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Walking the Pens: A Case Study of Secondary Agriculture Teachers' Experiences Using a Serious Digital Game in an Introductory Animal Science Course

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In a world where knowledge is a click away, today's students need information delivered in ways that meet their expectations as digital natives. Serious digital games are one way to meet the demand. This particularistic case study sought to understand agriculture teachers' experiences using a serious digital game in an introductory animal science course. Three themes emerged from the data collected: 1) the real-world context provided by the game; 2) the game's potential to promote students' agricultural awareness; and 3) teachers' positioning of the game as a secondary teaching approach. Based on these findings, it can be recommended that professional development opportunities be created for teachers to learn how to use serious digital games more effectively in other situations. In-service workshops focused on using digital games as a primary approach to teaching secondary agricultural education curricula, especially when simulations are necessary for teaching content. Because agricultural literacy was an unintended outcome, future research should focus intentionally on the impact serious digital games have on agricultural literacy.

Keywords: serious digital game, agriculture teachers, animal science, secondary classroom

Introduction

In a world where knowledge is just a click away, today's students need information delivered in ways that meet their expectations as digital natives (Prensky, 2001). One way for educators to provide high-quality content that meets students' desires for receiving information is through the use of serious digital games (Huang, Huang, & Tschopp, 2010). Serious digital games provide an incredible learning environment for students (Oblinger, 2004) because they simulate facets of the real world. "Educational games and simulations, unlike direct forms of instruction, are

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experiential exercises” (Gredler, 1996, p. 521) that provide a context for applying concepts to the real world (Huang et al., 2010). Serious digital games are platforms for delivering content as fun, engaging, and motivational learning experiences for students (Franciosi, 2011; Kiili, 2005). The phrase coined to represent the pedagogy of serious digital games is digital game-based learning (DGBL) (Prensky, 2001). Ultimately, the goal of DGBL “is to engage learners in the experiential learning process” (Franciosi, 2011, p. 12). DGBL promotes active learning through constant reflection (Papastergiou, 2009) and is grounded in *real-life* problems that students must work to resolve (Franciosi, 2011; Oblinger, 2004).

Because of its bent on experiential learning and solving problems in real-world contexts, DGBL has value for agricultural education teachers (Bunch, Robinson, Edwards, & Antonenko, 2014). The purpose of agricultural education is to teach students about agriculture in preparation for careers and post-secondary education (Roberts & Ball, 2009). To accomplish that, agricultural education has always attempted to be experiential in nature (Baker, Robinson, & Kolb, 2012; Cheek, Arrington, Carter, & Randell, 1994; Hughes & Barrick, 1993; Knobloch, 2003; Randell, Arrington, & Cheek, 1993; Stewart & Birkenholz, 1991) and grounded in real-world problems (Knobloch, 2003; Splan, Porr, & Broyles, 2011). When delivered well, every aspect of the program is experiential for students, including the classroom (Baker et al., 2012), where technologies such as serious digital games are being implemented more so now than ever before (Stewart, Antonenko, Robinson, & Mwavita, 2013).

One of the greatest attributes of game-based simulations is that they help students apply the theory of what they learn (Boyd & Murphrey, 2002; Leggette et al., 2012). This is important because “students are consistently looking for practical applications of their studies in a real-world context” (Windham, 2005, p. 5.8). Unfortunately, many of the games played today were not designed for educational purposes. Instead, they were created solely to entertain (Oblinger, 2006). Therefore, questions exist regarding how educators can use games to teach students content that can be applied in various real-life contexts.

