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Pilot Study of Reactions to an Educational Game

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Abstract
This pilot study examined students' reactions to engagement in an online educational simulation titled "The Great Flu" (TGF). After the students finished the simulation, they completed an anonymous questionnaire. Results indicated that students had both positively and negatively valenced reactions. Some students found TGF to be a fun and valuable learning experience, whereas other students disliked the ambiguities and lack of online feedback. The potential benefits of online games/simulations for education are noted.

Introduction

Online games/simulations (OGS) can be a valuable teaching resource. They provide an interactive way for (a) instructors to expose learners to concepts and (b) learners to explore decision-making skills. Simulations allow individuals to test several scenarios to determine which course of action (in the real world) is most likely to be effective (Cioffi-Revilla, 2011). Games can also be emergent, in that the parameters can be altered as conditions (in the simulation or actual environment) change over time (Jiao, Sun, & Sun, 2007). Recently, there has been an emphasis on enhancing the human elements within OGS, such as adding personality traits to online figures or increasing the degree of interaction between simulations and individuals (Cioffi-Revila & Rouleau, 2010; Ghasem-Aghaee & Oren, 2007). It is presumed that elements increase the realism of participants' experiences, and tests their skills more effectively (Nassiri-Mofakham, Ghasem-Aghaee, Nematbakhsh, & Baraani-Dastjerdi, 2008).

Online programs have been used in fields such as engineering and business (Colwell, 2005; Corsi, Boyson, Verbraeck, Van Houten, Han, & MacDonald, 2006). However, simulations can also be used in other environments, such as the college classroom. It is important for students to have exposure to the demands that they are likely to face in future professions (Joiner, Iacovides, Owen, Gavin, Clibbery, Darling & Drew, 2011; McKinnon & McCrae, 2011). The purpose of this paper is to briefly (a) review the advantages of games/simulations as a pedagogical resource and (b) summarize students' perceptions of an epidemic simulation used in a public policy course.

Social science instructors often seek to engage learners in active learning processes. Instructors commonly use hypothetical case studies (Hall, 2006), films/documentaries (Zoccolillo, 2009) and role plays (Haddad & Lieberman, 2002). These techniques are more active than traditional lecture, but they also have weaknesses. For example,

students might generate unrealistic/overly simplistic solutions to hypothetical problems (Morales-Mann & Kaitell, 2001) and viewing documentaries is a relatively passive experience. Role plays require learner engagement (Pomerantz, 2003), but can be perceived as too intrusive (Smith, 2009). One alternative to these techniques is games/simulations. Compared to discussion or documentaries, simulations require a higher level of engagement. In addition, instructors can set parameters that limit learners to realistic issues in social sciences, such as limited resources and resistant clients. Academically- based games can encourage students to think about (a) technology use beyond social networking and (b) issues in a less personalized way (Cain, 2008).

Students gain technological skills from recreational online games. Instructors can build upon these skills to make academic concepts more accessible (Ferdig, 2007; Urtel, 2010). This approach is consistent with principles that undergraduates are co-creators of their learning experiences and should be empowered to make some educational choices (Akin, 2010; Culross, 2010; Fitzpatrick, Boden, & Kostina-Ritchey, 2010). Games allow instructors to expose learners to situations that would be hard to replicate in the classroom, such as global water conditions (Hoekstra, 2012), physical disabilities (Roccetti, Marfia, & Palazzi, 2011), or epidemics. OGS also allow students to be proactive in exploring possibilities, without doing actual harm to others. As noted by Colwell (2005), games help learners to test the limits of systems and their knowledge. In addition, online simulations can be a venue for teachers to assess cognitive skills. According to Dunlap and Lowenthal (2010), students' choices can provide information about their capacities to recognize, analyze and/or apply concepts. If teachers want to open pathways to knowledge and skill development (Weitzenkamp & Heckathorn, 2001), then games are an option worthy of consideration.

