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INFORMATION & COMMUNICATIONS TECHNOLOGY IN EDUCATION | REVIEW ARTICLE

Influence of online computer games on the academic achievement of nontraditional undergraduate students

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Abstract: Technological advances have provided educational institutions the capability to explore various online teaching strategies such as digital games in the classroom. Though games can be used to engage various learning styles and behaviors, the platform is mainly practiced at the secondary educational grade level with traditional-aged students. Little research literature exists that explores the influence of digital game-based learning on the academic achievement of nontraditional undergraduate students. An extensive literature review of 77 articles was conducted using the procedure developed in Cooper's Taxonomy (1998) for analyzing and synthesizing literature. Cooper's system involved (a) formulating the problem, (b) collecting data, (c) evaluating data appropriateness, (d) analyzing and interpreting relevant data, and (e) organizing and presenting the results. This scoping literature review explores how digital games can be used in the educational environment to support the learning of nontraditional students.

Subjects: Educational Technology; Teaching & Learning - Education; Adult Education and Lifelong Learning; Teaching & Learning; Technology in Education; Curriculum; Video Games

Keywords: nontraditional students; computer games; academic achievement; motivation; retention; higher education; part-time student; post-secondary education; gamification; game-based learning

ABOUT THE AUTHORS

The authors are both researchers and practitioners in the field of education who are either faculty members or administrators at a post-secondary institution serving both traditional and non-traditional students. The team lead, Patrick Turner is the Director of Student Support Center-Helena College at the University of Montana whose research focus is student retention and persistence. Elizabeth Johnston currently serves as Senior Research Fellow for the Center for Educational and Instructional Technology Research (CEITR). Mansureh Kebritchi is the Chair of CEITR in the School of Advanced Studies. David Heflich is a researcher in the (CEITR), mentors doctoral students for UOP and for Nova Southeastern University. Sally Evans is a researcher in CEITR who serves as a Doctoral Chair and on candidate committees. All members have an active research agenda in the field of education and scholarship is presented at both national and international conferences.

PUBLIC INTEREST STATEMENT

Many US college and university leaders need to construct ways to engage and retain non-traditional students who make up 75% of student enrollment. During the Obama administration, the US was tied for 12th position with 39% of adults having a minimum of an associate degree. Digital game-based learning, when aligned with the learning objectives of a course or curriculum has been shown to provide a hands-on, interactive, and real-life application learning experience. Learners are engaged through the cognitive, psychomotor and affective domains which increase the opportunity for retention, persistence, and graduation. If the United States is to once again lead worldwide in college degree attainment, the percent rate of successful college graduates needs to raise to 56% by the year 2020. Finding ways to engage the largest but most vulnerable population of learners on campus is vital to the US global position and workforce development.

1. Introduction

Though 75% of nontraditional or adult learners enroll in a colleges or universities in the United States, only 33.7% complete college with a degree or certificate (New, 2014). The US Department of Education (2002) defines non-traditional students as learners over the age of 24 who are not only balancing work, life, and family but also returning to school after a pause in educational pursuit. A study of 4.5 million non-first-time students conducted by the National Student Clearinghouse Research Center reported only a third of nontraditional students completed college compared to 60.7% of traditional learners (New, 2014). Finding instructional strategies that engage, motivate, and retain nontraditional learners are not only critical to the academic success of this population of students, but also to the continued development of workforce talent in the United States.

Digital game-based learning is an instructional method that has shown promise in adult education and learning (Anderson, Anderson, & Taylor, 2009). Digital game-based learning combines educational content with the use of video games. The digital games are explicitly designed for educational purposes and have the capability to engage a diverse of learning styles and behaviors. Learning can take place in both formal and informal environments, one-on-one or in groups. Game-based learning has shown to increase various abilities related to cognition such as perception, reasoning, critical-thinking, spatial navigation, and memory retention (Granic & Lobel, 2013).

Unfortunately, current empirical research conducted on digital game-based learning mainly focuses on adolescents (Ding, Guan, & Yu, 2017). Though some research examines the effectiveness of using digital games-based learning on traditional college students (Ding et al., 2017), a limited number of studies are dedicated to explore the influence of digital game-based learning on undergraduate non-traditional students. The integration of digital games in the educational environment has shown positive results in enhancing the learning process (Trybus, 2014). Strategically designed and integrated, digital games have the potential to increase academic and learning effectiveness. This scoping literature review examines the research on digital game-based learning for non-traditional students enrolled in postsecondary education and the implication games can have on achievement and learning outcomes.

2. Theoretical framework

The framework for the scoping literature review is supported by two theoretical models: Adult Learning (Knowles, 1984) and Situated Cognition (Brown, Collins, & Duguid, 1989). The focus of a scoping study is to place knowledge regarding a particular topic in a conceptual framework, map relevant literature, and present what is known and unknown (Anderson, Allen, & Peckham, 2008). The broad range of data can be inclusive of both material from empirical and non-research materials (2008). The objective is to generate meaningful discussion around a specified topic.