Teachers from all disciplines have begun considering the digital gaming phenomenon as a viable instructional delivery mechanism (Huang et al., 2010). However, because agricultural education teachers rely on experiential learning (Baker et al., 2012), they must be cautious not to utilize games that are focused entirely on *drill and practice* (Kiili, 2005). Instead, these games should provide a context in which instructors can teach valuable skills about the agricultural industry. One game that seeks to accomplish this goal is Pfizer’s *Virtual Walking the Pens®*. *Walking the Pens* focuses on the swine industry and is used to teach entry-level employees about swine health and management (S. Miller, personal communication, July 1, 2011). Based on face value, this game has the potential to increase instructors’ abilities to provide a solid context to their content regarding the swine industry in animal science courses. This is beneficial because the greatest challenge for agricultural education teachers today “is to move beyond the ‘doing’ and ensure

that all learning is connected to thinking and knowledge that will be easily remembered and applied later in life” (Knobloch, 2003, p. 31). Therefore, agricultural education teachers must continue to ground their pedagogies in a context with experiences that support students' learning of agriculture (Roberts & Ball, 2009) so that it can be transferred to various situations involving the agricultural industry (Bunch et al., 2014).

Conceptual Framework

The framework that undergirded this study was contextual teaching and learning (CTL) (Parr, Edwards, & Leising, 2006). The idea behind CTL is that educators can help students better understand how their specific content relates to and transfers to a different context. Specifically, Parr et al. (2006) used CTL to help students learn mathematics in the context of agricultural power and technology (APT) courses. Essentially, the APT courses provided students with a context in which they could learn mathematics content better.

CTL is a seven-element approach to teaching in which educators teach their content by providing examples that are relatable to students (Stone, Alfeld, Pearson, Lewis, & Jensen, 2005). Once the examples have been rooted firmly and students begin to grasp the content, educators stretch students outside of their original context (in this case, agriculture) until they are learning another subject area altogether. Finally, the educator brings students back into the agricultural context by providing another example to which students can relate and identify fully. This contextual experience method of teaching enables students to transfer information more easily from one context to another (Stone et al., 2005). Because DGBL simulates aspects of the real world, it appears to be a pedagogy that has the capability of serving as a context in which students can transfer their learning to various real-world contexts.

Although digital games have numerous positive qualities and appear to be a strong pedagogical tool for educators (Kiili, 2005), they are met with mixed emotions and resistance (Garris, Ahlers, & Driskell, 2002). Part of the dilemma is that there is no clear-cut agreement on how games are defined (Garris et al., 2002). On one side of the debate, games are perceived as violent and full of negative images. On the other side of the debate, games are perceived as positive instructional methods that are fun and engaging (Garris et al., 2002; Kiili, 2005). Because it is important to evaluate agricultural education teachers' beliefs toward integrating technology (Stewart et al., 2013), this study focused on teachers' experiences of teaching a unit on swine health and management while using DGBL as the primary instructional approach.

Purpose and Objectives

The purpose of this study was to understand agriculture teachers' experiences using a serious digital game in an introductory animal science course. Two objectives guided the study:

1. To understand teachers' overall perceptions of using serious digital game-based learning in an introductory animal science course.
2. To describe teachers' perceptions of a serious digital game for student learning.

Because serious digital games have been identified as engaging (Franciosi, 2011; Oblinger, 2004; Papastergiou, 2009; Prensky, 2001), this research study addresses Research Priority 4, "Meaningful, Engaged Learning in All Environments," of the American Association for Agricultural Education Research Agenda for 2011–2015 (Doerfert, 2011).

Methods

Case study methods (Merriam, 2001) were used to collect and analyze data to better understand agriculture teachers' experiences using a serious digital game in an introductory animal science course. Focusing on the particularistic nature of a case is an effective method for exploring practical issues. The specific focus of particularistic case study exposes what the phenomenon—teachers' use of a serious digital game—might represent about everyday occurrences. The cases were bound by time (10-day instructional unit), and the serious digital game was used. The cases were identified as particularistic because they allowed us to enhance our understanding of a particular phenomenon: teachers' use of a serious digital game (Merriam, 2001).

This study focused on four agriculture teachers who used a serious digital game developed by Pfizer Animal Health® to teach an instructional unit regarding swine health and management. The teachers who participated in this study were chosen purposively because we perceived these teachers to be technologically savvy and willing to attend a 2-day professional development workshop focused on digital game-based learning as an instructional approach. Profiles of participating teachers follow; each was given a pseudonym to maintain anonymity.

