

Game Design Experience for Teachers' Design Thinking in Participatory Design Culture

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Abstract: This case study explored how the experience of game design in the culture of participatory design contributed to teachers' design thinking. Three in-service middle school teachers were invited to be game design partners in an 8-hour workshop, aiming to enhance the reliability and validity of an architecture-based game. Data were collected from in-field observation, screen recording videos, and semi-structured interview debriefing. Three salient themes were extracted to explore teachers' game design experience in relation to their development of design thinking.

Introduction

Design thinking which refers to an analytic and creative process to solve problems is considered as a crucial skill that all students should possess (Razzouk & Shute, 2016). As a result, teachers, as the most important practitioners in K-12 classrooms, play vital roles in teaching design thinking to students in K-12 settings (Bressler & Annetta, 2021). Prior research suggested that the experience of game design is conducive to the development of teachers' design thinking (Bressler & Annetta, 2021). In these studies, teachers were given predefined game design scenario and placed in the position of independent game designers to design their own games.

However, the process of the design and development of a game is complex and difficult in the real world (Hauge et al., 2020). The success of the game design needs efforts and contributions made by various stakeholders (Khaled & Vasalou, 2014), which is called participatory design (PD). As a participatory designer, teachers will act as design partners in the game design process. However, few studies explore whether the experience of game design during the participatory process could contribute to teachers' design thinking. Therefore, it is warranted to investigate what benefits could bring to teachers when involving as game design partners in a situation of PD. Specifically, in the current study, we seek to have teachers contribute their creations to the educational game design process and at the same time learn knowledge and skills with respect to game design to advance their design thinking. The research question guides the entire study is: *How could the experience of game design during the participatory process contribute to teachers' design thinking?*

Methodology

We adopted a descriptive, holistic single case study approach (Yin, 2009) to examine the process and nature of learning by design within the context of participatory design in the case of computer game making. Three in-service math teachers at a suburban middle school in the southeast of United States were invited to be design partners for refining and designing a game called *E-Rebuild*, which is an architecture-based game for teaching conceptual understanding of mathematical concepts and problem solving for middle school students (Ke, 2019). Teachers participated in an 8-hour workshop, including program orientation, play-testing the prototype, as well as integrated brainstorming and interview. We collected data from in-field observation, screen recording videos, and semi-structured interview debriefing. All the collected qualitative data were analyzed by systematic coding followed by thematic analysis.

Findings

Three major themes found in the study pertain to participants' design thinking, including (a) cultivated problem solving skills through iterative troubleshooting, (b) better understanding of the principles of game design, and (c) improved divergent design thinking.

Cultivated problem solving skills through iterative troubleshooting

As observed, PD activities provided participants with iterative troubleshooting and hence cultivated their problem-solving skills. When involving as game design partners in the real-life context, teachers were given opportunities to identify "problems" of game design with respect to their knowledge, skills and expertise. For example, during the interview session, all the participants left comments stating that

they “have not done with the *Q, E* (keys)”. After analyzing this issue in terms of students’ abilities, teachers confirmed that their students “need more assistance in technical operation”. Subsequently, they had fruitful discussions of how to resolve it in the session of brainstorming. For example, Participant 1 suggested “*Hav(ing) a picture with Q, E functions*” as a supplement for “WSAD” keys. Participant 3 suggested associating keys to specific meaningful words, such as “*S equals back, like backwards; and W means forwards.*” Even though participants did not have chance to evaluate the feasibility of the proposed solutions in a workshop, they were given opportunities to cultivate problem solving skills which included defining and representing the problem, formulating an expected result, and exploring a possible way of solving the problem.

Better understanding of the principles of game design

Qualitative interviewing indicated that PD activities could support participants’ better understanding of the principles of game design. Such learning generally happened during the discussion between participants and members of game design team (e.g., researchers, game designers, and game developers). For instance, one of the design discussions was about “teaching versus experiencing”. Participants tended to identify “*What is the idea of learning (unfamiliar game operation) through initiated playing (which caused) students’ frustration for the first four or five hours*” instead of “*direct teaching*”. Through discussion, participants were informed with the design intention from game designers’ perspective that students would better master technical operations (i.e., input mappings) through their experience of interactions in the game.

Improved divergent design thinking

Involving teachers in PD provided opportunities to improve teachers’ divergent design thinking, which was a vital stage for constructing individual design proposals. It was occurred when teachers tried to locate similar information in existing data (*E-Rebuild*) and connect it with their previous skills, knowledge, and experience. For instance, in the brainstorming, Participant 3 proposed a solution corresponding to the way to monitor game players’ progress. She stated, “*Some thoughts like what a lot of mechanism all you know. Like kind of game success sound effects. I hear like ‘Ching-Ching’. Just let you know (what has happened).*”

Discussion and Conclusion

The findings indicated that when participants were actively engaged in the PD process, they had many opportunities to foster their design thinking. Specifically, the experience of game design during the PD process cultivated teachers’ problem-solving skills through iterative troubleshooting. Also, the findings show that PD could reinforce participants’ design thinking by understanding the basic principles of game design through the discussions with team members. It is in line with the prior research that the PD provides teachers with opportunities of improving their understanding of game design (Bressler & Annetta, 2021). Furthermore, our findings are aligned with prior research that involving teachers in PD helps improve their abilities of divergent design thinking (Hu et al., 2018).

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