

Teacher Candidates' Views of Digital Games as Learning Devices

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The objective of this research study was to explore teacher candidate views toward digital learning games using an immersive strategy. Specifically, we were interested in finding out what game use in classroom settings taught candidates about the role of teacher as facilitator of instruction. The procedures first focused teacher candidate attention on effective learning methods followed by attention to the pedagogies of teaching digital games to middle or high school students and peers. Data was collected regarding teacher candidate reactions to this learning medium. Teacher educators may be interested in the findings to help design contemporary curricula to support candidates' development in using computer-based games for learning purposes in middle and secondary classrooms. In addition, research findings may help developers and instructional technologists design future games that are germane to specific learning contexts while challenging students to think critically and develop complex reasoning skills.

Introduction and Background to the Problem

Recent studies provide evidence that technology-based teaching

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methods result in increased student learning (Aldrich, 2005; Borja, 2007; Devaney, 2008; Gibson, 2002; Kirriemuir & McFarlane, 2004; Partnership for 21st Century Skills, 2007; Project Tomorrow: NetDay, 2006; Project Tomorrow, 2008, Stansbury, 2009; Warren, Dondlinger, & Barab, 2008). Technology-based teaching can impact learning, and the call for increasing its use in school settings has become more insistent and widespread. Echoing this call is the National Education Association's (NEA) recent report which not only advocates for increasing technology's role as a tool to foster student learning but strongly recommends that schools of education take the lead in preparing teacher candidates with the knowledge, skills, and dispositions associated with technology as a learning agent in classrooms (2008).

For many schools of education, this task also requires teacher educators to consider complex curriculum restructuring in order to implement change. Specifically, they must consider which technology tools should be taught. Which strategies should be used to teach technology tools as learning devices in classrooms—a skills-oriented approach or an immersive one that is often used with English language learners? What types of technology-oriented learning experiences do K-12 students find motivating, challenging, and interesting? And, pertinent to this study, what might digital games teach preservice candidates about the role of instructional facilitator?

Public interest in one specific educational technology area, digital games, is growing. Digital games refer to any type of game played online, on a computer, console, or via a handheld device. On web sites associated with Nickelodeon, Disney, and Electronic Arts, millions of children and adolescents play 'casual digital games' based on popular movies and television shows (Stelter, 2008). To get students to read, publishers have adopted a new strategy for engaging young people: they created web-based video games associated with their books, such as Scholastic's book series, *Harry Potter*, *Inheritance*, and *The 39 Clues*. Science fiction author Philip-Jon (PJ) Haarsma developed a free, online role playing game (*Rings of Orbis*) to accompany his novel (*The Softwire: Virus on Orbis 1*). This clever approach gave gamers who might not otherwise rush to pick up a book a clear incentive to read. Game developers hope the games encourage kids to get involved in reading (Berman, 2008) because "one way that players advance is by answering questions with information from the novel" (Rich, 2008, p. A1).

Gaming is pervasive in the lives of American teens. Recent findings of the Pew Internet & American Life Project indicated that 97% of children ages 12-17 polled played digital/video games on computers, the web, consoles, and/or handheld devices (Lenhart et al., 2008). In

addition, game play is gender neutral with 99% of boys and 94% of girls reporting active game play experiences. When asked about the value of gaming technologies related to learning, students in grades 6-12 were interested for a variety of reasons, noting that games make it easier to understand difficult concepts (51%); that they allow for more engagement in the subject (50%); and provide a more interesting way to practice problems (44%). In addition, 56 percent of K-12 students stated that the number one reason they valued digital games was because they felt they learned more while playing (Project Tomorrow, 2008).

When looking for meaningful ways to integrate technology in the K-12 curriculum, games offer a potential solution to an urgent problem to prepare a more technologically-oriented work force. It is believed our ability to innovate and prepare students for careers in science and technology will be key factors in keeping the U.S. competitive in the global economy (Devaney, 2008). Yet, nearly three out of five American teens do not believe their high school is preparing them adequately for a career in technology or engineering. Nearly 72 percent believe technological innovations can solve some of the world's most pressing environmental issues within the next decade. Furthermore, a similar majority of teens (79%) surveyed believe there is value in hands-on project-based science, technology, engineering, and math (STEM) education and learning in high school (Devaney, 2008).