Fred is a traditionally certified secondary agriculture teacher in a rural school district. He is 24 years of age and has been teaching agriculture for 2 and a half years. Fred holds a bachelor's degree in agricultural education. Outside of agriculture, Fred has no other teaching certifications. Fred has used digital games as a teaching approach in his classroom. In fact, he has been using serious digital games for 2 years now.

Mark is 57 years of age and a veteran teacher as a result of his 30 years in the secondary agriculture classroom. Mark teaches in an urban school district. His classroom is considered technology-enhanced because of a large grant awarded to the school district. Mark holds a bachelor's degree in agricultural education and a master's degree in educational leadership, and he is traditionally certified. In addition to agriculture, Mark is science certified. Although his

classroom is considered technology-enhanced, Mark has never used serious digital games as a teaching approach.

Suzy is 28 years of age and has taught secondary agriculture in a rural setting for 3 years. Suzy has earned a bachelor's degree in agricultural economics and a master's degree in agricultural education. Suzy completed a traditional teacher preparation program while working on her master's degree; thus, she is traditionally certified. She has not had experience using serious digital games as a teaching approach in the past.

Misty has taught secondary agriculture in rural and urban settings for 8 years. She is 31 years of age and holds a bachelor's degree in agricultural education. Misty is a product of a traditional teacher preparation program. She has no other teaching certifications outside of agriculture. Misty has not used serious digital games as a teaching approach in the past. In fact, she was not aware of serious digital games focused on agriculture before this study.

Data Collection

The primary data collected for this study were interviews. We conducted one 1-hour semi-structured interview with each of the teachers involved, totaling four interviews. The use of semi-structured interviews was important because it gave us the opportunity to ask probing questions based on the teachers' responses to the questions. For consistency, the interviews were audio recorded and transcribed verbatim. Member checks were utilized by sending the transcriptions, via e-mail, to the teachers to ratify the creditability of the information given to us in the interview process (Creswell & Miller, 2000; Dooley, 2007). In addition to the interviews, teachers completed two weekly reports to ensure fidelity of their use of the game. These reports were used as one means of triangulating the data with what was received through the interviews. Further, during each interview, we took pictures of the technology used in the classroom/laboratory as a means to understand more fully the teachers' climate and environment in regard to technology usage.

Data Analysis

To ensure trustworthiness, we independently coded and triangulated all interviews, weekly reports, and pictures to identify initial codes. One week later, we met to negotiate and deliberate disconfirming evidence. Negotiation of disconfirming evidence allowed us to reexamine all data to approve or reject identified codes and themes (Creswell & Miller, 2000). Further, peer debriefing was used to discuss data collection procedures and identify themes. We used external candidates, two colleagues, and two graduate students to assist us in the accuracy of our data collection procedures and our identified themes. The external candidates were charged with challenging our assumptions and interpretations. According to Creswell and Miller (2000), "a

peer review or debriefing is the review of the data and research process by someone who is familiar with the research or the phenomenon being explored” (p. 129). It should also be noted that the biases we each brought to the interpretation of the findings were accounted for during the peer debriefing process. This was accomplished through team reflection. We reflected on our backgrounds as previous secondary teachers and identified possible biases.

Context

The serious digital game used for this study was *Virtual Walking the Pens*®, developed by Pfizer Animal Health®. This game provides a 3-D virtual world in which Pfizer’s entry-level employees can experience the daily operations of a 2,400-head swine operation as a training simulation. Because agricultural education exists, in part, to prepare students for entry-level careers in various sectors of the agricultural industry (Roberts & Ball, 2009), *Virtual Walking the Pens*® was deemed a viable curriculum for this study.

The virtual world affords students the opportunity to become a farm manager for a day. Embedded within the game are 10 scenarios; each scenario exposes students to a different swine disease that pork producers face daily. As a farm manager, students make decisions that are crucial to production and profitability. Students must be able to identify unhealthy animals, make decisions to treat an individual pig or the whole herd, and control the environment. The decisions made by the student affect not only the animals, but also the livelihood of the farm. In our findings that follow, we will refer to *Virtual Walking the Pens*® as “the game.”

