Teacher Candidate Responses to Digital Games: 21st-Century Skills Development

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Abstract

Researchers conducted a mixed-methods study with 21 undergraduate university students majoring in education to determine their ability to recognize the motivational factors and 21st-century learning skills associated with digital games. Results suggest that students in the study were able to detect the learning skills embedded in games. The majority of participants stated that the element of motivation was important, but motivation alone was not a sufficient reason to influence them to use digital-game-based instruction in their future classrooms. However, peer modeling and the positive responses received from middle/high school students to whom candidates taught games appeared to be factors in teacher candidates' decision to use digital games in the classroom. (Keywords: digital learning games, 21st-century learning skills, new pedagogies, teacher candidates, educational innovations)

Digital game play is a common activity for U.S. teens (Lenhart et al., 2008) because it engages them in the subject matter, provides a more interesting way to practice problem-solving skills, and offers a pathway to understanding difficult concepts (Project Tomorrow, 2008). Games encourage students to perform in academic settings with the greatest impact on the bottom third of students (Dede, Ketelhut, & Nelson, 2004).

In the past few years, there has been an increase in attention to digital games in schools to improve learning (Gros, 2007). Squire (2006) reviews next-generation digital games and documents this growing interest as representative of a shift toward a culture of simulation, where digital technologies make it possible to investigate different environments. Games get students thinking, caring, and acting about real-world issues. Games that offer a look at current issues and/or provide opportunities for critical thinking are one potential avenue to prepare a technically skilled workforce that possesses the ability to think critically and innovatively. Referred to in the current literature as "21st-century learning skills," these skills are currently a major focus of teachers, administrators, parents, standards bodies, and federal and state education departments (American Society

for Quality [ASQ], 2008; Bausell, 2008; Devaney, 2008; Partnership for 21st Century Skills, 2009; Prabhu, 2009).

Critical thinking and problem-solving, deemed most important of the 21st-century (21C) learning 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). A documented increase in IQ scores across all societies that administer standardized tests of intelligence over the last few decades indicate that they cannot be attributed easily to education or nutrition factors alone. Some believe this increase is due to immersion in the cognitive complexity of video games and other forms of mass entertainment in which students learn to "read" visual images as representations of three-dimensional space, develop multidimensional visual-spatial skills (McGrath, 2003; Tüzün, et al., 2009), and hone their mathematical, problem-solving, and reading-comprehension abilities (Borja, 2007). Students also form mental maps, develop inductive reasoning, are more engaged in learning (Annetta, Minogue, Holmes, & Cheng, 2009), and respond faster to expected and unexpected stimuli (Greenfield, 1984). Forms of (internal) communications, motor movement, and dexterity—other 21C skills—are also improved (Fery & Ponserre, 2001). Students also develop group decision-making skills (Kirriemuir & McFarlane, 2004), improve their scientific literacy (Barab, Dodge, Jackson, & Arici, 2003; Dede, Ketelhut, & Nelson, 2004), and achieve higher levels in social studies (Barab, Dodge, Jackson, & Arici, 2003) from digital game play.

Although teacher candidates need to be exposed to a range of instructional methods with guidance and time to develop confidence in their ability to facilitate game-based instruction in classrooms, more often than not, undergraduate teacher education programs require only one technology course, which tends to be narrowly focused and standardized (Gibson, 2002). Within these constraints, it is difficult for teacher candidates to learn to lead a digital game, design lessons for students using game-based technology, and determine best practices for this learning technique (Kirriemuir, 2002).

In this exploratory study, the authors used a combined strategy that included faculty partnering to teach a newly designed game-based instruction module in a sophomore-level teacher education course. This article reports reactions of candidates while learning and teaching with digital games. We examined participants' oral and written comments to determine the identification of (a) the motivational factor of digital game-based instruction, and (b) the embedded 21C learning skills. Because games offer a way to develop students' 21C skills and enhance content knowledge, preservice teacher reactions to digital learning games are important to study.