Building on the natural affinity students have for game play and technology tools, researchers are designing today's digital games with educational purposes in mind. Squire (2006) reviewed next-generation digital games and documented this growing interest as representative of a "shift toward a culture of simulation, where digital technologies make it possible to construct, investigate, and interrogate hypothetical worlds" (p. 19). Shaffer (2006) coined the term for such games as *epistemic*. Epistemic games immerse students in authentic activities in order to evoke their consideration and innovation in problem-solving. The games get students thinking, acting, and caring about real world issues. As a result of the exploration and investigation provided, students know more because they were immersed and engaged. Many epistemic games are currently being piloted in classrooms across the U.S., and data are being collected as to their overall effectiveness (Anderson, 2005; Dede, Ketelhut, & Nelson, 2004; Prensky, 2006; Squire, 2006). Some of the games currently being piloted more widely include *Quest Atlantis*, *Immune Attack*, *Tabula Digita*, and *River City*.

In addition, findings of digital game-related studies relate increased student motivation to learn with decreased racial and gender differences. Some study results indicate that classroom game use fosters academic

confidence with the greatest impact on the bottom third of students (Dede, Ketelhut, & Nelson, 2004). Students were also found to develop social and technology skills and grow in their scientific literacy. Most important to self-esteem, when learning preferences are met, students believe they have a voice in the educational process (Fox, Anderson, & Rainie, 2005; Kantrowitz et al. 1999; Montgomery, 2007; Oblinger, 2003).

Deemed the most important skill for the 21st century, thinking skills can be enhanced by repeated exposure to computer games and other digital media (Day, Arthur & Gettman, 2001; DeLisi & Wolford, 2002; Gee, 2007; Ravenscroft & Matheson, 2002). There has been a documented increase in IQ scores across all societies that have administered standardized tests of intelligence over the last few decades. The results cannot be attributed easily to education, nutrition, or other factors alone. Some believe that this increase is due to the impact of the cognitive complexity of video games and other forms of mass entertainment on students' thinking (Johnson, 2005).

There are numerous benefits to learning with digital games. Students learn to read visual images as representations of three-dimensional space and develop multidimensional visual-spatial skills. They form mental maps, develop inductive reasoning skills, and focus their attention skills. They respond faster to expected and unexpected stimuli (Greenfield, 1984) and improve their motor skills (Fery & Ponserre, 2001). Gee's (2007) research indicated that video games built on a set of design principles may translate into fundamental learning principles: (1) educational gaming encourages active learning and risk taking in an environment where real-world consequences are diminished; (2) they offer intrinsic rewards that are customized to each learner's level and effort; (3) and the complex environment of games provides a context in which practice is challenging. As a result, players spend more time on tasks to advance in the game, thus improving their thinking skills.

Investment in our youth culture and their learning preferences is important. The MacArthur Foundation recently awarded \$1.1 million to assist in the development of a New York City public school, scheduled to open in fall 2009, where the curriculum will be aimed at teaching literacy and other skills through game design and game-inspired methods to children in grades 6-12. This grant comes as part of a larger \$50 million grant scheduled for dispersion over the next five years to help examine the impact of technology on children and the ways in which they learn; both inside and outside the classroom (Dobson, 2007). Moreover, with SAT scores at their lowest level in years, two test-prep course providers have turned to video game companies to provide more engaging forms of test practice (Test-Prep, 2008).

Purpose of the Study

Teacher candidates need to be exposed to a full range of research-based instructional methods. They also need to consider the learning preferences of current K-12 students and be able to evaluate how well instructional methods match those learning preferences. Further, candidates need to experience what it is to facilitate student instruction, to guide from the sidelines instead of instruct from center-stage. Learning to use and facilitate newer forms of instruction such as digital games, which motivate today's digital natives, should be a concern for teacher educators, who are themselves, by virtue of their age, "digital immigrants" (Prensky, 2006).