Knowles (1984), one of the leading teachers, scholars, and practitioner of adult-learning and education was considered the father of andragogy. After extensive research, Knowles outlined four principles related to adult learning that applied to non-traditional students. These principles are: adult learners must be included in the assessment and planning of their learning; adult learners' experiences and mistakes form the foundation for learning; adult students are interested in subjects that are immediately connected to their lives or employment; and learning is more meaningful when problem-based as opposed to theoretical or ambiguous (Kearsley, 2010).

Situated Cognition theory, the second theory, is based on the premise that knowledge is formed and supported by the cultural, social, and physical experiences and situations of an individual (Brown et al., 1989). Learning occurs in the everyday life experiences of an individual and the theoretical model emphasizes an authentic context for skill acquisition (Brown et al., 1989). Learning is organic, meaningful, and effective when materials are rooted in personal connections and reflect real-life experiences (Herrington & Oliver, 1995). Students persist academically when course lessons and materials are made relevant to the lived experience (Park & Choi, 2009).

Digital game-based learning aligned with many of the suggested parameters outlined by theories of Situated Cognition and Adult Learning promotes effective adult learning (Kearsley, 2010). The digital gaming experience provides learning within a specific problem-solving context which allows adult learners to use their experiences and errors as a gage for learning. In many cases, the games are related to real life experiences or careers skills found in the work environment. Digital game-based learning provides nontraditional learners with more authentic context for skill acquisition (Trybus, 2014). Important features connecting adult learning and digital games are: (1) genuine context which mirrors how information is utilized in real-life, (2) presents authentic activities, (3) numerous points of view and roles, (4) games can give linked assessment of the learning, (5) can scaffolding learning or instruction at decisive points (Herrington & Oliver, 1995).

3. Literature review

The use of digital game-based learning as supplementary aids at the university level is in the early stages of development (Herro & Clark, 2016; Holmes & Gee, 2016; Kanthan & Senger, 2011; Moylan, Burgess, Figley, & Bernstein, 2015). College and university leaders hesitate to use digital games at the postsecondary level because of insufficient data on learning outcomes, assessments, and academic performance directly linked to digital game-based interventions (Kanthan & Senger, 2011; Vandercruysse, Vandewaetere, Cornillie, & Clarebout, 2013). Ding et al. (2017) stated, "due to difficulties in defining, constructing, and measuring complex variables as well as the subsequent results, rigorous empirical research on the effectiveness of gamification in education or game-based learning has been limited" (p. 148). However, technology savvy students seek an engaging hands-on interactive learning experience that is available in game-based learning. To increase teaching effectiveness, instructors must develop an understanding of the internal structure of digital game design as well as the limitations of technology (Kanthan & Senger, 2011). Research is lacking in the design aspects of digital games and the related learning to non-traditional students (Tham & Tham, 2014). The lack of research and comprehension deter the use of digital gaming for instructional purposes.

Indications of interest in digital game-based learning are noted in research studies across many disciplines. For example, significant gains over traditional teaching methods for both male and female students were reported when a 3D game-based learning system for teaching engineering content was assessed (Su & Cheng, 2013). The display of a positive attitude and engagement were higher for engineering students who used digital games, compared to the engineering students who learned via traditional teaching methods (Boeker, Andel, Vach, & Frankenschmidt, 2013). The use of digital game-based learning resulted in increased cognition for medical students over script-based instruction (Boeker et al., 2013; Rondon, Chiarion, & Furquim de Andrade, 2013). Digital games often provide a safe environment for students' learning a second language thereby reducing anxiety and increasing willingness to communicate which directly affects language learning (Reinders & Wattana, 2015).

Alternatively, digital games were not always found to inspire students in higher education. A group of college students in Singapore who were found to possess a high level of intrinsic motivation showed no increase in motivation or engagement due to the use of games (Tham & Tham, 2014). In fact, the Singapore students who were unfamiliar with digital games-based learning experienced feelings of apprehension. Further assessments on student learning indicated the continued need to use a combination of lecture with digital learning (Rondon et al., 2013). Familiarizing students with the technology requires extensive time, which further delays learning. Adjusting for these differences presents challenges for instructors (Holmes & Gee, 2016). Another factor that affects student acceptance of digital games in learning is the mindset of students accustomed to a passive style of learning through the lecture format (Herro & Clark, 2016).

Digital games-based learning has been used to increase student retention, build teamwork skills, and communication (Bodnar, Anastasio, Enszer, & Burkey, 2016). Furthermore, digital gaming technology provides the option to measure students' progress over extended periods of time due to the prolonged interaction and play with the games. To be effective at the university level, digital games must align with the course content and course objectives (Moylan et al., 2015).

