

Integrating educational computer games in science teaching: In-service science teachers' perspectives

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Abstract: This study explored a group of science teachers' perspectives on integrating educational computer games in science teaching. Through tape-recorded interviews, the participant teachers' perspectives regarding the integration of educational computer games in science teaching were collected and analyzed qualitatively. To ensure the teachers had basic experiences regarding playing science educational computer games, the participant teachers were asked to play a science educational computer game designed for third graders before being interviewed. Some important findings are revealed and educational implications are discussed.

Keywords: educational computer game, science teaching, science teacher

Introduction

Rapid development in information technologies has dramatically influenced the ways of teaching and learning [1]. In recent years, more and more researchers and educators have reorganized the powerful potential of using computers games or online games for educational purposes [2]. As a result, digital game-based learning (DGBL) has been highlighted.

Computer games are powerful educational tools if used appropriately [3]. When using an educational computer game in classrooms, the instructional strategies used by teacher should be crucial for the success of the integration a digital computer game into his/her class [4]. Undoubtedly, teachers' understanding of educational computer games will influence how they make use of this powerful instructional tool. In other words, teachers' perspectives on the integration of educational computer games into science teaching should be one of the important research issues.

In the last decade, more and more researchers paid their attention to DGBL-related issues. However, most of them addressed the effectiveness of the use of educational computer games in students' learning outcomes [4] and their motivation [5]. Not many studies have focused on teachers' understanding or adoption of educational computer games [6][7]. In particular, research aiming to explore science teachers' perspectives on the integration of educational computer games into science teaching. To address this important issue, this study explored a group of elementary science teachers' perspectives on the integration of educational computer games into science teaching.

1. Methods

1.1 Subjects

The subjects of this study are 21 voluntary in-service elementary science teachers (including 9 male and 12 female teachers). Only one of them had a master degree, and the others had undergraduate degrees. Their teaching experiences ranged from three to twenty seven years. The interview has shown that 20 participants have experiences in computer game, only one participant has non-experience.

1.2 Data collection

This study was conducted to explore a group of elementary science teachers' perspectives on the use of digital educational games in science classrooms. To this end, tape-recorded interviews were conducted. To ensure the teachers had basic experiences regarding playing science educational computer games, the participant teachers were asked to play a science educational computer game designed for third graders before being interviewed. This computer game was designed in Hsu, Tsai and Liang (2011) to teach the concepts of light and shadow [8].

After playing the computer game, the teachers were interviewed with the following questions:

- (1) What are the differences between educational computer games and computer games?
- (2) Are you willing to employed educational computer games in your science instruction?
- (3) How will you applying educational computer games in your science classes?
- (4) What are the advantages and disadvantages of integrating educational computer games in science teaching?
- (5) When employing educational computer games in science instruction, what relevant professional abilities teachers will needed?

1.3 Data analyses

The teachers' narratives obtained from tape-recorded interviews are transcribed. And the data regarding the teachers' perspectives were analyzed qualitatively.

2. Major finding and discussion

2.1 Science teachers' perspectives on the differences between an educational computer game and a computer game

In this study, 12 participants (60%) considered that educational computer games had included science content, principle, learning progress and purpose. For example, a teacher mentioned that "the game of light and shadow is easily to be identified by science educators or experts, but it also invokes young students to think how they pass the game missions by the game's contents."

Besides, the teachers in this study also mentioned some common characters. Six participants (30%) believed educational computer games had included entertaining effect in order to attract young students interested, and provided additional explains and cues to assist players passing the game. Also, 3 participants (15%) mentioned the educational computer game and

a game without education have the same user interface and equipment, such as keyboard and mouse; furthermore, vivid sound and video effects attract young students' learning willing.

2.2 Science Teachers' willing to employed educational computer games in science education

After experiencing the educational computer game, 19 participants (95%) expressed that they were willing to employ educational computers games for young students if the games' contents synchronize class progresses. No participant (0%) disagree that the educational game is a positive medium. Besides, only one participant (5%) did not response in this issue.

