Learning Through Game Design – Is This Deep Learning?

Conference Paper · August 2019

CITATIONS
0

READS
288

1 author:

Charlotte Lærke Weitze
Digital and Creative Learning Lab
34 PUBLICATIONS **232** CITATIONS

SEE PROFILE

Learning Through Game Design

- Is This Deep Learning?

Charlotte Lærke Weitze
Digital & Creative Learning Lab
Ulstrupparken 11
3000 Helsingør
Denmark
Phone: +45 29921792
clw@digitalcreativelearninglab.dk

Keywords
GBL, Learning Through Game Design, Higher-Order Thinking Skills.

INTRODUCTION
Game-Based Learning (GBL) provides new and powerful ways of learning (Connolly et al., 2012; Gee 2003; Squire, 2011). But the efficacy of the GBL environment depends on how it is designed (Plass, Homer, Kinzer, 2015). To qualify GBL it is important to focus on studying the cognitive-consequences and value added as well as explore how theoretically driven design decisions may influence situated learning outcomes for the students (Clark, Tanner-Smith & Killingswort, 2016).

Currently GBL is extended from students learning specific subject matters by playing games to students learning through designing games (Earp, 2015; Whitton, 2014). This leads to a new focus on how we may support students' deep learning processes as they learn by creating games for learning.

The hypothesis in this abstract is that the depth and complexity of the students' learning and game design processes when developing games for learning will influence how deep learning processes the student-game designers will experience as they implement academic knowledge and learning opportunities into their games (Weitze, 2016). Previous studies investigated how to qualify the process of learning through design of games for learning. That is, the process where students implement academic content into games to learn about specific subject matters, while the players of these games also have an opportunity to reach specific learning goals. (Weitze, 2016, 2017).

This abstract initiates the investigation of how the creation of games for learning with specific learning goals can contribute to the development of students lower- and higher-order thinking skills. The various ascending levels of cognitive complexity involves the students ability to remember, understand, apply, analyze, evaluate and be creative within a specific area of a subject matter (Anderson & Krathwohl, 2001) as well as their ability to reflect and think critically. The aim for the article following this abstract is to create learning and design principles for students and teachers learning through game design, with the purpose to enhance the students' deep learning processes (Biggs & Tang, 2011), critical thinking and reflection processes.

METHOD AND RESEARCH DESIGN
In this design-based research project (Plomp, 2013; Reimann, 2011) 120 highschool students participated in an six hour, one-day workshop. They formed groups and created 30 board games. By playing these games their fellow students could learn about, reflect on and critically analyse aspects about energy sources and CO2 emission. The learning goals for the students learning games e.g. were: 1) Which

energy sources emit the most CO2? 2) What advantages and disadvantages does different energy sources have in relation to: the climate, the environment, the economy, and in terms of availability. In addition to the researcher two teachers were deeply involved in the development and debriefing of the workshop.

This extended abstract is based on an empirical analysis of: a) observations of the students in the workshop, b) the game-play of ten games, and c) the students selfmade videos showing how these games should be played and explaining the principles behind. Therefore results may be subject to change when the remaining data e.g. the semistructured interviews with the teachers (conducted before, during and after the workshop) are analyzed in depth.

RESULTS

The creative process of developing a game for learning was more comprehensive than playing commercial game for learning, as the students worked from a highly problem-based and constructionist learning approach. When analyzing the data there were many examples of students developing lower-order thinking skills (remembering, understanding, applying); e.g. in the process of creating subject matter relevant narratives for their board games and when elaborating questions and answers for quiz games. Here students collected, understood, discussed and collaboratively developed and chose these narratives, questions and answers.

An even more interesting part of the students' learning processes involved the students development of higher-order thinking skills (analyzing, evaluating and being creative) as they created rules, game and learning mechanics for their games.

In games the learning mechanics and game mechanics may overlap. The game mechanics are the things that the player interact with and can do in the game. While learning mechanics more specifically can be defined as: "the mechanics and interactions intended to support players in learning the target learning outcomes" (Clark, Tanner-Smith & Killingswort, 2016, p. 101).

The following is one example of how students had developed learning mechanics and rules inside their game, and in this process showed signs of applying, analyzing, evaluating and being creative developing higher-order thinking skills regarding their subject matter.

In this game example (Energy-Island) students were inspired by a settlers game board. When throwing a dice the players would land on a random spot in the game and depending on which of the six different (polluting or green) energy sources they ended up being closest to, they would gain a) x amount of energy, and b) x amount of CO2. The idea was to get as much energy as possible, and as little CO2 as possible. Students thus created rules that would teach the player what energy sources would emit the least CO2 and create the most energy, the ideal (= the winner) was a green society. There was one catch - if you were placed next to nuclear power there was a chance you were killed, though this energy source was high in energy and low in pollution.

In order to create these rules, game and learning mechanics, the students had to investigate the various energy sources. They also analyzed how much energy these sources created compared to each other, and connected this to how much CO2 the sources emitted compared to each other. Then the students evaluated those informations and created a gameplay, so players of the game could learn how energy production and CO2 emission were connected within an energy source as well as between energy sources.

When analyzing and comparing the more superficial and quiz based games with the more advanced games, as in the example above, the result was that the students designing the more advanced games had more comprehensive learning outcomes as well as a deeper understanding of the subject matter, coving a larger part of the learning goals.

In the talk other examples will be elaborated, as will the teachers role in qualifying the complexity of what the students taught in their games and thereby learned though building these games.

BIBLIOGRAPHY

Anderson, L. W. & Krathwohl, D. R. (Eds.). 2001. *A taxonomy for learning, teaching and assessing: a revision of Bloom's Taxonomy of educational objectives: Complete edition*. New York: Longman.

Biggs, J. B. & Tang, C. (2011). Teaching for quality learning at university: What the student does. McGraw-hill education (UK).

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. 2016. "Digital games, design, and learning: A systematic review and meta-analysis." *Review of educational research*, 86(1), 79-122.

Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. 2012. "A systematic literature review of empirical evidence on computer games and serious games." *Computers & Education*, 59(2), 661-686.

Earp, J. 2015. "Game making for learning: A systematic review of the research literature." In *Proceedings of 8th International Conference of Education, Research and Innovation* (ICERI2015), (pp. 6426–6435). Seville, Spain: International.

Gee, J. P. 2005. "Learning by design: Good video games as learning machines." *E-learning and Digital Media*, 2(1), 5-16.

Plass, J. L., Homer, B. D., & Kinzer, C. K. 2015. "Foundations of game-based learning." *Educational Psychologist*, 50(4), 258-283.

Plomp, T. 2013. "Educational design research: An introduction." In Plomp, T. & Nieveen, N. (Eds.). *Educational design research*, Enschede: SLO, Netherlands institute for curriculum development, 11-50.

Reimann, P. 2011. "Design-based research." In L. Markauskaite et al. (Eds.), *Methodological Choice and Design* (chapter 3), (pp. 37-50) Dordrecht: Springer Netherlands.

Squire, K. 2011. *Video Games and Learning: Teaching and Participatory Culture in the Digital Age*. *Technology, Education--Connections* (the TEC Series) . Teachers College Press. 1234 Amsterdam Avenue, New York, NY 10027.

Weitze, C. L. (2017, October). Reflective, Creative and Computational Thinking Strategies Used When Students Learn Through Making Games. In ECGBL (pp. 744-753). ACPI.

Weitze, C. L. (2016, October). Student learning-game designs: Emerging learning trajectories. In ECGBL (p. 756). ACPI.

Whitton, N. (2014). Digital Games and Learning: Research and Theory. New York: Routledge.