Literature Review

21st-Century Learning Skills

Thirteen states have committed to incorporate the 21C skills in their state's educational curriculum. These skills combine content knowledge with personal and learning skills (creativity and innovation, critical thinking and problem-solving, and communications and collaboration) and information, media, and technology skills, all viewed as essential for future employment and keeping the United States competitive in the global economy (Devaney, 2008; Partnership for 21st Century Skills, 2009). This movement points toward a shift that values knowing how to perform specified skills rather than knowing about a topic (Shaffer, 2006).

In May 2009, U.S. Senate Bill 1029 was presented to the Senate Committee on Finance to encourage states to adopt the 21st Century Skills Framework (Prabhu, 2009). Not many schools provide rich learning experiences that incorporate these skills into the curriculum (Partnership for 21st Century Skills, 2007), yet teachers and administrators (52%) and parents (96%) agree that schools need to make 21C skills a priority (ASQ, 2008). The National Education Association not only advocates for greater uses of technology as a tool to foster learning, but also strongly recommends that schools of education should put more emphasis on learning with technology in teacher preparation programs. Further, standards set by the National Council for Accreditation of Teacher Education (NCATE) recommend that technology integration for teachers is a priority. Currently, 19 states have policies that tie initial teacher licensure to technology coursework or competence demonstrated through a test (Bausell, 2008).

Candidates and Technology

Attitude is a predictor of behaviors. "Attitudes and beliefs are a subset of a group of constructs that name, define, and describe the structure and content of mental states that are thought to drive a person's actions" (Richardson, 2003, p. 102). Applied to technology use, attitudes toward technology predict how one behaves with, or uses, technology.

Research citing the reluctance of teachers to integrate technology into the teaching and learning process is not new (Kerry, 2000; Watson, 1997; Wetzel et al., 2004; Zhao & Frank, 2003). Specific to digital games, teacher candidates voice concerns related to assistance with implementation, classroom management, and the perceived usefulness of games (Bullock, 2004; Cuban, 2001; Doering et al., 2003; Sardone & Devlin-Scherer, 2008). It appears that personal experiences with technology may not provide the confidence needed for preservice teachers to lead games with their students. Implementation of digital games requires skill, time, and attention that new teachers may not have (Sardone & Devlin-Scherer, 2008; Vannatta & Fordham, 2004). As teachers are critical to successful adoption of educational change, preconceived attitudes to digital games may present problems in their future implementation.

Table 1. Class Sessions

Week 1	Introduce game project and assignment (10 minutes)
Weeks 2-4	Demonstrate varied mental, physical and drama games, verbal and nonverbal, to help learn information in class (20 minutes/session)
Week 7	Survey of attitudes toward game play Introduce games specific to different subject fields Candidates select games to study (2.5 hrs)
Week 11	Presentation on research related to gaming in classrooms Demonstration of Turning Point, an interactive polling/quiz audience response system to use for teacher-created classroom games (1 hr) Planning the game presentation (1.5 hrs)
Week 13	Game demonstrations (2.5 hrs)
Week 14	Game demonstrations (1.5 hrs) Focus groups (40 minutes)

Digital Games and Student Motivation

Motivation is goal-directed behavior (Weiten, 2002). Some researchers believe that motivation to play a game is extrinsic and that the person is pulled toward the play due to the reward that it presents, whereas others believe that game play is intrinsic, where the person is pushed to play by their own forces. Malone and Lepper (1987) suggest that factors of fantasy and curiosity influence motivation for students to engage and learn. Games seem to be effective in enhancing motivation and increasing student interest in subject matter (Yee, 2006).

A complete review of the research base regarding student motivation is well beyond the aim and scope of this article. Instead we focus on the connection of digital games and student motivation. Well-designed educational digital games aim to "capture the enthusiasm and motivation inherent in entertainment products, yet situate these into a positive context focused on empowering children, supporting learning, and promoting a social agenda" (Barab et al., 2005). Evidence does suggest that digital games have more positive effect on motivation and retention of knowledge than conventional instruction (Jonnavithula & Kinshuk, 2005), yet the motivational power of digital games alone is not sufficient to elicit effective learning.