Limitations

Because the purpose of particularistic case studies is to enhance the understanding of a specific phenomenon and shed light on what that phenomenon might represent about everyday occurrences, the reader should be cautioned against generalizing the results of this study; however, the reader may transfer learning in the event of similar cases. In addition, the small sample size and the specificity of the serious digital game used in this study may impede the reader’s ability to generalize (Merriam, 2001).

Findings

The findings and conclusions presented here represent the agriculture teachers’ experiences using the game in an introductory animal science course. Profiles of the participants have been offered previously, so our findings focus on the major themes across their experiences implementing the game. The major themes discussed below include (a) the real-world context provided by the game, (b) the game’s potential to promote students’ agricultural awareness, and (c) teachers’ positioning of the game as a secondary teaching approach.

“I feel like I’m in a hog barn.”

Consistent with previous literature (Franciosi, 2011; Huang et al., 2010; Oblinger, 2004), all four teachers, to varying degrees, acknowledged and appreciated the real-world context represented in the game. They recognized students could connect to the real-world context and valued that the game provided students with learning experiences that even field trips could not. As Fred said, “I think that games became more popular and more useful in my mind because we can have those experiences and never leave my classroom.” He later emphasized, “It brings real-life experiences to the classroom...It’s more learning because it’s not just a tour of some facilities. It’s an actual; they get to be the worker for the day.”

The game contains real-life sights and sounds that are consistent with raising swine in a confinement operation. The virtual sights and sounds represented in the game expanded students’ learning experiences, enabling them to see, rather than read or hear about, a swine operation in action. Misty highlighted this notion, saying:

To me, it was a virtual way they could actually see it. My kids, they even said, ‘I feel like I’m in a hog barn.’ You know, so I think it’s the closest way a student can learn about that specific subject without actually going to the hog barn or actually doing it themselves. I mean, it’s the closest thing to reality they can get to in the classroom.

Student experiences with the sights, sounds, and inner workings of a swine operation were crucial to the applications of student understanding presented in the game. This contextualized feature of understanding through scenarios was especially important for students unfamiliar with farms or swine operations, as Suzy illustrated. She said:

For some of the kids who had never been on a farm or been to a swine operation, they were able to kind of see it through the game, and I think that helped kind of make the concept more real for them.

A safe, low-risk space.

That students could see and experience the inner workings of a swine operation while testing their knowledge of relevant swine health and management concepts positioned the game as a safe, low-risk space for students to connect concepts and apply their knowledge. As Mark described:

The benefits that I see is again taking something you’ve learned and seeing how it can be really applied. Too many times kids will [say], ‘Well, I’m never going to use that.’ Well, here’s where you use it. Here’s why it’s important for you to understand. When you’re

doing the crop scene, here's what you see. Here's how you can, okay, you look at a pig and realize they've got some type of disease and what do you need to do correct it or prevent it? Do you need to get on a phone with a veterinarian and say, 'Hey, here's what I got; help.'?

The opportunity for students to diagnose and act on such problems, as well as decide on the day-to-day happenings of the swine operation, allowed them to apply their knowledge and test their conjectures in a low-risk environment where no swine (or students) were harmed, yet where the students could see their decisions play out. Within the context of the game, students were able to see the outcomes and consequences of their decisions unfold. This is consistent with research suggesting games provide a context in which students can learn to solve career-related (agriculture) problems (Oblinger, 2004). As Fred explained:

You're the hired hand. You're in charge of taking care of these animals. So, day to day, 'What would you do?' What practices would you use? What management practices would you use here and there? I think, yes, they didn't get the actual 'on-the-farm experience,' but they probably learned more from it because they were allowed to take more steps and be more involved in the management process.

The real-world context depicted in the game, coupled with the safe, low-risk space it provided for learning, was relevant and effective, even for students with little to no previous experiences with farms or swine operations. As they progressed through the scenarios of the game and had opportunities to apply and test their knowledge, the students began to develop a working understanding of a swine operation. Misty illustrated this best, saying:

The further we went along, the more they were getting the hang of it, because this was totally foreign to these kids. Like I said, none of them come from an [agricultural] background, all ten of them, and the more they went through this, they were beginning to understand. Okay, this animal needs this to be healthy, and this is what we've got to do if this animal's dying, or we've got to separate it. And so I think as it progressed, they were beginning to understand swine husbandry.