Instructors do not have to limit themselves to recreational games. Rather, teachers can use educational or technical games (DiPietro, Ferdig, Boyer, & Black, 2007). Educational OGS can serve multiple purposes. For example, games can be used to build general cognitive skills, such as memory or concentration. As students gain such skills, they can engage in activities that will likely facilitate effective learning (Papastergiou, 2009). In addition, some online games focus on information and skills that are unique to a particular field of study. Such specialized simulations can expose individuals to the types of challenges that they will face in their professions (Blaylock & Kopf, 2009; Light, 2006). Similar to films/documentaries (Shdaimah, 2009; Zoccolillo, 2009), games can also be used to give rapid exposure to phenomena. Within an hour, students can engage in simulation processes that would take years to enact in the real world. Thus, OGS allows repeated engagement that can foster knowledge development (DiPietro, et al., 2007).

Although a game might be designed with a singular purpose, the game elements could be interpreted differently by students in diverse fields of study. One OGS that is well-suited to transdisciplinary use is "The Great Flu" [1] (TPM Games, 2011). This simulation focuses on five international flu epidemics that have the potential to infect/kill millions of people. The player takes the role of a humanitarian aid worker who decides how to distribute resources. Similar to real-world conditions, the player is given limited resources and it is impossible to protect everyone from infection. Thus, the game sets limits on tools and objectives (Bang, Wisdom, & Labat, 2010). So, the best outcome is often to minimize the degree of harm caused by the epidemic. TGF has been used in prior research with student and community samples (Wijers, 2009; Wiklund, Rudenmalm, Norberg, Westin, & Mozelius, 2015), which suggests that the parameters do not require highly advanced computer skills.

During the past few years, the authors have utilized this OGS in an undergraduate public policy course. This course focuses on general public policies, such as health care, and their impact on families. Whether undergraduates pursue social science careers that focus on (a) direct client care and/or (b) policy development, they are likely to face

situations in which there are inadequate resources or unsolvable problems. Thus, it can be valuable to expose students to such scenarios before entering their professions (Blaylock & Kopf, 2009; Roper, 2009). TGF gives such exposure and allows learners to navigate resource allocation systems, make mistakes and learn from their mistakes. After students completed this online simulation, pilot study data was gathered about their perceptions of the simulation experience.

Method

Simulation Selection for Course

The first author developed the undergraduate course, which focuses on the impact of macrosocial policies (e.g., health care, poverty, education, refugee/immigrant status) on families. She selected the teaching activities, including the online game/simulation, for the course as well. In reference to the simulation, the selection criteria included the (a) range of policy issues that would be reflected, (b) realism of the potential crisis, (c) realism of resources available to address the crisis, (d) multiple variations on crisis conditions, and (e) degree of difficulty in minimizing negative outcomes, such as number of deaths. Based on these criteria, the first author identified and completed several online simulations. As a result of the experiences, she determined that the TGF simulation was the best fit for this particular course. In addition, she added three required course readings (Kelley, 2010; Olsen, 2007; Stirrat 2006) in order to give students sufficient exposure to international humanitarian aid issues. Overall, the simulation selection process was consistent with recommendations for alignment between online games and educational course plans (Shelton & Scoresby, 2011; Yien, Hung, Hwang & Lin, 2011).

TGF is comprised of five virus (flu) options: (a) Kai Virus; (b) Golden Flu; (c) Jabali Virus; (d) Gamera Flu; and (e) Brodaway Virus. The viruses vary in intensity and degree of damage. For example, when a player (resource allocator) took no action in response to the Kai Virus, the result was 819,160,023 infected individuals and 17,435,865 deaths over a 33-day period (2% death rate). In contrast, inaction towards the Broadway virus results in 2,454,484,291 infected individuals and 274,917,800 deaths (11% death rate).