However, without teacher educator guidance into newer forms of teaching and learning such as digital games as an instructional method that fosters student inquiry, the richness and depth of preparation for candidates' practice may be lacking. Therefore, this study focused on teacher candidate perceptions and reactions to digital games as a learning technique and what the use of gaming tells us about candidate emergence into the role of teacher.

Method

This section is divided into five parts: participants, materials, instruments, procedures, and data analysis.

Participants

At a mid-sized private university in the northeastern section of the United States, two course sections of secondary teacher education students aged 20-22 explored educational digital games related to their subject matter content major. Of the original 25 participants, nine were male and 16 were female; all were college sophomores. One participant withdrew from the university before completing the project.

Materials

A list of game titles associated with curricula taught at the middle/secondary levels was compiled and reviewed by the researchers from various curriculum resources. Of the original list of 50 games identified across varied content areas, 33 were accepted for use in this study. Criteria used for selection included:

- Ability to engage the player through the marrying of pleasure with learning;

- Whether the game asked players to connect game play to subject matter;
- Whether reasoning skills were required;
- Connection to state curriculum standards;
- Ease of accessibility;
- Cost—only inexpensive games were accepted.

Of the 33 games, 30 games were web-based and free to use. The remaining three were CD-ROM based: *Making History*, *Peacemaker*, and *Zapitalism*. Each cost between \$30-40. Table 1 below lists the games explored in this study by subject and provides the title of the game, a brief annotation, and, when appropriate, the Web address (URL) where information about the game can be found.

Instrumentation

Several instruments were used to collect candidate feedback on the digital games. Before the game project began, candidates completed a researcher designed survey (see Table 2) indicating whether they believed games were an effective method to promote student learning and what their general attitude was toward games. The purpose of the preliminary survey was to determine pre-existing attitudes toward games.

Next, candidates were allowed the opportunity to trial play games on the approved list before selecting a game to use in the game project. Secondary education students were provided game choices within their content areas. As candidates learned how to play their games, they were asked complete a researcher designed *Game Review Form Including Evaluation Criteria* (see Table 3) that asked questions about the purpose of the game, ease of play, use of feedback, and game uses in education (thirteen primarily open-ended questions). As the candidates taught their game(s) to a group of younger students, they were asked to complete a researcher designed *Student Game Play Report* (Table 4) which asked four questions relating to the candidates' observations of students during their students' game play. In addition, candidates were asked to present their game to each other in a 20-minute class presentation. Researchers recorded any comments made during the presentations that were related to game content and play that were expressed either by the study participants or their peers during the presentations. These comments are referred to as field notes. Afterwards, focus group interviews were conducted to further clarify candidates' perceptions of digital games.

Table 1:
 Digital Game Selections Provided to Candidates:
 Sorted by Subject Area and Including Annotation and Web Site Location

Subject & Subtopic	Title, Description & URL
Art	<i>Renaissance Florence: A Virtual Tour</i> Provides background on the times, artists and advancements of the Renaissance http://www.activehistory.co.uk/Miscellaneous/free_stuff/renaissance/frameset.htm
	<i>Jackson Pollock/Splatter</i> Create a painting in the style of Jackson Pollack http://www.jacksonpollack.org/
Biology	<i>Blood Typing</i> Study different blood types and perform a transfusion correctly http://nobelprize.org/educational_games/medicine/landsteiner/index.html
	<i>Outbreak at Watersedge</i> Discover why people are getting sick using trend analysis http://www.mclph.umn.edu/watersedge/ (CD-ROM available)
	<i>Secrets at Sea</i> Presents information on marine life and environment http://www.secretsatsea.org/tg/
Business	<i>Play a Virtual Market</i> Determine circumstances for buying and selling stocks using a real life simulation of the Black-Scholes formula http://www.pbs.org/wgbh/nova/stockmarket/virtual.html
	<i>Hot Shot for Business</i> Build financial literacy skills and keep a business in operation http://spapps.go.com/hsb4/landing/
	<i>Zapitalism</i> A business strategy simulation game with multi-player capability. http://www.lavamind.com/zap.html (CD-ROM \$34.00)
Chemistry	<i>Conductive Valley</i> Furnish a future home with products made from conductive polymers http://nobelprize.org/educational_games/chemistry/conductive_polymers/index.html