Few studies examined the relationship between digital games and achievement for non-traditional students (Burgess, Stermer, & Burgess, 2012; Young et al., 2012). In fact, the National Research Council suggested research be conducted on games and learning while also admitting that little evidence exist to support digital games as a tool for achievement (Clark, Tanner-Smith, & Killingsworth, 2014). Recommendations on how best to employ digital games to improve learning outcomes are available, however, a broader understanding of the possible influence on diverse learners or subject matters is required (Kim & Chang, 2010).

4. Formulating the problem

The stated problem is that although extensive literature is available on the influence of digital game-based learning on traditional students, scant research exists that explores the use of digital game-based learning specifically on the academic achievement of nontraditional undergraduate students.

To examine the problem, the following questions guided the review:

Research Question 1: How is digital game-based learning used as a supplemental tool to engage nontraditional students in classroom instruction and coursework?

Research Question 2: How is digital game-based learning used to build learning and work-related skills for nontraditional undergraduate students?

Research Question 3: In what subjects are digital game-based learning used to engage nontraditional students in classroom instruction and coursework.

The purpose of this scoping literature review was to frame the discussion surrounding digital game based learning as pertains to nontraditional students, create meaningful dialog, identify existing gaps, map out relevant literature, and synthesis findings from various studies.

4.1. Method

An in-depth understanding of a topic, such as digital game-based learning for nontraditional students, is achieved through identification of what has already been researched and areas needing further exploration. To provide a comprehensive understanding of a particular topic, a systematic review of the literature is required (Booth, Papaioannou, & Sutton, 2012). To address the research problem the researchers conducted a literature review using the systematized procedure developed by Cooper (1998) for synthesizing the literature. The Cooper organizational structure outlined how to (a) formulate the problem, (b) collect data, (c) evaluate the appropriateness of the data, (d) analyze and interpret relevant data, and (e) organize and present the results. Results were compared with issues existing in large higher education institutions where digital games were being used as an instructional tool. Use of a structure such as Copper, increases the study objectivity, constructs a contextual framework, and clarifies the objectives of the review for the reader (Cooper, 1988). Cooper's taxonomy has been shown to be a reliable method for conducting a review.

4.2. Data collection

A search was conducted to find empirical studies including quantitative, qualitative, mixed method, comparative and theoretical analyses, and literature reviews to answer the research questions. Key search words included non-traditional students, non-traditional learners, games, and game-based learning. Other keywords included adult learners, GameScape, Toolwire, gamification, and for-profit universities. Search engines used for the literature research included Google Scholar, ProQuest, and EBSCO HOST. Databases included Education Sources, Educational Resources Information Center (ERIC), Computers and Applied Sciences Complete, Cochranes. Database searches were conducted individually after checking thesaurus terms to ensure a comprehensive search. Additionally, searches were conducted in multiple database packages. Search terms derived from thesaurus searches included: non-traditional students, older students, working adults, part-time undergraduates and games, gamification, simulations, and classroom technologies. These terms were used alone or together in multiple combinations. A sample of 77 articles was collected for analysis. Although many articles could be used to provide background and context, based on the outlined procedure, 14 articles were studied intensively for RQ 1, 2, and 3 (Tables 1, 2, and 3). The search also included articles pertaining to digital games incorporated in the curriculums of for-profit universities. For-profit universities serve non-traditional undergraduate students as a primary population. The emerging data on the current practice of using DGBL are incorporated into Table 3. A third research question was developed in response to emerging data. Articles that included varied learners fitting one or more criteria for a non-traditional undergraduate student in higher education were included. Documents indicating a primary focus on traditional undergraduate students were excluded from the research.

5. Data evaluation and analysis

The scoping study review included articles that were empirical studies related to digital games as a strategy for increasing learning and could be used to answer the research questions. The team adopted a method for guiding the literature review developed by Cooper (1988). An extensive search for literature was conducted using the terms and search strategies described above. A broad-based definition of nontraditional students was adopted that included those who study part time, work full time or at part time jobs that require many hours, students aged over 24, ESL learners and those enrolled in distance learning, particularly enrolled at for-profit universities that primarily serve nontraditional students. US Department of Education definitions for nontraditional students were used and individuals needed to meet only one of these criteria to be considered a nontraditional student (Zawacki-Richter, Müskens, Krause, Alturki, & Aldraiweesh, 2015).

Some limitation of the study were articles that did not include specified search terms might have been overlooked because of scant research on the topic. Each team member assumed responsibility for reviewing specific articles related to a research question. The entire team checked and counter checked each other's work and reviewed the analyses to ensure accuracy and validity.

6. Results of analysis

A discussion of results is presented for each of three research questions. Articles were grouped as related to the research questions. A short introduction prepares the reader for the analysis. The next three sections will indicate findings for each of three research questions. Tables 1, 2, and 3 show details of the analysis.

> RQ1: How is digital game-based learning used as a supplemental tool to engage nontraditional students in classroom instruction and coursework.