Strategies for Digital Game Integration

Kay (2006) evaluated strategies for technology integration in teacher education in an analysis of 68 refereed journal articles. These strategies included

delivering a single technology course, offering mini-workshops, integrating technology in all courses, modeling how to use technology, using multimedia in classes, collaborating with other preservice teachers, mentoring by cooperative teachers and university faculty, practicing technology in the field, teaching education faculty how to infuse technology, teaching mentor teachers, and improving student access to software, hardware, and/or support. Results indicated that when four or more strategies were used, the effect on preservice teachers' use of computers in the classroom appeared to be more pervasive.

We decided to follow the technology integration literature when determining how to integrate digital games in the curriculum. Our combined strategy included faculty partnering, mentoring opportunities, modeling, collaboration among candidates, creating opportunities for candidates to practice teaching with digital games in the field, and modifying a course offering to include a digital game module (similar to mini-workshops) (see Table 1).

Method

Employing a mixed-methods research design, we recorded candidate impressions regarding elements of motivating factors, playability, and manageability of leading games. We also observed and recorded explicit comments that candidates made regarding certain qualities (learning and innovation) that related to the development of 21C skills. We employed focus groups at the end of the experience to devise a developed picture of candidates' reactions to game-based instruction.

Participants and Setting

At a midsized New Jersey private university, undergraduate secondary teacher education students (n = 25), ages 20-22, who were enrolled in a teacher education course participated in the exploration of digital learning games. Major fields in the class included history, English, mathematics, and science. The remaining students studied art, theology, or Spanish. Of the original 25 participants, 9 were male and 16 were female, all in their second year of a four-year teacher education program.

As part of their 30-credit education program, candidates complete two required technology courses, a computer fundamentals class followed by a technology integration class. Of the original 25 participants, 13 completed the computer fundamentals course, 7 completed only the technology integration course, and 5 participants completed both courses prior to the study.

Materials

We reviewed 50 game titles according to specific criteria: ability to motivate students and use of any of the 21C learning skills (creativity and innovation, critical thinking and problem-solving skills, or communication and collaboration skills). They were matched according to participant content majors as well as state curriculum standards. Further, games had

Table 2. 21st-Century Learning and Innovation Skills

Learning and innovation skills increasingly are recognized as those that separate students who are prepared for a more and more complex life and work environments in the 21st century, and those who are not. A focus on creativity, critical thinking, communication, and collaboration is essential to prepare students for the future.

CREATIVITY AND INNOVATION
Think Creatively
• Use a wide range of idea-creation techniques (such as brainstorming).
• Create new and worthwhile ideas (both incremental and radical concepts).
• Elaborate, refine, analyze, and evaluate one's own ideas to improve and maximize creative efforts.
• Work creatively with others.
• Develop, implement, and communicate new ideas to others effectively.
• Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work.
• Demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas.
• View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes.
• Implement innovations.
• Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur.
CRITICAL THINKING AND PROBLEM SOLVING
Reason Effectively
• Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation.
• Use systems thinking.
• Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems.
• Make judgments and decisions.
• Effectively analyze and evaluate evidence, arguments, claims, and beliefs.
• Analyze and evaluate major alternative points of view.
• Synthesize and make connections between information and arguments.
• Interpret information and draw conclusions based on the best analysis.
• Reflect critically on learning experiences and processes.
• Solve problems.
• Solve different kinds of nonfamiliar problems in both conventional and innovative ways.
• Identify and ask significant questions that clarify various points of view and lead to better solutions.
COMMUNICATION AND COLLABORATION
Communicate Clearly
• Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts.
• Listen effectively to decipher meaning, including knowledge, values, attitudes, and intentions.
• Use communication for a range of purposes (e.g., to inform, instruct, motivate, and persuade).
• Utilize multiple media and technologies and know how to judge their effectiveness a priori as well as assess their impact.
• Communicate effectively in diverse environments (including multilingual).
• Collaborate with others.
• Demonstrate ability to work effectively and respectfully with diverse teams.
• Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal.
• Assume shared responsibility for collaborative work and value the individual contributions made by each team member.

(Partnership for 21st Century Skills, 2009)

to be accessible (Web or CD-ROM) and inexpensive so they could be used in any school. Table 2 lists the 21C learning and innovation skills.

Table 3 (p. 416) contains a list of the 20 games in varied content areas fitting all criteria which were chosen for study.