Further, the safe, low-risk space afforded by the game not only allowed students to test their knowledge, but it likewise increased their agricultural awareness. Mark hinted at this perhaps unintended outcome, saying:

Also, they learn to check the feeders every day, check the water. That's one of the first things they got. 'Hey, if we don't check those things, we can really get in trouble, can't we?' Well, you know, you guys look and see what's happening. And I think that created a little bit of awareness for them.

These findings support Boyd and Murphrey (2002) and Leggette et al. (2012), who surmised that games provide a virtual world for students to apply what they have learned.

“We’re so far removed from the farm.”

The teachers in this study recognized that today’s students are not as connected to the farm as students of past generations. Despite this, they realized the game held the potential to reconnect students with agriculture, thereby fostering students’ agricultural awareness. As Mark said, “Some of the best things in the world happen on a farm. But people don’t understand that.” Even students with agricultural backgrounds can become disconnected, and as Fred indicated, the game can serve to reestablish their connections with agriculture:

It was very beneficial to take something that’s very [agriculturally] related that a traditional [agriculture] student might know a lot, but as we go through the years and these students get more urbanized as we go, [the game] was a way to take some things from off the farm and bring them back to the students and relate it in a way, with the use of a game, that every kid could understand.

Not only did the game have the potential to reconnect students with agriculture, but it also held potential as the context for discussing negative portrayals of swine operations in the popular media. If faced with negative portrayals of swine operations, Misty anticipated that her students would not have a similar negative reaction to swine operations. She maintained:

I don’t think they would have a negative reaction. I think they could say, ‘Oh, yeah, we talked about that in class,’ and ‘We did a game,’ you know? I don’t think they would say one negative thing about it. Because it was kind of like they understood, you know, that things can happen and these are the things you’ve got to do to prevent that, you know, that bad things can happen. And that didn’t seem to faze them at all...

This situation actually arose in Mark’s class. While his students were playing the game, an animal rights activist filed an exposé on a swine facility for euthanizing pigs inhumanely. As he described:

Well, the pigs were sick and instead of giving them an injection and euthanizing them, they just took a shovel and took care of it. Anyway, they said, ‘Well, what’s happening? They shouldn’t take care of an animal that way.’ And I said, ‘Well, how would you do it, then?’ And we talked about different ways of euthanizing animals. We talked about efficiency. We talked about how expensive it was. Then we got to talking about, well, should you have to euthanize? Should you just let the pig die on its own? And we talked about those things. And then we talked about suffering, etc.

Discussing the exposé in the context of the game enabled Mark to cover numerous concepts related to swine health and management and the ethics of animal care. Students were able to ground these discussions in their experiences working through the scenarios of the game. This finding supports the assertion that games provide an active learning environment (Papastergiou, 2009). These discussions helped students separate fact from fiction of swine operations and increased their agricultural awareness. Mark continued to describe the ways in which the game promoted students' agricultural awareness:

And if we don't have farms like that, are we willing to have a pig farm in our own backyard and take them to the local market and let them slaughter them there, or are you going to slaughter them yourself? And they go, 'Oh, maybe we do need those markets. Maybe we do need those things out there for us.' Because they don't want to spend the time or the effort. They sure don't want to have to go out there and kill the hog and clean it and dress it and butcher it. You know, that's pretty well gone by the wayside. And then my comment is, 'We're so far removed from the farm that people don't understand what it's like to take care of animals.' And I always tell them no farmer that I know of is ever going to mistreat an animal. Because they can't afford to...So, they're not going to go out there and just abuse or misuse any animal.

“It's a nice break.”