TGF allows has approximately eight action options: (a) face mask distribution; (b) health care and/or research facility improvements; (c) school, market and/or airport closures; (d) isolation of individuals who exhibit flu symptoms; (e) generation of an early warning system; (f) notification to general public; and (g) prepatory storage of antiviral drugs and vaccines. In addition, the resource allocator has access to (h) three research teams that can be sent to infected regions. When the player clicks on each action option, an explanatory statement and cost emerges onscreen. For exam, the statement for research facility improvement explains that virology teams will be able to create vaccines more quickly (in response to an outbreak) when facilities have advanced and relevant resources. The cost of the facilities improvement is Euros €200,000,000 (approximately US$224,500,000). This cost represents 10% of the total budget for addressing the flu outbreak (€2billion).

In addition, there are temporal limits (in response to flu conditions) placed upon the action options. Thus, a certain proportion of infection has to occur before the player can engage in actions which have substantive repercussions in other social domains (e.g., political, economic, law enforcement, transportation). For example, the player can't shut down airports during the first 48 hours because this would be considered unnecessary (for health reasons) and unduly disruptive to other domains. Two benefits of this tiered approach are that it (a) hinders an overreaction or panic choice [by the resource allocator], and (b) provides a realistic view of operational options [economic, legal, social] available during an outbreak. After the player has chosen an action, the (a) cost is withdrawn from the budget and (b) action cannot be undone. In contrast to recreational games (e.g., Bainbridge & Bainbridge, 2007; Davidson, 2008), TGF was not constructed to contain 'Easter eggs' or hidden resources that would allow the player to recoup from ineffective

choices. Parallel to the real world (Kelley, 2010; Stirrat, 2006; Welling, Ryan, Burris & Rich, 2010), the player is stuck with the consequences of his/her humanitarian aid/health care choices. These parameters fit with TGF's "aims to teach players both about effectiveness of various interventions as well as the politics and ethics of enacting them" (Wiklund, et al., 2015, p. 608).

However, it is possible for the player to replay the viral simulation on multiple occasions. In this way, it is possible to learn from prior iterations and attempt a different series of actions in the next attempt. This fits with Ypsilanti, et al.'s (2014) argument that game-based learning should allow opportunities for "trial and error" (p. 517) learning with a minimalist approach to instructor guidance during the games/simulations. In an analysis of serious games, Göbel (2016) classified TGF as an awareness/impact game which addressed socially relevant issues.

Pilot Study Sample and Procedure

The participants were 19 undergraduates (mean age= 24 years) enrolled in the public policy course. Fifty-three percent were seniors, 31% were juniors and 16% were sophomores. Following a guest lecture on international development and humanitarian aid public policies, the students moved to a computer lab and engaged in TGF. They completed the online simulation together, in small self-selected groups of 3-4 students. Each group was randomly assigned a virus that would be the focus of their intervention efforts. As virus conditions emerged, the group members collaborated by discussing their options and then chose the actions in which they engaged (e.g., face mask distribution). The second author was present to monitor their progress and provide general feedback, but did not tell them (a) which choices to make or (b) what would be the likely consequences of each choice option. Thus, the second author fulfilled the guidance role recommended for applied teaching techniques (Culross, 2010; Ypsilanti, et al, 2014). One week later, the students completed the Fitzpatrick Course Assignment Perception Scale (Fitzpatrick & Kostina-Ritchey, 2012) in reference to the TGF learning activity. One section of the scale included open-ended questions in which they could record their reactions to TGF participation. The surveys were completed anonymously. Consistent with qualitative research guidelines (Patton, 2002), the responses to open-ended questions were perused independently by each author. Across the responses to questions, common themes emerged.