Procedures and Instrumentation

We designed several instruments to collect candidate feedback on digital games. Before the game project, candidates completed a preliminary survey about their game-playing experiences. We then provided candidates with list of game titles organized by content area. We gave them an opportunity to trial play games before making their final selection as to the game they wanted to learn, play, and teach to middle/high school students. Table 4 (p. 417) contains the preliminary survey questions participants answered.

After selecting games, candidates learned games on their own and reported that this process took an average of 60 minutes, depending on game complexity. As candidates learned how to play their games, they completed the Game Review Form, which asked them to define purpose(s) of the game, rate the ease of play, comment on the use of feedback, and indicate how the game's use was tied to core curriculum standards (see Table 5, p. 418, for question format).

Five candidates led games with high school students, but most candidates taught their game in a required secondary education field experience, which was a structured weekly tutoring program with at-risk middle school students. The program was in place before the study and was simply used by study participants. Most times, the sessions are directed by the tutees themselves in terms of the areas of review needed. In the case of the 16 participants who tutored in the middle school, they spent one of the sessions teaching the game to middle schools students. The tutoring sessions were approximately 60 minutes in length. As they taught their game to students, they completed the Student Game Play Report, which asked questions relating to candidates' observations of students during play.

We then asked candidates to discuss their game in a 20-minute presentation to the class in the last two weeks of the semester. During these presentations, researchers recorded participant comments related to game content and 21C learning skills development opportunities. We conducted focus groups during the last class session. This face-to-face unstructured interview asked the participants to reflect on the game project and share their overall impressions of game-based instruction and its influence or perceived impact on student learning.

Data Analysis

This qualitative study includes descriptive analysis derived from survey data. Missing data resulted in 21 useable surveys, reducing the responses to

Table 3. Digital Game Selections Provided to Candidates

Subject	Title, Description, and URL	
Art	**Renaissance Florence: A Virtual Tour (Free)**	**Jackson Pollock/Splatter (Free)**
	Provides background on the times, artists, and advancements of the Renaissance	Create a painting in the style of Jackson Pollock
	http://www.activehistory.co.uk/Miscellaneous/free_stuff/renaissance/frameset. htm	http://www.jacksonpollock.org
Biology	**Blood Typing (Free)**	**Secrets at Sea (Free)**
	Study blood types and perform a transfusion correctly	Presents information on marine life and environment
	http://nobelprize.org/educational_games/medicine/landsteiner/index.html	http://www.secretsatsea.org/tg/
Business	**Play a Virtual Market (Free)**	**Hot Shot for Business (Free)**
	Determine circumstances for buying and selling stocks using a simulation of Black-Scholes formula	Build financial literacy skills and keep a business in operation
	http://www.pbs.org/wgbh/nova/stockmarket/virtual.html	http://spapps.go.com/hsb4/landing/
Chemistry	**Polymers: Conductive Valley (Free)**	**EleMental (Free)**
	Furnish a future home with products made from conductive polymers	Join elements to make compounds
	http://nobelprize.org/educational_games/chemistry/conductive_polymers/index.html	http://www.hagames.org/elemental.aspx
English	***Research*: CyberSense and Nonsense (Free)**	***Literature*: Lord of the Flies (Free)**
	Raises awareness about Internet ethics and safety	Assesses understanding of character and symbol
	http://www.media-awareness.ca/english/games/cybersense_nonsense/	http://nobelprize.org/educational_games/literature/golding/index.html
Social Studies	**Ayiti: The Cost of Life (Free)**	**Darfur is Dying (Free)**
	Shows how poverty circumscribes people's lives	Depicts the horrors of genocide
	http://www.unicef.org/voy/explore/rights/explore_3142.html	http://www.darfurisdying.com/
	Discover Babylon (Free)	**Easter Island (Free)**
	Provides cultural and historical information on the ancient world of Mesopotamia	Shows process of building of statues on Easter Island and effects on its environment
	http://www.discoverbabylon.org/	http://www.pbs.org/wgbh/nova/easter/move/
	Food Force (Free download)	**Making History: The Calm and the Storm (CD-ROM $38)**
	Depicts how UN intervenes and assists developing countries in crisis through the World Food Program	Examines events and decisions made during WWII and outcomes if different decisions had been made
	http://www.food-force.com/	http://www.making-history.com/hq/
	Peacemaker (CD-ROM $30)	**Real Lives (Free)**
	Simulation of the Israeli and Palestinian conflict	Highlights economic, social, and health problems people face worldwide
	http://www.peacemakergame.com/	http://www.educationalsimulations.com/products.html
Spanish	**Contar en Español (Free)**	**El Dilema de Dude (Free)**
	Practice in basic skills using Spanish	Reviews addition, subtraction, multiplication, and division skills along with Spanish vocabulary
	http://www.apples4theteacher.com/costa-rica-dot2dot.html	http://teacher.scholastic.com/activities/adventure/spanish4.htm#

