greetings, co-creation and feedback

Around 800 school students have already participated in co-creating the products of 15 companies in Heureka science centre during two years. The evaluation methods have been tailored for each company. Typically sessions have been observed, and participants have answered questionnaires after the session. This has given the researchers a great amount of data on children's approach to games. The companies have participated co-creation sessions to a varied degree, additionally, they have received summary reports of the findings. The service has been provided for free thanks to various sources of project funding. Whether companies will be willing to continue to use it when they will be charged, is yet an open question.

Student eagerness to participate in collaboration has been positive, even though their learning has not been measured. Students have been offered a glimpse into game development process, and a chance to influence the resulting products, which they have found inspiring. The real interaction between the entrepreneur and the student is a cornerstone of the process. If the entrepreneur is deeply interested in the feedback, the co-creation process is an empowering experience for students. Teacher evaluations indicate what kind of skills

teachers think their students learned during the process. Product development process, teamwork, brain-storming, causal relationships, and argumentation are often mentioned.

3 University students and a school in collaboration

The second case involves a single two-year development effort where students in Metropolia University of Applied Sciences developed a health-game for upper secondary school students. The collaboration included a school in Helsinki area and three departments at Metropolia. The game development was planned for two years, consisting of two innovation project course cycles at the university, which meant that there were two successive student teams. Each project course was implemented in its own department, but the development efforts were coordinated by instructors. The areas of oral health, clinical nursing, public health nursing, and information technology were involved. Additionally, the health education teachers and the well-being working group were involved in the partner school. (Holvikivi & Toivanen-Labiad 2018)

The aim of the project was to involve adolescents as partners in developing mobile tools to the promotion of their health and well-being. The adolescents would be inspired by the product to take the responsibility in monitoring and promoting their own health. In addition, the purpose of the project was to motivate adolescents to improve their health literacy. The goal was active participation in developing a mobile application in collaboration with peers, the school support network and experts from the university. The content of the game and its original design were prepared during the university courses.

The first version of the game was tested in the annual oral health promotion fair in the school. The fair was organized for 8th grade pupils in the school gym and assembly hall. The pupils participated in groups of seven, and they visited each of the nine displays for 5 minutes where they were guided by oral hy-gienist students. One stand had four iPad tablets for testing the demo version of the game. After playing the game, the pupils were briefly interviewed on their feelings. A week later, three university students visited a health education lesson where they collected opinions on a feedback form, and conducted further interviews. Pupils were asked about the outlook of the game and its sound effects, functionality, structure, and the understandability of the contents. (Beck et al 2015)

According to interview results, most pupils were positive toward the game, but many felt that the content and questions were too demanding. When discussing the game they also raised wider questions such as what health actually means. The game inspired them to reflect on health issues, which was an intended outcome. On the other hand, the pupils were not familiar with some terms and vocabulary that was used in the game, and therefore, they pre-

ferred to work with the game during health education lessons, not in their leisure time. The visual outlook was criticized not being attractive enough. (ibid)

The next round of the game development was based on the feedback. New content was added and game functionalities were improved. Some of the students continued in the same project working on their final thesis project, whereas three groups of new students worked again on health questions and information sources to improve the content of the game. The technical team also changed, and a graphical artist joined it. The technical solution was implemented on a different platform, and two successive prototypes were developed to be tested in the following school fairs (Tolessa 2016). Therefore, the main learning results from this project were received at the university, where a large group of students worked in a collaborative project with real prospective users.

On the other hand, pupils in the school had been offered a chance to see a game development process. By responding to the opinion survey, they had a chance to give their opinions on game design and visual outlook. Unfortunately, the same pupils did not get an improved version, which would have shown how their opinions influenced the design.

4 Games for young adults

Games are considered a promising way to include young people in the educational process, in particular when there is a conceived danger of dropping out of education. The city of Vantaa started to invest in games that are targeted for adolescents who have not found their career path. The pilot project designed a virtual reality game that simulated demanding situations in young peoples lives such as entrance examinations. The game was developed by Metropolia students together with a group of youngsters who gave their thoughts to the dialogue of the game. The young people participated in three workshops where narratives were elaborated, and their anxiety feelings were included in the game situations. The game prototype was tested by two other groups of young people as well as school instructors. They were given survey questions before and after the testing sessions. According to their responses, the youngsters were pleased with the game and found it intriguing despite some difficulties with the VR equipment and insufficient in-game instructions. (Joensuu 2018)

5 Technical education in vocational schools and universities

Vocational schools, as well as universities, have been unexpectedly reluctant to apply game-based education. A thesis that charted the attitudes of vocational school teachers and students in building construction, and HVAC teachers in particular, found that the teachers in Finland did not see any use for mobile game applications in their education. Nevertheless, most students expressed interest in learning through games (Haavisto 2015). In one of