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Table 1 (continued)

	<p><i>EleMental</i> Join elements to make compounds http://www.hagames.org/elemental.aspx</p> <p><i>MeChEM</i> Material science; create a robot http://www.hagames.org/mechem.aspx</p>
English Research skills	<p><i>Allies and Aliens: A Mission in Critical Thinking</i> Assesses instances of prejudice, stereotyping, hate on the Internet http://www.media-awareness.ca/english/games/allies_aliens/</p> <p><i>CyberSense and Nonsense</i> Raises awareness about Internet ethics and safety http://www.media-awareness.ca/english/games/cybersense_nonsense/</p>
Literature	<p><i>Dickens</i> Assesses knowledge of Dickens' writings and times http://www.pbs.org/wnet/dickens/</p> <p><i>Lord of the Flies</i> Assesses understanding of character and symbol in the novel http://nobelprize.org/educational_games/literature/golding/index.html</p> <p><i>A Shakespeare Murder Mystery: The Seven Noble Kinsmen</i> Presents clues so participants can solve the murder and learn about Shakespearean plays and times http://www.pbs.org/wgbh/mystery/game.html</p> <p><i>Playwright Game</i> Develop play writing skills; become familiar with Shakespearean times http://www.pbs.org/shakespeare/gande/index.html</p>
Health	<p><i>The Target is You!</i> Presents media messages about alcohol http://www.media-awareness.ca/english/games/alcohol_quiz/</p>
Mathematics	<p><i>Animal Watch</i> Assesses knowledge of animals and applied mathematics http://k12.usc.edu/</p>
Physics	<p><i>Waste of Space</i> Explores Newton's three Laws of Motion in an arcade game format http://www.hagames.org/wasteofspace.aspx</p>

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Table 1 (continued)

Social Studies	<p><i>Ayiti: The Cost of Life</i> Shows how poverty circumscribes people's lives http://www.unicef.org/voy/explore/rights/explore_3142.html</p> <p><i>Darfur is Dying</i> Depicts the horrors of genocide http://www.darfurisdying.com/</p> <p><i>Discover Babylon</i> Provides cultural and historical information on the ancient world of Mesopotamia http://www.discoverbabylon.org/</p> <p><i>Easter Island</i> Shows process of building of statues on Easter Island and effects on its environment http://www.pbs.org/wgbh/nova/easter/move/</p> <p><i>Food Force</i> Depicts how United Nations intervenes and assists developing countries in crisis through the World Food Program http://www.food-force.com/ (Download)</p> <p><i>Making History: The Calm and the Storm</i> Examines the events and decisions made during World War II and potential outcomes if different decisions had been made http://www.making-history.com/hq/ (CD-ROM \$38.00)</p> <p><i>Peacemaker</i> Simulation on the Israeli and Palestinian conflict http://www.peacemakergame.com/ (CD-ROM \$30.00)</p> <p><i>Peace Doves</i> Worldwide, the white dove is a symbol for peace. Use the Peace Doves to disarm one of the eight countries possessing nuclear weapons http://nobelprize.org/educational_games/peace/nuclear_weapons/index.html</p> <p><i>Plimouth Plantation</i> Presents information on aspects of Thanksgiving in an entertaining way http://www.plimoth.org/education/olc/index_js2.html#</p> <p><i>Real Lives</i> Highlights economic, social and health problems people face world-wide http://www.educationalsimulations.com/products.html</p>
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Table 1 (continued)

Spanish	<i>Spanish-English Cycle Race</i> Practice in basic skills using Spanish http://teacher.scholastic.com/activities/adventure/spanish1.htm
	<i>Spanish Education Games</i> Practice in basic skills using Spanish http://www.apples4theteacher.com/foreignlang.html#spanishgames
	<i>El Dilema de Dude</i> Reviews addition, subtraction, multiplication, and division skills along with Spanish vocabulary http://teacher.scholastic.com/activities/adventure/spanish4.htm#

Table 2:
Preliminary Game Survey Questions

1. Gender: _____
2. Comment on your past casual game experiences.
 - (a.) Do you currently enjoy playing games?
 - (b.) If yes, what types of games do you currently enjoy? Please list game titles played.
 - (c.) If no, why not?
3. Comment on your past educational game experiences.
 - (a.) Have you ever engaged in educational game playing in grades K-13?
 - (b.) If yes, what types of games did you play?
 - (c.) Please list game titles played.
4. Comment on using games in your future classroom.
 - (a.) Rate your opinion on the statement below.