Results

Negatively-Valenced Comments

Students wrote negative and positive comments about TGF. Negative comments addressed (a) the quality/lack of direction given by the online simulation, and (b) lack of connection between the simulation and course topics. In reference to game quality, some participants expressed dissatisfaction in comments such as wanting "a better game & more context to playing (goals, etc.)" and that it "was cool but kept messing up while we played." However, it is not clear whether students were criticizing the simulation's design features or its outcome. Their standards for a 'better' OGS might indicate that they are seeking a game in which they can achieve the outcomes that they seek. In contrast to some educational online environments (Charles, Charles, McNeill, Bustard, & Black, 2011), TGF does not give specific feedback on participants' choices. This simulation simply provides a record of actions taken (such as quarantines) and outcomes (such as death rates). This record offers feedback on the virus' "progression pathways" (Ohannessian, Yaghobian, Verger & Vanhems, 2016, p. 4482) and the ways in which students' actions impact the pathways. Although more successful results might be more gratifying, it might give learners a less credible exposure to social science issues (Culross, 2010).

In reference to game instructions, groups were exposed to the general introduction provided in the game (Bang et al., 2010). However, the students were not given specific

instructions as to when to allot specific resources or take specific actions. Rather, the game provides windows of opportunity in which certain actions can/can't be taken (such as closing airports). In these ways, the online simulation sets viable conditions. Yet, participants critiqued a lack of sufficient information. For example, one student wrote that she/he wanted "more knowledge about what we are doing & better instructions on game". Another person indicated that the simulation was too brief and recommended that participants be given "more time to study the moves we had to make in order to obtain a more real awareness of the job at hand. Saving the world". Some students also expressed a desire for more guidance from the simulation. For example, one person indicated the game didn't provide "feedback on what you did wrong". Similarly, a student wrote "it was somewhat confusing on what to do to treat the sickness; better instructions from game". It is possible that learners simply lacked sufficient knowledge about epidemics in order to understand their choices. It is also possible that they faced more ambiguity in this OGS than they face typically in recreational games, and found the ambiguity to be unpalatable. This premise is consistent with prior research that identified differences in students' use of online recreational and educational resources (Urtel, 2010) and adverse reactions to unclear situations (Akin, 2010).

The last set of comments specifically addressed the lack of clear connection between the course concepts and TGF simulation. This viewpoint was most articulately expressed in one participant's comment - "the assignment seemed irrelevant to what we were doing, although trying to save countries on a computer may show public policy, it didn't seem to." It is true that this simulation requires individuals to directly allocate resources rather than create policies about health care. Thus, the linkage might not have been sufficiently obvious for some undergraduates. However, it is also possible that the lack of linkage is reflected in the timing of measurement. Consistent with prior research and teaching recommendations (Markey, Swanson,

Jenkins, Jennings, St. Jean, Rosenberg, Yao, & Frost, 2009), a discussion was conducted with the class after the OGS to review its relevance to course concepts. However, students completed the survey (a) after completing TGF, but (b) before a debriefing discussion and lecture. Thus, it is possible that linkages were more apparent after the data collection and debriefing/lecture occurred.

Although the negatively-valenced comments are important, it is necessary to consider the degree to which more information would be helpful. Certainly, students need enough direction to understand the task. Yet, they might not benefit from answers to all of their inquiries. Rather, some have argued that students learn most effectively when they have imperfect or uncertain conditions (Charsky & Ressler, 2011). Under such conditions, undergraduates might rely on their own abilities or push themselves to greater efforts (Akin, 2010; Blaylock & Kopf, 2009). In these ways, they might gain more from experiences when instructors provide limited assistance. Thus, instructors serve a more reflective or consultative role as students explore ambiguities and engage in active learning processes (Peled & Dunnivan, 2011).

Positively-Valenced Comments

In contrast to the negative comments, there were some positive comments as well. Positive comments addressed (a) the general value of games as a variation in teaching/learning experiences and (b) specific lessons learned from this game. In reference to the first theme, some wrote that they liked doing TGF. One student seemed to enjoy the entertainment value, as he/she wrote "it is fun to learn in different ways". Consistent with this viewpoint, another person noted that the online simulation was a "fun hands-on experience – [was] better than talking about it for 3 whole hours...helps me remember the concept better because of visual cues attached to the game". A third student emphasized the value of the unique learning experience derived from the simulation - "it is always good to get away from the books and do things with technology.