Metropolia projects, a game prototype was designed in a related area, namely electric installations, in collaboration with Varia vocational school. When the complete prototype was released, it was tested by two groups of students, both vocational and engineering students. The engineering students (6 people) were already certified electricians, having completed their first education in a vocational school. According to the electricians, practicing electric installations in a real environment is slow, and going through alternative solutions takes considerable time. A game offers quickly various challenges and a safe environment to fail and retry. The electricians found this 3D game on PCs useful and interesting, and additionally, offered many suggestions to the improvement of the game. They all reported that they play video or computer games regularly, and had an interest in games in general. This group of students were accidentally an ideal collaboration partner in game development: they had already experience in their profession but could still remember the difficulties and obstacles during their previous studies. Moreover, they had the latest knowledge of industry practices compared to the vocational school teachers who had supplied the initial information for the game design.

Another game design effort related to the construction industry was initiated in a classroom for Building information modelling training. The participants were mostly experienced professionals, many of them vocational school instructors who were over 40. Most of them could not find games development for their work beneficial or interesting. Some rudimentary ideas were developed with the couple of interested participants, but because of their widely varied needs and lack of game experience, the process did not converge to any prototype suggestion. Despite the huge potential in this area, and some existing industry trials, this workshop was less successful. Obviously, a better focused approach is needed, and the participants would need some advance training in educational games possibilities.

Additionally, we conducted a workshop in a bioanalytics classroom at Metropolia, in order to develop gamified means to learn about antibiotics classification. This student group was younger than the previous case, even though some of the students had already work experience in the field. The students were given a short introduction to game design, and then divided into small groups for brainstorming. In this case, participants were mainly female, with little background in video game playing. They developed ideas that were rather obvious from the subject of bacteria killing antibiotics. Some game drafts could be developed based on the ideas, and in a second phase that has not been started yet, the games could be designed and prototypes built. The workshop and idea of a game were novel to the participants, however, they were all positive and enthusiastic to experiment with it.

6 Conclusions

Student attitudes towards participating in educational game development have been positive in all cases of this study. The experiments were started in 2014, and the last cases are from 2018. Some of the projects have not yet been completed. As the case descriptions show, student participation has not always been thoroughly planned or fully implemented. The positive outcome could largely be seen as a novelty effect, because the students have no previous experience on this kind of activity. They are curious and eager to see more. They play games, and like to see how they come into existence. The full potential of participation has not been exploited due to a number of practical reasons: schools and universities have their yearly cycle and curriculum requirements that constrain activities and keep the teachers busy.

Only two of the cases in this study contained a game that was specifically designed to fulfill curriculum requirements, namely the electric installations and health education. The testing situations indicated that the games could indeed function as learning tools, and learning could be observed even during trying the game. Otherwise, learning was not measured in the presented cases, and other outcomes were evaluated based on observations. The empowerment effect, the understanding of innovation processes and business development, and other inspiring outcomes were seen, but not proven. In the future, procedures and measurements for learning outcomes need to be developed.

References

Beck, E., Pyörre, M., Vihervuori, J.: Umbrella terveyspeli : uusi työväline nuorten suun terveysvalmennukseen. Metropolia. Helsinki. 2015 (In Finnish)

Haavisto, J.: Kartoitus mobiilioppimisen soveltamismahdollisuuksista toisen asteen talotekniikan koulutuksessa. Metropolia. Espoo. 2015. (in Finnish)

Joensuu, J. Pelisuunnittelu oppimispeleissä. Metropolia. Espoo. 2018. (in Finnish)

Holvikivi, J., Toivanen-Labiad, T.: Health-game development in university – lower secondary school collaboration. In Tatnall & Webb (eds.). Tomorrow's Learning: Involving Everyone. Springer, 45-54, 2018.

Kangas, M.: The school of the future: Theoretical and pedagogical approaches for creative and playful learning environments. Doctoral dissertation. Acta Universitatis Lapponiensis 188. University of Lapland, Rovaniemi. 2010

Mäyrä, F., Karvinen, J., Ermi, L.: Pelaajabarometri 2015: Lajityyppien suosio. Tampereen yliopisto. 2016. (in Finnish)

OPH. web document at: http://www.oph.fi/saadokset_ja_ohjeet/opetussuunnitelmien_ja_tutkintojen_perusteet/perusopetus. 2014 (in Finnish)

Plass, J.L., Homer, B.D., Kinzer,C.K.: Foundations of Game-Based Learning. Educ Psychol, 50(4), 258–283, 2015

Tolessa, B.: Umbrella: a web-based health education quiz game for school kids. Metropolia. Helsinki. 2016