Games offer an effective way to teach and learn in educational settings.

Disagree	Disagree somewhat	Not sure	Agree somewhat	Agree
1	2	3	4	5

5. Additional Comments:

Data Analysis

The study used mixed methods focusing on qualitative grounded theory approach for the conceptual framework. The open-ended nature of the instruments was an intentional design to get at intangible constructs and therefore, became the construct's operational definition (Kratwohl, 1998). We did, however, measure baseline attitudes toward

Table 3:
Game Review Form Including Evaluation Criteria

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1. Academic Major: _____
 2. Name of Game Played: _____
 3. Please note start time and finish times of game play and game length.
 4. What is the purpose of the game?
 5. Subject fields related to game: _____
 6. Explain in your own words what NJCCCS were addressed in this game.
 7. What is the intended age group of this game?
 8. What do students need to know to play the game and be successful?
 9. Was there frequent feedback on your performance?
 - a. Explain how this feedback helped, had no effect, or hindered your play.
 10. Were the technological difficulties present in game play?
 - a. Describe problem(s).
 11. What were your game play outcomes?
 12. What did you learn from the game in terms of :
 - a. Academic content?
 - b. Social skills?
 - c. Technology skills?
 - d. Personal reflection?
 - e. Other?
 13. Overall impressions of the game.
-

game use via a Likert-scale to determine pre-existing attitudes toward games (see Question 4a in Table 3).

Data were missing or incomplete on some review/play forms, so these data sets were discarded. Of the remaining 21 useable surveys, six males and 15 females remained in the pool which included subject matter majors of history [7], English [5], mathematics [4], theology [0], art [1], biology [1], chemistry [1], physics [1], and Spanish [1]). Responses on the *Game Review Form* and *Student Game Play Report*, field notes, and focus groups were examined. Initially, the data were coded using the following criteria: expressed positive or negative reactions toward use of games as a learning technique and expressed positive or negative reactions toward specific games played. Common remarks were clustered and given designated as headings. Comments were further examined and coded for indicators of emerging awareness of the steps toward facilitation of instruction. Throughout the analysis process, emergent candidate understanding of this concept was tested by continuously returning to the data to check for alternative explanations and negative instances in order to further reduce the data set and identify central themes (Creswell, 1998). Findings were reported under the themes derived from this analysis.

Table 4:
Sample Student Game Play Report

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1. Comment on game directions.
 - (a.) Were they clear?
 - (b.) Did you have to adapt directions for clarity?
 - (c.) Provide a copy of addition you made to game directions.
 2. Comment on student interest while playing game.
 - (a.) Did the game hold the interest of students?
 - (b.) Was there a point where they lost interest?
 3. Comment on learning.
 - (a.) Ask students what they learned from the game.
 - (b.) Ask students if they would like to see this game played in their regular classroom.
 - (c.) Ask students if the use of the game helped them process the information (content) differently than through lecture mode.
 4. Comment on using games in your future classroom.
 - (a.) Now that you have finished the game project, rate your opinion on the statement below.

Games offer an effective way to teach and learn in educational settings.

Disagree	Disagree somewhat	Not sure	Agree somewhat	Agree
1	2	3	4	5

- (b.) Explain your rating.
-

Results

In this research study, teacher candidates were first students and then teachers. Initially, they were immersed as students when learning how to play their chosen game at which time they were focused on accomplishing the game objectives. When they became the teacher, they were responsible for directing all aspects of the game and soliciting responses from game players. Specific themes emerged from the data during analysis including: significance of game content, interest level, multiple uses, and feedback. In addition, candidates' reactions to individual games (as winners and losers) and candidate views toward facilitation of learning using games were collated. Below, comments from individuals that expressed an interesting view or which represented generally held opinions are presented in quotations.