2.3 Science teachers' ideal application of educational computer games in science teaching

The teachers in this study mentioned the ideal ways for them to apply educational computer games in their science classes. Their responses are summarized as follows:

- (1) *Partly employed the game after teacher explained*: 6 participants (30%) considered to use educational games as a review after teachers' instruction.
- (2) *Partly employed the game in a class beginning*: 4 participants (20%) consider that the game has an inducement for young students study firstly.
- (3) *Partly employed the game as the assessment after a class progress has completed*: 6 participants (30%) mentioned that educational computer games could be used for assessments.
- (4) *Fully employed the game in a class*: Only one participant (5%) mentioned that an educational computer game could be used as a learning activity in science classes.
- (5) *Supplementary learning materials*: 1 participant (5%) mentioned that educational computer game could be used as supplementary learning materials.

It seems that the teachers in this study showed diverse perspective on how to use educational computer games in science classes.

2.4 Science teachers' perspectives regarding the advantages and disadvantages of integrating educational computer games in science teaching

Regarding the advantages of integrating educational computer games in science teaching, most participants (50%) mentioned that an educational computer game could be used as a replacement of real world, and it could improve young students' confidence and attention in order to encourage themselves. Some participants (20%) also stated that the educational computer game has improved real condition and preparation. Additionally, it assists teachers to understand young students' characteristic.

The teachers also majorly mentioned three disadvantages of integrating educational computer games in science teaching. The first disadvantage mentioned by the teachers is that integrating educational computer games in science teaching may increase their teaching load. For example, although a class has 40 minutes for students learning, the teachers have to add their extra personal time to prepare and training themselves in order to teach students how to learn by playing the educational computer game. The second one is that students may over-rely on playing educational computer game; and, as a result, they may not be interested in other learning materials or teachers' instruction in the classes. Also, they may

have addiction in playing computer games. It seems that the teachers may think that compare with educational computer games, their instruction is less attractive to their students. The third is that if an educational computer game is not designed properly, students may have alternative conception after playing an educational computer game.

2.5 Science teachers' perspectives regarding relevant professional abilities for integrating educational computer games in science teaching

The relevant professional abilities for integrating educational computer games in science teaching mentioned by the teachers in this study were:

- (1) *Specialized pedagogical content knowledge*: All the teachers mentioned about that. It seems that all the teachers in this study viewed the integration of educational computer games in science teaching as a new pedagogy. Teacher professional development on digital game-based learning may be needed.
- (2) *Basic computer skills*: All the teachers mentioned about that. It may due to that the teachers in this study may be not confident of their computer literacy.
- (3) *Advanced computer skills*: Five out of twenty-one teachers in this study mentioned that if teachers have advanced computer skills they can develop educational computer games by themselves. Such as one participant described that he would probably design a particular educational game for his students by *Adobe Flash*, if he has the advanced technique in developing an educational computer game.

3. Conclusions

This study investigated elementary science teachers' perspectives on integrating educational computer games in science teaching. This study revealed most of the science teachers in this study recognized the educational entity of educational games, and almost all the teachers in this study were willing to integrate educational computer games in their science classes. Besides, teachers proposed diverse ways for using educational computer games in science classes. They also mentioned the essentiality of specialized pedagogical content knowledge and basic computer skills when conducting computer game-based instruction. In addition, a half of participants believe that the occasion of applying educational computer games are partly employed in a class after teacher explained, or as an assessment after a class progress has completed. The finding of this study may provide some insights for teacher educators and educational designers. For example, teacher professional development regarding integrating computer game in science instruction will be needed. Besides, how to prevent students' alternative conception derived from educational games may be another important issue for educational game designers. Therefore, collaborative work from science teachers and educational computer game developers may be crucial of much importance.

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