Yang, J. C. et al. (Eds.) (2017). Extended Summary Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education

Authentic Learning in a Technology-Rich Classroom: Innovative Education in the Classroom

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Abstract. A recurring challenge in nearly every education is how to effectively integrate new and emerging technologies into existing curricula and existing learning places. In this paper, what is not new is the general approach to learning and instruction – namely, authentic learning. What is new and innovative are the ways and means to make authentic meaningful and effective using new digital technologies. To state the case briefly, what is not new is how best to support learning. What is new is putting that knowledge into practice in the technology-rich classrooms of the 21st century. We describe the basic principles of authentic learning and illustrate how they can be effectively integrated and supporting using state-of-the-practice technologies.

Keywords: Authentic learning, Educational innovation, Technology integration

1. Introduction

Authentic learning refers to learning that takes place in actual situations likely to be encountered outside the educational context or simulated situations that are realistically life-like in terms of look and feel and their compelling nature (Dewey, 1938; Howland, Jonassen, & Marra, 2012; NRC, 2000). John Dewey's "Experience and Education" is perhaps the classic work in the area of authentic learning. However, the concept dates far back to apprenticeship training with learning taking place in the actual workplace (Klein, Spector, Grabowski, & Teja, 2004). More recently, computer-based simulations and virtual reality devices have made it possible to create realistic settings in support of learning, especially in aviation, decision science, economics, medicine, and technical training (Clark, 2005). Moreover, the so-called Maker Movement that is now integrate 3D printing into many courses involving design, engineering and manufacturing is an example of how the early principles of authentic learning can be harnessed in support of effective instruction. An excellent of a large-scale effort in this area is the Beijing National Day School (BNDS; see https://www.facebook.com/pages/Beijing-National-Day-School/104061536296380).

2. Principles of Authentic Learning

A number of basic principles comprise authentic learning; these principles can be found explicitly or implicitly in the references already cited (Clark, 2005; Dewey, 1938; Howland et al., 2012; Klein et al., 2004; NRC, 2000).These principles include:

- Meaningful contexts – the situation surrounding the learning task should be one that is familiar or at least believable as possible or even probable to occur in a particular discipline or domain;
- Realistic and feasible tasks – the task to be learned or the problem to be solved should be realistic and relatable to actual tasks or problems known to occur in an area of inquiry;

- Expert guidance – a person (or computer-based agent0 with relevant experience and insight is available to demonstrate how to proceed and provide guidance to the learner;
- Informative feedback – timely and informative feedback on the learner's performance is provided during or immediately after the learning activity; and,
- Progression of tasks – problems and tasks are sequenced from simpler to complex to foster the progressive development of knowledge and understanding (Milrad, Spector, & Davidsen, 2003).

Several approaches have evolved that embody these principles which in somewhat different ways support authentic learning. These include (a) problem-based learning that originated in the medical domain (Barrows & Tamblyn, 1980), (b) situated learning that adds the notion of a community of practice (Lave & Wenger, 1990), and (c) cognitive apprenticeship that contributes the notion of progressive development (Collins, Brown, & Newman, 1987).

3. Examples of Effective Authentic Learning with New Technologies

There are many examples of effective authentic learning activities that could be cited based on the principles previously described. Space allows for the elaboration of just two: (a) A LEGO Mindstorms robot construction effort (Somyürek, 2014), and (b) DIGS – digital interactive globe system developed at National Taiwan Normal University (DD0933005251, 2016)

3.1 LEGO Mindstorms

An interesting piece of educational technology history is the general failure of Logo to deliver the promised improvements in learning advocated by Seymour Papert (1990). In spite of the marginal impact of Logo, the overall impact has been significant as shown by the subsequent successes of Scratch (Resnick, 2007) and the promotion of Papert's later work involving *mindstorms* and LEGO kits for constructing robots (Papert, 1993). LEGO preceded the maker movement but employed the important principles of learning by doing that thread throughout nearly all authentic learning approaches.

In a study by Somyürek (2014), students were engaged in constructing a robot using LEGO Mindstorms NXT. Students were engaged in a structured and active learning process involving challenging. However, students were allowed to learn by doing while in engaged in what they considered play. Students were given multiple tasks such as making predictions, developing hypotheses, and presenting their solutions. The results showed that students found the activities fun yet engaging in terms of their imaginations. The results showed improved motivation and the likelihood of improved critical thinking.

3.2 DIGS

The digital interactive globe system developed in Taiwan is also engaging and fosters problem solving in the domain of geography and thinking about the world in which we live. DIGS is a low-cost but relatively high-tech system to support learning geography and earth science. DIGS involves a data processing unit, a wireless control unit, an image capturing unit, a laser pointing device, and a 3D hemispheric body imaging unit – a kind of 3D screen. The system can be envisioned as a Google Earth on 3D steroids. A quasi-experimental study involving 105 junior high school students in a four-week experiment showed that the students in the experimental group learning with DIGS improved more than the control group. Moreover, the role of the teacher naturally changed in a way consistent with what was previously described with regard to cognitive apprenticeship.

Because DIGS is a low-cost but high-tech educational technology with evidence of effective support for improved learning of higher-order reasoning skills, it should be considered an innovative educational technology solution, along with LEGO Mindstorms and others too numerous to be included in this short piece about how emerging technologies can improve learning when aligned with the principles of authentic learning.

4. Summary

Our main point in this short piece was to remind researchers and practitioners of the significance of authentic learning when devising ways to take advantage of the many affordances of new technologies. For something to be considered innovative, we believe it needs to be effective, so we cited two examples that are aligned with authentic learning principles that have supporting research to show evidence of learning effectiveness. We encourage others to report learning gains that clearly indicate how technology can improve learning, which we understand to involve stable and persistent changes in what a person knows and can do. In the case of authentic learning, it is the doing that leads to knowing.

Acknowledgement

We are indebted to our mentors, and especially to Wei-Kai Liou, Chun-Yen Chang, Robert Gagné, and Dave Merrill, and others who have developed genuinely innovative educational approaches and solutions.

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