The following descriptions are presented as derived from an analysis of each article identified as related to findings for research question 1. The themes in this section are: (a) Design and Motivation, (b) Feedback and Alignment, (c) Finance Achievement, and (d) English Language Learning Achievement. The summary presents key findings. Table 1 provides key information for the response to RQ1 from each article including the topic, authors, design, and results. A discussion follows Table 1 and implications of the research are indicated in the final section before the responses for RQ2 and 3.

Table 1. Ways that digital game-based learning are used to engage nontraditional students

Topic	Author	Design	Results
Design and motivation	Flores (2015) Theoretical article: published in *Digital Education* open access, peer reviewed journal Published by University of Barcelona	Theoretical analysis of related literature and existent digital game-based learning (DGBL) (all ages including non-traditional college students) analyzed intrinsic motivation, and recommended more research. Emphasis on second language learners	DGBL was found to have a positive impact on the learning of a second language (L2). The learning platform enhanced reading, writing, and speaking skills in addition to encouraging collaboration
Design and motivation	Trybus (2014) Analysis of game elements as compared to traditional and hands on learning experiences in a. white paper Carnegie Mellon University faculty member: Entertainment Technology Center	Comparative commentary on game, traditional, and hands-on pedagogy concluded digital games increased motivation	A gap exists between traditional instructional strategies that promote passive learning and a workforce that requires an interactive, digital, and multimedia skill set. DGBL based learning can act as a bridge between the disconnections
Design and motivation	Nadolny and Halabi (2016) Empirical research article: Published in *Simulations and Gaming* (Sage) peer reviewed article	Mixed method case study including achievement, attendances, and surveys; 41 undergraduates ages 18–41	The data analysis indicated the potential of DGBL) to increase the attendance and level of motivation for students registered in large course sections
Design and motivation	Brady and Devitt (2016) Empirical research article: Published on the Social Science Research Network; not peer reviewed	Exploratory, qualitative case study which included non-traditional students in the sample of 34 online postgraduates and undergraduates students; ages varied	Findings indicated the use of DGBL as an instructional tool increased student engagement, assisted in connecting theory and practice and developed higher order processing skills
Feedback and alignment	Brady and Devitt (2016) Empirical research article: Published on the Social Science Research Network; not peer reviewed	Exploratory, qualitative case study which included non-traditional students in the sample of 34 online postgraduates and undergraduates students; ages varied	Findings indicated aligning DGBL strategies to curricular outcomes increased critical thinking, and content mastery
Real life experience	Ding et al. (2017) Empirical research article published in peer reviewed journal: Emerald publishers	Semi-structured survey tool administered to 67 part-time students in undergraduate finance class at a major university in Singapore. Thirty-four surveys were completed	Findings showed improved performance and student preferred DGBL opposed to traditional style teaching because the games provided an experiential learning experience

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Table 2. Learning and work-related skills developed by using digital game based learning

Topic	Author	Design	Results
Building competencies	Anderson et al. (2009)	Commentary and analysis based on literature review	Digital game based learning (DGBL) provides many advantages for adult learners and adult educators such as problem solving, decision-making, and patterns of recognition
	Peer reviewed, open access, Literature review		
	McFarlane (2003)	Commentary by editor of special issue of *Assessment in Education* focused on digital assessment	The editorial drew attention to the role of digital technologies in assessment and learning
	Editorial in peer reviewed special issue		
	Snow (2016)	Nontraditional students, school leaders, educators at community colleges and four-year institutions	DGBL has potential to increase learning opportunities for nontraditional students if tailored to specific needs and challenges encountered by this population of students
	Extensive empirical research on DGBL and non-traditional students conducted by Muzzy Lane and supported by the Gates foundation. Not peer reviewed		
Building Employment Competencies	Levy and Pliskin (2012)	Conceptual model drawn from study of the literature and applied to a specific context	DGBL used in business education was found to provide students a platform for better communication, building collaboration, improving problem-solving skills and promoting creativity
	Conceptual model for using games to improve decision making in peer reviewed book chapter		
In the Military	Kearney and Pivec (2007), peer	Content analysis of games, with focus on sex and violence content including a purposive sample poll of teenaged gamers (42)	DGBL has hidden value that can often be complex and multidimensional. Games sometimes feature sex and violence, which maybe of questionable value in some context. The military use of DGBL allows soldiers to safely practice lifesaving skills in violent situations
	reviewed, traditional journal, Blackwell Publishers		
	Mead (2013)	Commentary on how the US army developed video games to identify and recruit individuals with talent for combat and for other purposes	The US Military is one of the first and largest high-stakes educators that use DGBL and simulators as instructional tools for training, specifically warfare
	Book, not peer reviewed		
Collaborative learning	Snow (2016);	Focus Groups online surveys and interviews. Participants included nontraditional students, school leaders, educators at community colleges and four-year institutions	DGBL has the potential to increase the learning opportunity for nontraditional students if tailored to the specific needs and challenges encountered by this population of students
	Extensive empirical research on DGBL and non-traditional students conducted by Muzzy Lane and supported by the Gates foundation. Not peer reviewed		
	de Freitas and Oliver (2006)	Theoretical model to evaluate the use of DGBL	Four frameworks exist the guide the discussion on games and simulations: context, attributes of learners, mode of presentation, and process of learning
	Development and application of a theoretical model for using DGBL in peer reviewed article. Published by AECT		
	Levy and Pliskin (2012)	Conceptual model drawn from study of the literature and applied to a specific context	DGBL used in business education was found to provide students a platform for better communication, building collaboration, improving problem-solving skills and promoting creativity
	peer reviewed book chapter published by IGI		

