

Teaching Natural Science Through The Use Of Video Games

CURR 387 – Science and Technology

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An increasing concern for environmental sustainability has prompted schools to put an emphasis on environmental education. Students are often a target for environmental education because of the ability to impact their role as future educators and decision makers. In Ontario, visits to natural environments, often outdoor education centres, are used to support environmental education and to give students a real world setting (Ballantyne & Packer, 2002). For some schools, travelling to an outdoor education centre is not an option due to distance, cost or interest. Without teacher interest and without access to an outdoor education centre, students may miss out on environmental education. One way to ensure teachers incorporate environmental education is to add curriculum expectations but arguably more importantly, teachers need to be shown what works best for students and how to go about it.

Educators need to begin by examining what techniques work best for teaching science. Mayo (2009) argues that the use of well-designed video games can increase positive science, technology, engineering and math (STEM) education anywhere from 7-40% and ‘decrease the gap to the point where most students are performing at grade level’. Students quickly scaffold information because games can be adapted to the pace of the learner and present information in multiple modes for different types of learners. Mayo argues that when students are using games to learn, they are put in a situation where their learning is contextual. In a classroom setting, learning using games increases if there are positive social interactions surrounding the content. Students are more likely

to strive for achievement in games, particularly if given continuous, immediate feedback. In such situations, student self-assessment improves as well as confidence in their learning. If STEM games are well-set up, they also require students to ‘form hypotheses, experiment and discover the consequence of actions’ as well as cooperate within a group to solve problems (Mayo, 2009). Most importantly, students are immersed within their learning and can become familiar with the consequence of their actions, both short term and long term (Barab et al, 2009).

So what do video games mean for learning *natural science*? In order to tackle this issue, organizations have begun developing computer assisted learning in response to education for sustainability. One such group is the Physics Department at FURG (Fundação Universidade do Rio Grande, Brazil). They created a program called VISQ (Variáveis que Interação de modo Semi-Quantitativo), which is ‘a network for data analysis and real-world tasks created for primary students’. This program was created by the Brazilian government for children with low SES in one area of Rio Grande. In this particular study, students were previously not encouraged to think about environmental issues in their regular curriculum and teachers used static issues the students were unable to relate to. In using this program, students created ecological relationship models and were able to make links between two entities and include variables.

Eg. Number of rabbits \rightarrow + number of foxes

The game gives a variety of ecological activities and the students have to create graphs with up to six dynamic variables at a time. This game simulates biological, mathematical modelling for students, targeted at students aged 11-18 (Santos et al, 1997).

The traditional visit to a nature centre is experiential and is attractive to students. Visits have an important impact on their attitudes toward the environment and may change student behaviours and practices. Studies of activities students enjoyed most at nature centres did not include the use of the technology. Some of these activities include: wildlife observation, information given by the guide and seeing the consequences of environmental mismanagement (Ballantyne & Packer, 2002). For those who teach natural sciences, electronic technology is often avoided and seen as a negative, particularly at environmental education centres.

Barab et al (2009) argue that real life context with the aid of video games and teaching intervention provides a 'significantly more powerful curriculum for teaching and learning science.' In this particular study, students were introduced to a 3D game-based curriculum in order to learn about water quality concepts. Students were asked to use transformational play in order to act out particular science concepts. The theory behind transformational play is that it 'goes beyond perceptual immersion and involves the person as being within the concept, like you would be in a good book'. This can only exist if the game is a virtual world where a material world involves social interactions, culture and meaningful relations as an integral part of collaborative problem solving. Students who used the most interactive game paired with intervention performed significantly better on standardized test items than students who were given similar but more focused information. Barab et al (2009) argue that too much science teaching involves students as passive receivers of information, expected to memorize facts and concepts defined by textbook or teacher. The incorporation of transformational play game technology and teaching intervention resulted in a significantly higher intake of

information and better performance on test items (Barab et al, 2009). Technology can also be used to aid real life immersive experiences when teaching natural science. For example, many apps have been created for apple and android products in order to assist with natural science education. Some examples of these include wildlife identification apps, weather apps, astronomy apps etc.

Currently there are no transformational play games that incorporate teaching in the environment alongside them. As an environmental educator, I believe that transformational games should be used to assist education in STEM technology (particularly in the classroom), but should also be paired with lessons viewing the topic in real life. Kuo (2007) found that students who used the online game-based learning environment “Go Go Bugs” significantly increased motivation to explore natural science and engage in learning activities. By targeting students through an engaging, interactive medium, educators can improve student motivation and willingness to learn natural science. Paired with interactive, hands on lessons with environmental materials and outdoor activities, students should be developing a rich relationship with the environment and future interest in the natural sciences.

Bibliography

Ballantyne, R. & J. Packer (2002) Nature-based Excursions: School Students' Perceptions of Learning in Natural Environments, *International Research in Geographical and Environmental Education*, **11**(3) p. 218-236

Barab, S.A., Scott, B., Siyahhan, S., Goldstone, R., Ingram-Goble, A., Zuiker, S.J. & S. Warren (2009) Transformational Play as a Curricular Scaffold: using Videogames to Support Science Education, *Journal of Science Education Technology* **18** p. 305-320

M.J. Kuo (2007) How does an online game based learning environment promote students' intrinsic motivation for learning natural science and how does it affect their learning outcomes?, *Computer Society*, **1** p. 1-8

Kurtz dos Santos, A.C., Thielo, M.R., & A.A. Kleer (1997) Students modelling environmental issues, *Journal of Computer Assisted Learning*, **13** p. 35-47

M.J. Mayo (2009) Video Games: A Route to Large-Scale STEM Education?, *Science Mag*, **3** p. 79-82