Table 4. 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 play? Please list game titles.
(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? Please list game titles.

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

5. Additional Comments:

6 males and 15 females. Each researcher individually coded responses from the surveys and interviews using the following categories: expressed positive or negative reactions toward use of games as a learning technique and comments relating to motivation. Researchers exchanged their coding results under these headings and discussed items on each other's lists. Overall, there was little variation in the items on each list. One variation was found, and the researchers returned to the survey data together and discussed the issue to resolution. In addition, researchers clustered descriptions that pertained to the development of each main idea under 21C learning skills following the same recursive process.

We coded the data derived from the Game Review Form, Student Game Play Report, and observation notes from candidate presentations using the following criteria: comments relating to motivation based on middle/high school students' reactions to game play and identification of 21C learning skills embedded in games. Responses derived from focus groups were coded as positive or negative concerning game-based instruction. Similar comments were clustered under headings. Analysis of data is reported in the next section.

Results

Rather than teach about digital games through lecture, reading assignments, anecdotes, or traditional assessment, this study asked students to become immersed in a 21C learning environment. An examination of the themes and their relationship to the literature follows.

Table 5. Game Review Form Including Evaluation Criteria

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?
10.	Explain how this feedback helped, had no effect, or hindered your play.
11.	Were the technological difficulties present in game play?
12.	Describe problem(s).
13.	What were your game play outcomes?
14.	What did you learn from the game in terms of :
15.	Academic content?
16.	Social skills?
17.	Technology skills?
18.	Personal reflection?
19.	Other?
20.	Overall impressions of the game.

Game Vetting

In the preliminary survey and subsequent discussions, 97% of participants stated that prior to this project, they played games for fun and viewed them as enjoyable. However, after the project, they have new perspectives on the use of games for instruction. Of 20 games played, participants recommended 14 as useful instructional methods to teach content and develop students' 21C skills. Reasons for rejecting games were related to content and engagement level. They considered four games not applicable to curriculum content due to their level of difficulty for the intended age group (Play the Market and Elemental) or simplicity (El Dilemma de Dude and Contar en Español). Participants thought Real Lives lacked structure and found Easter Island unengaging because it required too much reading and was deemed "slow moving."

21st-Century Learning Skills

Researchers reviewed candidate responses for recognition of 21C skills within the category of learning and innovation. This category has subsets of critical thinking and problem-solving, creativity and innovation, and communication and collaboration, which are discussed as follows (see Table 2, p. 414).

21C learning skill: Critical thinking and problem solving. This skill area relates to the ability to reason effectively, use systems thinking, make judgments and decisions, and solve problems (Partnership for 21st Century Skills, 2009). Participants indicated they found aspects of critical thinking and problem-solving skill development opportunities in four digital games: Peacemaker, Hot Shot for Business, Polymers: Conductive Valley, and Making History.

In addition to informing students about geography and real-world issues, Peacemaker can develop students' problem-solving skills as players try to solve

conflicts in the Middle East as a real leader would. Instead of hearing about the Israeli-Palestinian conflict on the news, students have the opportunity to make important decisions. One player indicated that if "one decision does not work out properly, you know not to do it again, and … you try to find another solution to the problem. Making decisions can help students learn what variables are considered in trying to establish peace in that region."