Content Significance

Presentation of important content or issues with powerful messages

Issues in Teacher Education

was one reason games were valued by study participants. They appreciated games that tackled tough issues, e.g., *Dafur Is Dying* (genocide), *Food Force* (hunger), *Cyber Sense and Nonsense* (racism, Internet ethics), and *Ayiti: The Cost of Life* (poverty). Further, *Peacemaker* “gave players a larger picture of what is happening in the world” and made players realize “the heavy responsibility a person may have when governing a country,” two candidates noted. *Outbreak at Watersedge* highlighted the issue of public health, water sampling, and the importance of clean water. Participants saw this game as an interesting way to introduce an environmental science lesson. Similarly, *Hot Shot for Business* was viewed as a way to offer economics students an idea of what running a business was like and the many roles business owners assume.

All teacher candidates were able to match their game to appropriate curriculum standards, sometimes across different subject matter majors, and a number of candidates commented on how well course content could be embedded in a game format. They also cited specific subject matter content that they learned from different games and were genuinely pleased when they learned something new, i.e., “I was surprised that this game [*Making History: The Calm and the Storm*] was a challenge for me as I enjoy learning about World War II and am a history major.” However, even if the candidate did not learn new material from a game, they frequently were able to find some value in the game itself. As one noted, “I learned how to apply this game to [grades 9-12] students and I now think more about student needs.” Another candidate commented that, even though the game was easy, she enjoyed practicing math skills and “it was still fun to play.” Games identified as highly useful for review purposes were *El Dilema de Dude* and *Lord of the Flies*, which provided sections on quotations, characters, symbolism, and themes related to this commonly taught novel in secondary English classes. One candidate noted that it was “great for assessing reading and retention.”

Interest Level

Sometimes candidates had differing opinions from their peers or with their students as to whether a game was interesting. *Discover Babylon* fascinated one candidate yet initially disappointed another due to technology difficulties; who was then won over to its use after observing her students play the game. Two teacher candidates, who originally panned *Allies and Aliens* as “too linear, simplistic, and boring” were surprised at the high interest level and focused engagement of their game players. On the other hand, by also playing games with friends as well as leading them with younger students, teacher candidates were sometimes

reminded that while they are 'fans of their content' area, others, including 9-12 students, might not find a game in the field so fascinating.

Presentation of the material was also a factor in response. *Peacemaker* provided excellent graphics and realistic news/video clips which added to the game's appeal, as did the animations for *Cyber Sense and Nonsense* and *Hot Shot for Business*. Interactive material and use of real events were appealing to preservice teachers and they believed these features would be attractive to their students.

Multiple Uses

Respondents noted that a number of games had multiple ways in which they could be employed in secondary curriculums or could work in different subject areas or settings. *Making History: The Calm and the Storm* (geography, economic, and history standards), and *Peacemaker* (geography, world history) addressed multiple standards in social studies, while *Renaissance Florence* (art and history) and *Discover Babylon* (history, art, science) crossed curriculum fields. *El Dilema de Dude* could be used with English Language Learners who need to practice math skills; and its most challenging levels could be used for middle-level Spanish classes. Candidates tied *Dafur Is Dying* to current issues in social studies and to powerful readings in an English class, e.g., *Child Soldier*.

Use of Feedback

Concrete feedback is viewed as an essential ingredient that adds to the effectiveness of digital games (Kirriemuir & McFarlane, 2004). Participants who played *El Dilema de Dude* noted that timely and systematic feedback after each response would have added to this game. Examples of excellent and timely feedback included *Blood Typing*, where players were immediately informed if they chose the correct blood type. *Outbreak at Watersedge* told players if they were on the right track for tracing the root of an illness/mystery. Similarly, game characters in *Cyber Sense and Nonsense* provided feedback associated with positive and negative uses of netiquette. They also congratulated players when they got correct answers and steered them in another direction when incorrect. In *Discover Babylon*, game guides provided helpful information on objects to be found. World leaders reacted to the decisions players made in *Peacemaker*; similarly, players were provided outcomes of each decision made while playing *Making History: The Calm and the Storm*. In *Food Force*, a boss commented on the quality of the player's efforts in each of the tasks associated with food delivery and provided encouragement when needed. Statistics on refugee camp supplies were

shown, as well as information about each person (age, gender) who died, during *Darfur Is Dying*. Players noted feedback or lack of it as a factor in sustaining interest in play.