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Table 3. Subjects that digital game based learning are used to teach them in higher education

Content area	Game	University/Course	Participants
Develop critical thinking	Critical Thinking In Everyday Life/GameScape by Toolwire	University of Phoenix—Humanities	Undergraduates, who study in online classrooms and are primarily working adults
Psychology	What Happened To Uncle Bob/GameScape Mystery	University of Phoenix Psychology	
Writing	University Writing Essentials: Live! News!	University of Phoenix—English	
Environmental science	Sparksvile25; The Environmental Science Game	Arizona State University—Environmental Studies	
Nutrition	Nutrition—A Key to Health/Gamescape	University of Phoenix— Science	
Adaptable games	Toolwire Games	University of Phoenix, Arizona State University, Capella University, Kaplan University, Columbus State Community College, Strayer University	
English language learning achievement	Ting-Ting and Yueh-Min (2017)	Quasi-experimental study. Three different methods of instruction were assessed	Students who used the mobile game-based system displayed higher learning interest, engagement, and increase effectiveness in learning vocabulary knowledge. There was also evidence of self-efficacy
	Empirical research article published in peer reviewed journal Publisher: International Forum of Educational Technology & Society	Group A—received traditional instruction	
		Group B—traditional and then for half the class vocabulary review	
		Group C—traditional instruction and for half the class mobile game based vocabulary practice	
		94 first-year students enrolled in an Information Management Program at a private Taiwan University. Student were divided into three groups	
Math	Tate (2017)	Descriptive article on new video game called "Variant". Participant included 400 Faculty and Administrators members at 300 universities navigated an avatar through an abandoned planet by solving calculus-based equations	Feedback from participants using the pilot games found an increased level of student engagement. Data was not yet available measuring performance levels
	Descriptive article published in online professional news journal sharing news, opinions, career opportunities		
	Not peer reviewed		

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6.1. Design and motivation

Flores (2015) conducted an extensive analysis of related literature and existent digital games for teaching a second language. Digital games for every age group, including non-traditional adult learners, were analyzed using a literature-based framework of theory and research. The digital games promote a learner-centered approach, which relies on and supports intrinsic motivation when compared to traditional teaching methods that often undermine learning and decrease motivation. More empirical research is needed on games as a learning strategy for acquisition of a second language.

In a large lab setting, where students ranged in age from 18–41, digital games were shown to increase the level of participation and engagement in the learning content that was not related to age or gender, therefore providing motivation even for diverse learners (Nadolny & Halabi, 2016). No association was found between the final grade and age, gender, gaming experience, or learning style. Designing the digital game-based course took a great deal of time particularly related to assessment and feedback. Further, students responded to open-ended questions at the end of class indicating they preferred the digital game-based experience in class.

Postgraduate students working with theory in a digital game-based business module reported the experience engaging and enjoyable (Brady & Devitt, 2016). The reflective experiences were more meaningful than winning or losing a game but also supported continued participation even after losing. Course content must be aligned with the context for the digital game to be effective for learning.

Using a theoretical framework drawn from the literature, Trybus (2014) analyzed the qualities of traditional, game based, and hands on training. Digital game based and hands on training offer the opportunity to be experiential learners and serve as active participants in the learning process to develop higher order thinking skills. Students found the challenge of digital games enjoyable, which led to increased motivation. However, digital game challenges can have a negative effect on learner motivation (Brady & Devitt, 2016) indicating the need for support for students who are learning to navigate the digital gaming architecture.

6.2. Real life experience

Semi-structured interviews were used to collect data on digital game-based learning effectiveness in an online higher education finance course for part-time students (Ding et al., 2017). One hypothesis postulated that digital game-based learning could be more effective and increase learning outcome than the traditional method of teaching styles and practices. Students enrolled in the course played an online stock trading game. Though the exact amount of profit and level of improvement after use of the game was not specified, more than 50% of the students did note the online stock digital game provided a real-life experience. Learning for students was more meaningful, engaging, and applicable which increased the learning opportunity.

RQ 2: How is digital game based learning used to build learning and work-related skills for nontraditional undergraduate students?