Hot Shots for Business serves as a reminder of how important critical thinking skills are when running a successful business. Focused attention, monitoring multiple events, and responding to unexpected stimuli are as critical to success in this game as they are in real life (Greenfield, 1984). Polymers: Conductive Valley is based on the invention of the 2000 Nobel laureate in chemistry, who discovered that plastic can, after certain modifications, become electrically conductive. Players learn to solve unfamiliar problems in innovative ways.

For games to encourage the sort of problem-solving hypothesis generation and testing that are evident in effective learning environments, the challenges need to be real, complex, and difficult to solve (Colella, 2002; Facer, 2003). Such was the case for the game Making History, in which players saw how the actions of one small country can affect all others in a war.

21C learning skill: Creativity and innovation. This skill area includes idea generation techniques, creation, communication, implementation of new ideas, and self-evaluation as an opportunity to continually learn (Partnership for 21st Century Skills, 2009). Participants observed creativity and innovation skill development opportunities in two digital games: Jackson Pollock/Splatter and Renaissance Florence: Virtual Time Machine.

The free-form Jackson Pollock/Splatter game can help students develop their own style of expression. There are no directions, rules, or real guidelines to follow to make a painting. The freedom allows students to explore in innovative and creative ways.

The game Renaissance Florence can aid the processing of information in a different way than if a teacher provided the same information in lecture format. The game provides numerous visuals of the time period that can assist students in associating text with images, making it easier for some learners to understand and recall information about this period.

21C learning skill: Communication and collaboration. This area advocates the ability to communicate thoughts and ideas clearly; listen effectively to decipher meaning, values, and intentions; and work effectively and respectfully in diverse teams (Partnership for 21st Century Skills, 2009). Participants found communication and collaboration skill development opportunities in five digital games: Food Force, Darfur Is Dying, Blood Typing, Ayiti: The Cost of Life, and Renaissance Florence: Virtual Time Machine. Controversial issues can provoke active discussions (Kahn, 2007), and candidates noted that these games would get students talking about important issues (e.g., children's rights, poverty, global issues) and elicit diverse viewpoints.

Darfur is Dying provides students with an opportunity to develop values associated with human rights, whereas Food Force helps students learn firsthand about hunger and poverty. Participants reported high levels of engagement during Darfur is Dying play, which set the stage for after-play discussion. Students want to know where Darfur is located, what was happening, and the most important question of all, why genocide was occurring in this African region. Highly emotional events, sometimes omitted by teachers, might be taught through the lens of immersive, interactive digital games because they can stimulate discussion more easily and lessen the weight of the subject matter.

Blood Typing provides strong visuals that can aid in communicating the concepts associated with blood transfusions to students in a science class, which fosters collaboration. Peers can easily work together to better understand how blood cells differentiate themselves—a critical point in transfusions. Ayiti: The Cost of Life, a game sponsored by the United Nations Children's Fund (UNICEF), provides the foundation to create a rich class discussion about the effects of poverty as players assume the roles of family members living in rural Haiti. In this game, players examine the impact poverty has on access to education, nutrition, basic healthcare, and longevity. Similarly, through Renaissance Florence: Virtual Time Machine, students easily become involved in discussions of important artists and inventors of the period because of the interesting format and content.

Although games have potential in classrooms, teachers are limited by their interest, knowledge, innovation, and experiences. Any of these factors may limit how good a fit they see for a particular game. As one candidate noted, "In my content area of history, I've only experienced my teachers teaching in a straight lecture format. This might be tough to break away from, though I plan to try, as I see the value of class discussion emerging from game-based instruction."

Other candidates may be ready to challenge themselves and break through limitations of past experience. As one noted, "Now that I have assessed and observed students playing the game, I feel more comfortable incorporating digital games into the curriculum and now see them as an addition and asset to teaching students different topics. Prior to this experience, I was not in favor of using games in the classroom and believed that they were only a distraction to the students." During this study, some participants' comments provided evidence that they were beginning to think about their students' learning preferences. Participants indicated they were more open to gaming after observing student reactions, which suggests that they were beginning to think about their students' learning preferences.