Winners and Losers

Games that lacked simple navigation and clear directions were criticized by candidates. Three respondents added more explicit directions before teaching students how to play their game of choice because the game lacked direction and easy navigation. In addition, not all games were immediately appealing. Some candidates expressed concern that their students needed to have advanced information before playing *EleMental*, *Play a Virtual Market*, and *Polymers: Conductive Valley*. Another described *Easter Island* as an “ordeal ... the game was just clicking and walking through information,” although some of his group members found this informative site interesting. *Real Lives* was seen as having valuable content but also as being poorly constructed. Commenting on *Waste of Space* as “a cheesy rip-off of *Asteroids*,” the reviewer stated that “students are not going to be thinking about momentum and Newton, but instead, which buttons to press in time for the ship to fire or fly correctly.” In addition, candidates, who wanted to teach high school, were less interested in using games they believed were designed for the middle grades, such as *Plimouth Plantation*. While deemed “well done” and containing “interesting material as it dispels myths associated with this American holiday,” “it is too young for high school students,” reported one candidate.

Games that earned high praise from teacher candidates did so for different reasons. *Hot Shots for Business* had a lively presentation and character guides for realistic decisions that must be made to succeed in the game. Players got to decide whether to spend money on marketing, research and development, or on riskier ventures. With regard to *Discover Babylon*, one candidate remarked that he and his friends gleaned information from the game and he enjoyed the game more than reading a textbook. Because of its socially significant subject matter, *Darfur Is Dying* provoked thoughtful and concerned discussion because the game gave a human face to the horrific events in Sudan. One respondent noted that this game made her think of the children in Darfur. “It was shocking to have the little child, my character, get captured and killed. I truly felt sad.” Another female candidate commented that simply being told in a typical class lecture that young girls in Sudan had to run to a well to get water and thereby they risked capture would not have had the same effect on her understanding of the severity of the potential

consequences of needing to get water as playing this game and seeing what actually happened to the characters. Her level of sympathy for the Sudanese people was clearly more intense as a result of the simulated play. While playing *Food Force*, published by the United Nations World Food Program (WFP), players took on missions to distribute food in a famine-affected country to help it recover and become self-sufficient. Players appreciated learning about world famine and the WFP's work to prevent it.

Candidate Attitudes

In the preliminary survey completed prior to commencement of the game project, candidates reported the number of games played in a range from two to thirteen. Most game play was for pleasure and most often included card, computer, and board. While a few males listed different games than females (*Call of Duty*, *War Games*), in many cases they played similar games. Interestingly, few candidates stated that they played digital games on a regular basis.

At the beginning of the game project, ninety-six percent of the candidates were generally positive about educational digital games, perhaps because games had been historically viewed as fun for them and they therefore believed games would be enjoyed by their students. However, thirty percent further stated that although they were positive about curricular game use they had doubts about classroom management and the ability for games to stand-alone as a learning method. Most candidates thought games needed to be controlled by the teacher and could be distracting for students. Some wondered if games would teach concepts well enough and suggested that games might be better tools for reviewing and reinforcing previously taught concepts. Due to this finding, the researchers predicted that there might be a difference in pretest vs. posttest opinions regarding candidate perceptions of the effectiveness of games as a teaching method. Surprisingly, this was not the case. This finding could suggest that candidates are willing to consider alternate learning methods but do so gingerly.