The following descriptions are derived from an analysis of articles that indicated digital game-based learning aids in the development of work-related skills and abilities in 2017. The themes in this section are: (a) Building Competencies, (b) Building Employment Competencies, (c) In the Military, (d) Collaborative Learning, and (e) Math. Research question 2 also allowed the research team to explore postsecondary institutions and disciplines where computer games have been integrated into courses that serve and support non-traditional undergraduate students. The following descriptions are presented as derived from an analysis of university documentation where games were used as a part of the curriculum. These are displayed in Table 3. The themes are: (a) Critical Thinking, (b) Psychology, (c) Writing, (d) Environment Science, (e) Nutrition, (f) Adaptable Games, have been studied.

Table 2 provides key information about each article including the topic, authors, design, and results. A discussion follows Table 2 and implications of the research are indicated in the final section.

6.3. Building competencies

A contemporary society requires that students think-critically, collect, synthesize data, and use that information to solve complex problems (Anderson et al., 2009). Students must be able to modify and integrate new methods in reaction to new requirements or dynamic situations. Also, can use technology to generate new knowledge. Digital games provide learners the opportunity for a hands-on and real-life application which can lead to increase knowledge and awareness of issues, actions, and resolutions surrounding complicated issues.

Digital games are incorporated into a course for undergraduate nontraditional learners to allow students to auto-assess whether they have learned the material. When nontraditional students play games, they become involved in intricate changing worlds. Within the digital game play, students are made aware of details, come to conclusions, and take prompt action. If unsuccessful, students do the same task again, so knowledge is gained from errors as they progress toward mastery (Carroll & Borge, 2007). Digital skills have changed the way we express and communicate in the twenty-first century, (McFarlane, 2003) are mirrored in digital gaming, and may be essential to nontraditional student achievement.

6.4. Building employment competencies

Digital games are used in a course for nontraditional learners to help build employment competencies and skills for nontraditional students (Snow, 2016). The National Adult Learners Satisfaction-Priorities Report examined trends in satisfaction of adult learners, as well as how likely adult learners were to recommend the program to other adults. Findings related to enrollment factors for adult learners showed that at four-year institutions, 85% of the adult learners enrolled based on a requirement for a current or future job. Learning with digital games gives the non-traditional learner an opportunity to develop new abilities and expertise which they might use in employment and achievement (Levy & Pliskin, 2012).

6.5. In the military

Online programs enroll a large percentage of students are active military because of the accessibility and flexibility of the course offering. The military has advocated for the use of games for teaching since 1997 (Kearney & Pivec, 2007). The military recommends adopting computer games as learning tools (Mead, 2013). Digital games are also used by the military to re-acclimate soldiers to civilian activities (real-world activities), as well as dealing with PTSD (Mead, 2013).

6.6. Collaborative learning

Digital game-based learning is used to build nontraditional learners' academic skills in a positive way (Snow, 2016). Learning through digital games may provide adult students the opportunity to learn collaboratively. Digital games provide personalized instruction, learning controlled by students, and learning in groups or teams (Beck & Wade, 2004; de Freitas & Oliver, 2006). In business education, digital game-based learning provides a platform for communicating with nontraditional learners, empowering students to author their own material, and work collaboratively with other students in problem solving (Levy & Pliskin, 2012).

> RQ3: In what subjects are digital game-based learning used to engage nontraditional students in classroom instruction and coursework

In addition, the research team investigated how universities that primarily serve non-traditional students might be using DGBL with non-traditional students. We researched for profit universities because they primarily serve non-traditional students. Table 3 displays findings for this search.

6.7. Math

A new digital game was recently published by a university professor at Texas A&M (Tate, 2017). The game, Variant, launched in January of 2017, is designed to help students learn math while enjoying the learning experience. Variant uses an avatar to help learners solve calculus-based equations. During the launch period, the digital game was requested by 400 university faculty in over 300 universities, which indicates the interest in digital game based learning programs.

6.8. English language learning achievement

A block-clearing digital game was developed to provide vocabulary practice in an English course for students in their first year at a Taiwan university. Researchers Ting-Ting and Yueh-Min (2017) studied the implementation of the digital game in classroom instruction for students majoring in information management. Participants for the study consisted of three classes totaling 94 students. The same instructor taught all three groups. An ANOVA was used to compare student achievement for those who used the digital gaming program as part of the course instruction and those who were taught using traditional means. Results of the study indicated that students who used the games achieved at higher levels and were more interested in learning.

6.8.1. Develop critical thinking

Some of the leading for-profit and state colleges and universities use digital games to engage and teach critical-thinking skills to non-traditional students who make up a large percentage of their enrollment. University of Phoenix uses "Critical Thinking in Everyday Life", a GameScape by Toolwire in HUM/115, to help nontraditional students develop critical thinking skills (Toolwire Games, 2016) through a computerized, storytelling, experiential learning experience using the latest gaming technology. Students use investigative techniques in scenarios that connect theory to real-life concepts. Student are forced to assume certain characters, use interactive objects and connect previous knowledge to create new understanding to solve mysteries. Learning through digital games can help nontraditional students to think in novel or unusual ways about abstract ideas or knowledge. Digital game-based learning has been thought to be more successful than traditional teaching methods regarding constructing thinking related to memory skills and learning (Kolb & Lewis, 1986). Better memory skills and learning can lead to better achievement for nontraditional students.

