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Teachers' Views toward Integrating Visual Technological Simulations in Teaching Science: A Case Study in Urban Planning

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Abstract

In today's world, children are acquainted with various technological tools from early ages and use these tools in many aspects of their everyday lives. From the educational perspective, the impact of using technology as an instructional tool to enhance the students' learning outcomes have been supported by many studies (NSTA, 2003). However, the abundance of technological tools for enhancing students learning outcomes does not always encourage their learning and motivation. While many studies have blamed teachers' ineffective strategies in using technology, some others believe that teachers' resistance to change and fear of the unknown is a barrier to technology implementation. Yet, the underlying factors that inhibit or encourage teachers in using technological tools are still unknown.

Aim

Simulations have a great impact in sparking students' interest (Honey & Hilton, 2011). Good simulation allows learners to manipulate multiple variables in the process of engaging in an activity (Gredler, 1996). The literature says that despite having good computer simulations especially in science education, the students still do not value science in scientific ways and do not develop an interest in science beyond the classroom (Resnick, 1987). Since teachers` incorporation of new technologies is of paramount importance, this study first tries to focus on underlying factors that might inhibit or encourage them to teach science using simulations. Then, some teaching strategies in teaching science using visual simulations will be proposed that might be effective in keeping students motivated in science in general and in Urban Planning in particular as a simulation game.

Background and Problem Statement

The United States Department of Education views the integration of technology in education so important that the department issued the 'Enhancing Education through Technology Act of 2001' (USDE, 2001). It says that in addition to using technology in the science classroom, teachers should also be prepared for teaching students on how to incorporate computer technology (NSTA,2003).

Yet, Ertmer (1999) believes that the effective integration of new technologies is impacted by first-order and second-order barriers. While the first order barriers address the external resources, training, and support, the second order barriers comprise of internal factors such as teachers` beliefs confidence, and values. A few studies support the view that teachers' value beliefs (Vongkulluksn, Xie, & Bowman, 2018) resistance to change from traditional methods to new technological approaches, as well as fear of the unknown, are the main barriers in the way

of teachers (Mannino, 2004; Shane & Wojnowski, 2005). Nonetheless, these factors might not be valid for science teachers who have more opportunities for using technological tools in practice. More focused studies need to be done to shed light on teachers' views toward using technological tools in teaching STEM in general and science in particular.

Methodology

This study aimed to answer the following research questions:

1. What are high school science teachers' views toward using visual technological simulations in science teaching?
2. What motivating effects (if any) do the teachers see in using visual simulation for science students?
3. What teaching strategies are suggested by teachers to enhance the quality of learning by incorporating technological simulations?

To answer the research questions, a case study was used which is the study of a case within its real-life setting (Yin, 1998). Convenient sampling enabled the researcher to recruit a science teacher who had incorporated Philadelphia Land Science (PLS) as a simulation in teaching Urban Planning course. An observation session was also organized in which the researcher visited the site while the same teacher was using the simulation to teach Urban Planning. The validity of interview and observation session was ensured by member checking (Yin, 2013).

Preliminary Results

The interview and observation results after two rounds of analysis (open and axial coding) (Creswell, 2002) revealed the following themes:

- The teacher had very positive views toward using technology and especially simulations. Regarding Philadelphia Land Science (PLS) simulation, she believed that these sorts of technologies allow users to virtually make an important impact on environmental and economic variables and see the changes. Simulations "can offer experiences for learners that they might not have access to anywhere else" or "simulation can offer a connection to real-world issues/problems". Therefore, she believed teachers need to incorporate them more.
- The first-order barriers were also observable in the research site such as internet connection and difficulty in accessing the simulation with the students' personal laptops. The teacher believed that the first-order barriers can even impact the teachers' beliefs and values which are the second-order barriers negatively.
- Well-designed simulations can be motivating if used properly. By well-designed simulations, the teacher meant a simulation that provides enough engaging opportunities as well as enough interaction between the players.

- Two fundamental barriers emerged out of results of this study which were neither first-order barriers nor second-order barriers:
    1. "teachers do not know how to integrate the simulation," she believed that teachers generally don't know when and how to use technologies. They don't know if they should use them as assessment tools, as the core content of the lesson plan, or as an after-school program.
    2. "teachers do not know which simulations are appropriate for their class," she said that teachers are unaware of affordances that different simulation can provide for the players. They need to know what type of content is taught, what digital literacy skills are needed and how the simulation is going to deliver the content.

Research Implications

Generally, the positive perception of teachers toward using visual technological simulations could provide policymakers and school administrators with a basis for change needed for technology implementation in science teaching. Yet, some of the teachers' concerns such as choosing appropriate simulations need to be addressed by game analysis researchers.

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Hamideh Talafian is a second year Ph.D. student in Educational Leadership and Learning Technologies (STEM concentration) at Drexel University. Hamideh received her Master`s degree in Teaching English as a Foreign Language and her Bachelor`s Degree in English Literature from the top-ranked universities in Iran. Prior to her education at Drexel, she has taught English for seven years in a number of high schools, art schools, elementary schools and English institutions in Iran. Her research interests focus on the role of new technologies and students' motivation in STEM.