Teacher candidates made strongly stated comments about using games in their classrooms on the *Game Review* form and in focus group responses. Statements included how the game project directly benefited them. One candidate noted that "I would say my handiness at playing games has improved. [This experience] made me think of ways [methods] that would help others learn faster." Another remarked that "she learned to have more patience and persist when trying new tasks," while recalling her own frustration when learning how to play *Darfur is Dy-*

ing. Many participants emerged into the role of facilitator of instruction, which was summarized by the candidate who remarked, "Digital games are a great way to teach students things because not every student likes to be taught through lectures. This gives the student a chance to use their own mind and work toward game goals and learn information while being part of a simulation." Yet, we need to be careful when comparing instructional methods. Squire (2003) pointed out that much of the research in educational gaming has focused on comparing game playing to lecturing, which is often inappropriate because each activity requires a different pedagogical technique that usually embodies different values and is suited for different types of learning experiences.

Candidates made suggestions how to improve the digital games. Being able to save paintings made with *Jackson Pollack / Splatter* would allow for comparison among pieces. Adding a way to keep an individual player's score in *Darfur is Dying* was seen as a possible incentive to keep players involved since the game was challenging. If the *Renaissance Florence: A Virtual Tour* directions indicated the significance of the gold coins, players would have better understood game objectives in first round play.

During game presentations, teacher candidates expressed satisfaction with the ability to play many different games and indicated that they could see ways to connect them to varied curriculum. Even when a game was not directly applicable to a candidate's desired teaching level or content area, they found an appropriate purpose for using it. Although not gamers themselves, several candidates said they would use games in their future classes because of the variety of games available and the positive reactions they received from their peers during the presentations. In the post-treatment focus group, participants reported becoming more positive to digital game made note of their students' reactions and listened to their students' opinions. This attentiveness to students may be a result of the immersive and explorative nature of this research study in which candidates were asked to play the role of both student and teacher.

Conclusion

In this college of education, two teacher educators designed a research study using an immersive strategy to engage preservice candidates to learn and teach with digital games. What we found was teaching future teachers about classroom digital game use enabled them to understand the role of teacher as a facilitator of instruction. Student-centered learning represents a paradigm shift in candidates' thinking and perceptions

about the role of teacher. This shift forces candidates to think about instructional strategies, resources, and values. The study findings suggest that an immersive strategy provided through the incorporation of a game module in a course curriculum enabled candidates to begin to perceive the deeper values associated with multiple responsibilities and the many roles teachers assume. Focus group remarks made by teacher candidates indicated they were beginning to weigh the value of instructional strategies and resources, recognizing that instructional time matters and what students do with that time matters deeply. Aside from addressing the importance of engaging all students in ways that are meaningful, more immersive experiences are recommended with larger preservice teacher groups who could provide statistical data.

The literature highlights reasons that teachers do not use games in classrooms: curriculum mismatch, loss of time learning how to play a game, and having to defend game use to those wedded to more traditional methods of instruction. Candidate reactions told us that games that are limited in their focus or content or seen as too simplistic will perhaps not win teachers over to their use in the wider classroom setting as indicated in past research findings (Kirriemuir & McFarlane, 2004). On the *Game Review* forms, preservice teachers expressed concern about the level of interest generated by different individual games, the difficulty fitting games into a structured curriculum, and budgetary constraints. For games to become more widely used as a tool for learning, developers and instructional technologists might need to focus on significant and specific topics in the formal curriculum mandated by state core curriculum standards and to provide more focused learning segments within games.

Key to the develop thinking skills is student engagement in curriculum materials. The initial findings from this study which took place in classroom settings indicate that digital games have the potential to engage students, foster positive attitudes toward learning, enhance focus, as well as encourage collaboration, healthy competition, and involved discussions (Aldrich, 2005; Anderson, 2005; Borja, 2007; Dede, Ketelhut, & Nelson, 2004; Devaney, 2008; Gibson, 2002; Kirriemuir & McFarlane, 2004; Prensky, 2006; Rich, 2008; Squire, 2006). This exploratory study added to this literature base by suggesting that if game content is integral to the curriculum, its technological aspects are easy to master, and the game is well received by students when teachers present it, then this innovation has the potential to be an exciting and useful instructional resource for teachers. Educators must stay closely attuned to future research studies involving digital game use as the potential cognitive, social, and thinking benefits derived from them may provide reason to

consider major curricular changes requiring the incorporation of gaming pedagogy in K-12, higher education, and teacher preparation settings.

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