Digital game-based learning teaches ideas by involving students in experience by devising arenas in which information is used for a practical purpose (Squire, Giovanetto, Devane, & Durga, 2005). By demonstrating authoritative problem solving and integrating situations that enable students to construct meaning based on previous comprehension, digital games provide practical experiences for non-traditional learners. These aspects create an ideal environment for the acquisition of knowledge or skill building. Building academic skills in a positive manner is one area in which computer games help nontraditional students reach learning goals (Snow, 2016).

6.8.2. Reinforcing content in psychology

Digital games are used in courses for non-traditional students to reinforce content and real-world application. University of Phoenix uses "What Happened to Uncle Bob? a GameScape Mystery" to help teach psychology in PSY201. The first episode involves Scientific Inquiry. The other subsequent episodes involve Human Development, Emotions and Motivation, Individual Differences, and Abnormal Psychology. Students learn skills such as the steps in the scientific method, collecting evidence, and examining pieces of information that lead to solutions.

6.8.3. Skill building in writing

To teach writing skills, University of Phoenix uses, "University Writing Essentials: Live! News" in ENG 147 University Writing Essentials. After completing each episode students save their responses to a PDF file and send it to their instructor. The digital game covers areas such as paragraph building, quoting/paraphrasing activity, fixing paragraphs, and essay construction kit.

6.9. Environmental science

Every module in the Sparksville 25 game program corresponds to learning objectives. Included is a point system for performance measurement and competition. Modules within the game are: Balancing Ecosystems, Managing Population Growth, Maintaining Terrestrial and Atmospheric Resources, Controlling Energy Systems, and Building a Positive Environmental Agency. Digital game-based learning provides a means for operative learning, transfer of the application of knowledge, theory to realistic activity and experience (Anderson et al., 2009).

6.10. Nutrition

The University of Phoenix uses a Toolwire GameScape episode, "Nutrition—A Key to Health" in SCI 220, Human Nutrition. This online game allows non-traditional students to explore the following modules in a game format: a key to health, nutrient sources and significance, energy balance, vitamins, minerals and water, fitness and food safety, and a focus on life stages. Another nutrition GameScape that may be used in a Nutrition course for non-traditional learners is "Where Health Happens". Likewise, "Health and Wellness: The Game Show Where Wellness Wins!" may also be used in health courses.

6.11. Adaptable games

Toolwire Games are educational games with assessments and tasks that include realistic video. The digital games are grouped into subject areas that contains several games. The Toolwire games are used in face to face, blended, or online courses. The following universities use the Toolwire games: University of Phoenix, Arizona State University, Capella University, Kaplan University, Columbus State Community College, and Strayer University (Toolwire Games, 2016). These universities enrollment consist of a large population of nontraditional students. Using the Toolwire educational games assist students' achievement in the given curriculum areas.

7. Discussion and conclusions

7.1. Significance

Limited research literature exists on the impact of digital game-based learning on non-traditional students. As a result, some of the research articles referenced include participants who are categorized as traditional students but also qualify as nontraditional under the stated definition. Only a few such studies exist including: Hayes and Ohrenberger (2013), on the effect of digital games and gaming for pre-service teacher education; Hanson-Smith (2016), on motivation; and Foss et al. (2014) on the effects of a digital game for nursing students on administering proper dosages of medications. Jabbar, Azita, and Felicia (2015) conducted a review of games-based learning and developed a series of recommendations for the future design of educational games. The concept of digital game-based learning in instruction is international in scope and interest. For example, Chik (2014) examined the use of digital games to stimulate second language learners in East Asia. The present study examines literature for the effects of gaming on learning for the fast-growing population of nontraditional undergraduate students. The study has both national and international implications that leads to providing comprehensive understanding of the influence digital game-based learning has on the learning outcomes of nontraditional students when integrated into a university course or curriculum.

7.2. Contributions, implications of the study, and results

Digital games, when used as a supplemental tool have a positive influence on the academic achievement of nontraditional students pursuing an undergraduate degree. As the number of nontraditional students enrolled in colleges courses and online classes increase, post-secondary institutions are pressured to develop effective strategies to not only engage but promote academic success for this population of students. As a result, the demand for digital games in education for nontraditional undergraduate students will continue to grow because of the potential role in academic achievement and student engagement. However, if digital games are to be effective, course learning objectives must be related and directly connected to the game. A direct alignment is required between the game, feedback, learning outcomes, and assessment.

Digital games have been found to promote students' confidence, satisfaction, interest, and effort (Keller, 2008). These types of digital games provide an authentic context for skill acquisition, and connect theoretical in-class lessons to real-life application which is supported by the situated learning theory (Brown et al., 1989). Colleges and universities must develop a better understanding of the optimal circumstances and systems that best accommodates the learning needs and behavior of nontraditional students taking online courses.