Motivational Factors of Games

The majority of candidate responses suggested that intrinsic motivation and curiosity fueled player interest. "The intrinsic motivation of the game [Making

History] is seeing what would happen if factors were different in WWII and another country won. I really was curious if the game would allow allies to win the world and change history." Potential to alter outcomes or uncertainty can increase player involvement. As one player noted, "The interesting thing about Peacemaker is that you never really win. You can have higher approval ratings in all the different countries, and that keeps you in the game longer. Not being able to win makes the game interesting because … no one has fully resolved the conflict in the Middle East."

Novelty and fantasy were highlighted as significant motivators but may not be sustained through multiple sessions with the same game. Cybersense and Nonsense participants did not know what to expect their first time through the game, so they were very attentive but lost interest when the same questions were asked the next round. One candidate thought introducing the background of artist Jackson Pollock and his style of painting to middle school students would reduce interest in the unique environment of game. One study participant noted that "it made sense that the first student would enjoy the game more because ... she had no idea what the game was about. Only after she was done did I reveal who Jackson Pollock was and shared information about his art work."

In Discover Babylon, elements of surprise continued to attract players to the game. Players assume the role of a character whose prime objective is to save ancient Mesopotamia from destruction. The participant indicated that "the 3D environment allows players to explore and learn interesting facts with information icons throughout the game."

Factors Influencing the Use of Digital Game-Based Instruction

In the focus groups, we asked the participants to comment on the factors that they believed would influence them to use or not use digital games in their teaching. The majority of participants stated that the element of motivation was important, but motivation alone was not a sufficient reason to influence them to use digital game–based instruction in their future classrooms. A majority of participants reported that peer modeling and the responses of the [middle and high school] students to whom they taught the digital games positively influenced them to use game-based instruction.

Summary, Conclusion, and Recommendations

Summary

Ways to promote learning while effectively teaching 21C skills are of great interest to the academic community. Digital games offer cognitively complex situations because they can provide students with opportunities to assume roles, examine problems, and pose solutions. Skills taught through digital game play are those desired by employers: critical thinking and problem solving, teamwork and communication, creativity and innovation, and technology proficiency.

As a conceptual model of how candidates would facilitate a digital game in their future classroom, we explored the environment in which learning occurred as well as instructional methods used in order to explore how undergraduate programs might change existing curricula to better prepare teacher candidates and their students for the rapidly changing 21st-century workplace. We designed a combined strategy that included provision of partnered education faculty, instructor modeling, peer collaboration, and a modified teacher education course offering. We used multiple data collection methods to help increase the validity of data collected and presented (Kay, 2006). Focus group notes reflected that respondents felt positive and confident about integrating digital game-based instruction in the curriculum as a result of watching their peers' presentations and teaching students how to play games.

Conclusion

Teacher educators' examination of practice could lead to teaching topics using digital games that offer students meaningful and motivating learning opportunities to develop 21C skills. Customized course preparation can provide teacher candidates with a focused opportunity to practice with selected digital game content and explore options for their use, rather than being narrowly focused and standardized, which is the norm (Gibson, 2002).

The design of a digital game module in an existing teacher education course with carefully selected digital games can foster motivation for most candidates who need opportunities to learn with technology in their course work as a way to familiarize themselves and master how to learn and teach using digital games. A technology-proficient faculty member is needed to guide and assess candidate leadership during the game play, followed by the opportunity to deliver field-based, digital-game-infused lessons.

For faculty, pairing an educational technology colleague with a teacher educator can yield benefits to both. A willing teacher educator can learn to use and trouble-shoot technology issues in unique ways, and the educational technology faculty member benefits from seeing the effectiveness and problems with implementing a technology application such as digital games with students with a range of skills. In the future, a more extensive digital game module would be desirable in a teacher education course featuring alternate forms of educational technology, including the design and facilitation of digital media—digital games, simulations, and multiuser virtual environments (MUVE).

Recommendations

Based on the conclusions, we present the following recommendations for further research with preservice teachers:

1. Are there any differences in preservice teacher motivation to teach via digital games versus other instructional materials?
2. Is there a relationship between a preservice teacher's content area [major] and willingness to teach with digital games?
3. What is the relationship between prior teacher modeling and preservice teacher willingness to teach with digital games?
4. How many times does a preservice candidate need to practice teaching a digital game before developing confidence and experiencing cognitive ownership?

Author Notes

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