Also, the more interested we are in the class or assignment the better outcome we will have". The comments fit with Ferdig's (2007) viewpoint that instructors should not underestimate the novelty value of diverse teaching techniques. In addition, the comments highlighted that online simulations can facilitate the comprehension of course concepts. Parallel to the principles of stealth assessment (Schute, 2011), online simulations might create stealth learning (in which students underestimate how much they gained from educational activities).

In contrast to general learning processes, some students focused on the specific lessons that they learned from this OGS. For example, they wrote that TGF "opens your eyes to how fast diseases spread" and that students "get to see how distribution of fund works. No real answers". In addition, one person wrote "I thought it was a good way to see something that normally would seem to large scale to fully understand". This latter statement fits with the viewpoint that undergraduates comprehend global issues more effectively when they have exposure via venues that are familiar, or part of their own experience (Peled & Dunnivan, 2011). Some students recommended that this simulation be used across semesters. For example, one person wrote "the assignment was pretty interesting. I would def [definitely] show it to classes in the future".

Overall, it appears that students saw some value in TGF experience. It might be surprising that they would label an epidemic simulation as "fun", but this should not be dismissed too abruptly. Active teaching techniques emphasize that personal interest is a precursor to effective learning. Fun should not be a substitute for intensive instruction, but enjoyment can be utilized to foster educational experiences (Farrell, Kostkova, Lazareck, Weerasinghe, Weinberg, Lecky, Adrianssens, Herotová, Holt, Touboul, Merokau, Koncan, Olczak-Pienkowska, Avô, Campos, & McNulty, 2011). In addition, some students noted that this OGS fostered thoughts about "large" social problems. Such thoughts are a stepping stone in taking expansive viewpoints toward global issues (Peled & Dunnivan, 2011).

Conclusion

This pilot study examined students' reactions to their participation in TGF, an online simulation of an international epidemic. This simulation exposed the students to the type of decision-making processes that they are likely to face in their careers. Students recorded their reactions in an anonymous questionnaire, and the authors conducted a content analysis of these reactions. Some students reported that the simulation was a valuable learning experience and challenged them to see social policy/practice issues in a new way. In contrast, others found the nebulous nature of the activity to be a source of frustration. They indicated a desire for more specific feedback from the instructor and/or online game itself. These findings are consistent with Urtel (2010), who noted that it is not sufficient for instructors to simply make technology available to students. Rather, technology is only a delivery device and social science teachers still need to guide learners through valuable learning experiences (Fitzpatrick, et al., 2010; Roper, 2009).

In addition, it is important to remember that students and instructors might not see online simulations in the same way. For example, the second author (as facilitator of the TGF activity) observed group behaviors/dynamics that were consistent with competitive humanitarianism. Group members were sufficiently engaged to seek opportunities to rerun simulations and improve their outcomes (e.g., lower death rates) in subsequent iterations. In addition, groups used various benchmarks (e.g., budget surplus, infection rates, geographic protectionism) to determine whether they were the most successful interventionists (in comparison to other groups). The comparative discussions (across groups) were not combative, but they were indicative of self-interest/self-promotion in a humanitarian context. This self-other dynamic has been identified in literature on actual humanitarian aid events (e.g., Stirrat, 2006; Welling, et al., 2010). This group dynamic aligns with the argument that serious games can foster serious learning (e.g., Göbel,

2016; Ypsilanti, et al., 2014). The depth of student engagement was illuminating and facilitated discussion about relevant topics in subsequent class meetings (of the undergraduate public policy course). Thus, instructors are advised to be open to the unexpected teachable moments or resources that are generated from serious game learning activities.

Endnote

[1] "The Great Flu" online simulation was created by Erasmus University Medical Center in Rotterdam, The Netherlands.

[2] A briefer version of this paper was published previously: Fitzpatrick, J. & Kostina-Ritchey, E. (2013). An epidemic simulation in a public policy course. Academic Exchange Quarterly, 17, 17-23.

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