Despite recognizing the real-world context provided by the game and realizing the game offered a context for promoting students' agricultural awareness, teachers in this study positioned the game as a supplemental, rather than primary, teaching approach. As Mark described, the game was “just an extension of what [students] already learned.” He and other teachers in the study “pretty well covered most of the content before I ever introduced the game” (Mark's interview). Teachers described the game as “a follow up to have some hands-on to what [students] already learned” (Mark's interview). In addition, the game was used to “break up the monotony of the basic classroom” (Fred's interview), was “more relaxing for the teacher” (Fred's interview), and served as “a nice break, and it provides a variety in the classroom for [students]” (Suzy's interview).

The game's secondary status as a teaching approach was emphasized further as Fred discussed using it as a reward for good student behavior. As Fred explained:

[The game] was something that I could kind of hold over their head as, 'Hey, you know, in a couple of weeks, or if you guys work hard these four days, then I'll be gone and you can play the game.'

This positioning of the game as secondary and supplemental mirrored the ways in which other inquiry-focused, student-centered teaching approaches, such as project-based learning, have been similarly considered as dessert, rather than the main course for student learning (Larmer & Mergendoller, 2011).

Conclusions and Recommendations

The game provides a real-world context for student learning. The game's contextualization of student learning affords a safe, low-risk space in which students explore the concepts beyond what they could in everyday life. In this way, the game appears to satisfy the same goals as contextual teaching and learning (Stone et al., 2005). In this space, students are free to apply their knowledge and test their conjectures related to swine health and management. Consequently, the safe, low-risk space of the game also provides a context for fostering students' agricultural awareness.

Although an unexpected finding of this study, the real-world context of the game enables discussion of relevant and timely agricultural issues and representations of agriculture in the popular media. This prompts students to think about the validity of claims based on their experiences working through the scenarios of the game, thereby promoting agricultural literacy.

Having the platform to discuss agricultural literacy topics that are relevant and meaningful to students is necessary because people are illiterate about agricultural practices (Blackburn, 1999; Hess & Trexler, 2011; National Research Council, 1988; Powell, Agnew, & Trexler, 2008; Terry, Herring, & Larke, 1992), even those who are incoming freshmen at land-grant institutions, where agriculture is a major component of the institution's mission (Jones, 2013). To take advantage of the game's real-world context and its potential to promote students' agricultural awareness, teachers need to reposition the game from a secondary to a primary teaching approach. Without doing so, the teachers failed to utilize the full potential of the game.

Professional development opportunities should be created for teachers to learn how to use serious digital games effectively. It could be implied that the teachers in this study viewed the game as a *dessert* rather than the main course (Larmer & Mergendoller, 2011); yet through professional development, the game could be repositioned as a primary instructional approach to increase student learning and effectiveness of this type of contextualized, game-based learning. Sustained professional development on the effective use of serious digital games would provide teachers with a dedicated time and space to share stories of successful integration and to brainstorm ideas for overcoming barriers to implementation collaboratively (Guzey & Roehrig, 2012). In this context, teachers can discuss ways for and derive support for using serious digital games as a primary instructional approach. For example, professional development providers should consider delivering in-service workshops focused on using digital games as a primary

pedagogy for student-centered learning. Efforts should allow students to learn through the game's scenarios (primary approach) instead of teaching content and then allowing students to play the game at the conclusion of an instructional unit (supplemental approach).

This approach poses questions for teachers to consider regarding their course design. Understanding what (i.e., content) to teach and how (i.e., media and methods) to teach it effectively is imperative for teachers. Therefore, efforts should be devoted to aiding teachers in constructing the game around content in meaningful ways so that both student engagement and success are optimized. Teacher educators might consider introducing the use of serious digital games to pre-service teachers and providing opportunities for pre-service teachers to engage with and teach using serious digital games via teaching methodology courses.

As researchers, we have further questions based on the results of this study. Principally, are our results common of serious digital games implemented in the context of agriculture education? This study should be replicated using other serious digital games focused on agricultural content and those results compared to the findings of this study. Additionally, because agricultural literacy was an unintended outcome, future research should focus intentionally on the impact serious digital games have on agricultural literacy. Finally, as a result of the game providing a real-world context, future research should be conducted to determine if skills and knowledge learned through the game could be transferred to real-life situations.

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