Nontraditional students' needs are unique and different from those of traditional students. Additional attention is required by institutions to ensure this population of students feel supported and successful in their academic endeavors. Leveraging the use of technology, specifically digital games, increase student retention and decrease the attrition rate resulting in increased graduation rate. Positive results have been found in such areas as English as a Second Language (ESL), nursing, mathematics, military, and engineering. Students experienced increased levels of engagement, motivation, academic success, problem solving, and critical thinking. Further, digital games used as a learning resource and tool provide non-traditional students access to a quality education and meaningful learning experience.

Technology has had a great influence on every aspect of society and is constantly evolving. Higher education institutions still struggle with how to effectively integrate electronic devices in the classroom to increase student engagement, development, performance, and learning outcomes. The lack of guidance is apparent by the existing gap in research literature that addresses the topic of the use of digital games to engage nontraditional students. This literature review attempts to bridge the gap by providing an overview of the existing problem, methods, benefits, challenges, and possible solutions. The hope is that educational administrators, policy-makers, instructors, and decision-makers better understand the complex issues surrounding the educational needs of nontraditional students and how digital games support efforts to improve persistence, access, equity, retention, and persistence to obtain a quality education.

7.3. Results and conclusions

Nontraditional students possess different learning behaviors and levels of motivation (Knowles, 1984; Pelletier, 2010). However, incorporating the principles derived from the literature on traditional students, allows instructors to adapt and use digital games to support the nontraditional learners. For example, digital games, were used in computer science programs to enhance student learning for traditional learners (Angel, Caudell, & Whitmore, 2017). Other fields where traditional students have experienced positive outcomes include medical education, particularly in preparing nursing students (Blakely, Skirton, Cooper, Allum, & Nelmes, 2008). Business is another area where simulations are incorporated to model real-life situations that traditional students may encounter in their discipline (Davis, 2011; Tanner, Stewart, Totaro, & Hargreave, 2012). Digital games are used in many disciplines including: Cartography, Corporate Training, Mathematics, Microbiology and Electromagnetic Theory (Beylefeld & Struwig, 2007; Chen, Liao, Cheng, Yeh, & Chan, 2012; Feeney, 2007; Kumer & Lightner, 2007; Thomas & Mead, 2008).

Learning by way of active participation and drawing inferences from that experience is a core idea of the constructivist theories of learning (Facer, n.d.; Rogoff, 1994; Vygotsky, 1980). Digital games in education provide an interactive and hands-on learning experience, especially when experiential learning is used to engage adult learners (Knowles, 1984). The digital games and simulations take students into another world and let them experience life in another dimension (Nkonyane & Van Wyk, 2015).

When used as a supplemental tool in online courses, digital games have a positive influence on the motivation, academic achievement, and retention of nontraditional students pursuing an undergraduate degree (Snow, 2016). The use of digital games as supplemental learning aids promotes students' confidence, satisfaction, interest, and effort (Keller, 2008). Digital games provide an

authentic context for skill acquisition, and help relate what students learn to their everyday life which is supported by the situated learning theory of Brown et al. (1989).

The study was designed to provide information on digital game-based learning for nontraditional learners that will enable educational administrators, leaders, policymakers, instructors, and decision-makers to better understand the complex issues surrounding the educational needs of nontraditional students. A second purpose was to show how digital games support efforts to improve learner persistence, access, equity, retention, and persistence. The goal is to enable educators in providing a higher quality education for nontraditional students.

7.4. Recommendations

The findings indicate that using digital games in courses for nontraditional undergraduate students have benefits in areas of academic achievement. The use of digital games is recommended in undergraduate programs for promoting and developing problem-solving, critical-thinking skills (Trybus, 2014), and achieving the learning goals of instruction (Adachi & Willoughby, 2013). Using digital games as supplemental tools in courses for nontraditional students are recommended to improve cognitive skills such as memory and reasoning (Granic & Lobel, 2013). Since digital games have the potential to increase student success, Ma, Jain, and Anderson (2011) recommend educational game developers consider these factors in game design. A further recommendation is that course designers and educators incorporate games aligned with the course content (Brady & Devitt, 2016), and that digital games are selected which target instructional goals to maximize learning. Another recommendation is to include digital games as supplemental tools to increase class relevance and learning engagement (Park & Choi, 2009). A final recommendation is that digital games be related to learners' career, job or life to develop transferable and marketable skills to the workforce (Park & Choi, 2009). The sparse number of articles found that explored or assessed the experiences of nontraditional students for this study exposed a gap in the literature. In the first decades of the twenty-first century, nontraditional undergraduates are entering undergraduate programs in greater numbers (New, 2014). The purpose of this scoping literature review was to frame the discussion surrounding digital game-based learning as it pertains to nontraditional students, create meaningful dialog, identify existing gaps, map out relevant literature, and synthesize findings from various studies.

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