Let the Games Begin: Evaluation of Gamification for Health Informatics Students

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Abstract

Health Informatics is a growing concentrated field within information technology, which bridges communications and healthcare to improve governance and safety of patient information. The challenge is for health educators to integrate emerging interactive technology efficiently to assure new information is relayed, received and applied by health informatics students to the dynamic genre system of health information. Since traditional lecturing methods fail to encompass the dynamic genre system of health information, research communicating the effectiveness of game science technology has moved to the fore. Gamification answers the argument of using interactive technology to create a personalized and cooperative learning environment that provides health informatics students relevant skills to better facilitate enculturation into the workplace. This study aims to evaluate the literature on gamification for adult and health informatics education, and the effectiveness of gamification experiences on the enculturation of graduate students into responsible and responsive health professionals. The evaluative framework of this study is Knowles' Andragogy, the adult characteristic learning theory, from the perspective of Merriam and Bierema in *Adult Learning: Linking Theory and Practice*. I use this foundation as a divergent well-respected system that defined theoretical constructs, insights and understandings for educators and technical communicators over many generations. Three databases were used in the search: ERIC, PubMed and Summon. A total of 337 articles from electronic databases were identified. The final selection of 20 expert writings were the most illustrative of the topic. Results indicated gamification, as an educational technology, cooperated with the theoretical learning contributions of Malcolm Knowles, and

was recognized as a resourceful and effectual concept to assist the next generation of health informatics professionals. But the literature only offers revisions to theory, with limited practical applications and less mentions of solutions. The neglect, in this regard, arises primarily from the lacking evidence-based documentation of the educational efficacy of gamification. Thus, I investigate how technical communicators can make an important contribution to the game development industry and why the field of technical communication gains from close involvement with the emerging industry of gamification technology. I discuss ethical concerns encompassed in technological instruction and suggest novel curriculum that empower students to propel beyond the zone of proximal development towards an adaptive and inclusive global health perspective.

Introduction

Global advances in technology present challenges to traditional face-to-face rostrum teaching in a formal, cognitive learning discourse community. There is little doubt, "technology infused in lives of today's learners" is shaping not only the context of learning, but the learning itself (Merriam & Bierema, 2013). This 21st century trend plays a significant role in transforming online educational programs, which "until recently, there has been relatively little thinking, investigating, and writing about adult learning" (Knowles, Holton III, and Swanson, 2015). Instructional games can provide effective learning for a various learners and tasks in the domains of higher declarative knowledge, procedural knowledge, and retention (Kapp, 2012).

Subject: Engagement in online programs is difficult to maintain (McDougal, 2010). Gamification offers increased engagement through the inclusion of game-like elements or the incorporation of learning within a game-based application in non-game contexts (Karp, 2012). One practical

implication of measuring the value gamification brings to education is the incorporation of technical communicators as the unrecognized documentation gurus of the game development industry (Deterding, Dixon, Khaled, & Nacke, 2011). Technical communicators are positioned to situate themselves as professionals who move seamlessly from creating internal artifacts to developing user-experience strategies for various content in emerging gamification formats, forms and designs (Moeller, 2014). With the ability to manage projects, document processes and workflows in dynamic team environments, a technical communicator can easily become an asset to any organization (Moeller, 2014). **Purpose:** A serious need exists for health information genre professionals who understand the demands of this dynamic field. Traditional information systems degree programs fail to adequately prepare students to enter the dynamic demands of today's healthcare environment (Campbell, et al, 2012). Most importantly, the fundamental role of gamification in health education increases research data needed to study the processes of interactive learning and to improve curricula and strategies for teaching advanced health technology (McDougal, 2010). I propose a blended learning curriculum for a baccalaureate health informatics degree that combines gamification technology and cognitive classroom instruction, built on the theoretical principles of andragogy to deliver a graduate that can function proficiently in our complex, global healthcare genre system. **Main Point:** Health informatics systems require well-trained teams for delivery of quality services to effectively improve health outcomes, minimize costs, and advance global healthcare in the 21st Century. The works in this evaluative, annotated bibliography present evidence in support of gaming science innovation as an effective learning tool that promotes motivation of student engagement (in cognitive and interpretative construction of knowledge) for decision making in

complex scenarios. According to Knowles (2015), concepts such as "experience, readiness to learn, and internal motivation" are essential in preparing graduates for future roles in a global healthcare system. My goal in this paper, therefore, is to evaluate gamification as an effectual, technological tool (for the adult learner) in an online health informatics discourse community. In order to reach this goal successfully, I evaluate novel curriculum to address the specific learning needs for this type of program. Lastly, but most importantly, I plan to evaluate the role technical communication plays in the rapid, intense paradigm of interactive game development technologies. If we (technical communicators) focus on properly writing gamification concepts into learning instruction, we can revolutionize healthcare and engage students to be responsible and responsive health professionals throughout the 21st Century.

Methods

Choice of Methods

A. Databases

Articles were identified by searching three electronic databases: ERIC (39), PubMed (92) and Summon (206). Databases were filtered by full text available and peer reviewed journals. An initial search produced a total of 337 scholarly articles.

B. Electronic Textbooks

E-textbooks were identified by searching the VitalSource database. A total of (26) textbooks were suggested and filtered further by title and author. I selected (3) textbooks from my personal VitalSource electronic library collection and added (2) topic related textbooks.

Collection of Methods

a. Collaborative Effort

   Collaboration with NCSU librarian, Cindy Levine, identified respected experts in the field of adult learner theory.

b. Keywords

   The keywords used in the search were “gamification”, “education”, “health informatics” “adult”, “learner” and “curriculum”.

c. Inclusion Criteria

   Relevant articles were those that (1) focused on the use of specific educational gaming in comparison to the lecture setup, (2) used educational or instructional gaming as a teaching tool, (3) applied educational gaming in relation to adult learner theories.

d. Exclusion Criteria

   Irrelevant articles were excluded if the paper (1) used card-based games, (2) was related to clinical healthcare (3) covered subjects that are not related to health professions, (4) date preceded 2008, (5) focused on k-12 students (6) focused on patient education.

Analysis of Methods

A final analysis included fifteen articles and a total of five e-textbooks. I used two e-textbooks to study adult learning theory and three e-textbooks to study gamification theory. I recorded the remaining textbooks and articles bibliographic information using RefWorks ProQuest.

Lastly, I evaluated and annotated a summary of my findings to purpose my research questions. Wherefore, I seek literature to answer the following: (a) does gamification cooperate with adult learner characteristics? (b) does gamification increase engagement and improve outcomes for health informatics? (c) can gamification integrate into novel curriculum? (d) what role can technical communication play in the game development industry?

Annotated Bibliography Part I

Evaluation of Adult Learning Theory

Merriam, S. B., Bierema, L. L. (2013-10-14). *Adult Learning: Linking Theory and Practice*. [VitalSource]. Retrieved from https://bookshelf.vitalsource.com/#/books/9781118419106/

Adult learning theories provide educators insight (into how adults learn) to be more effectual in their practice and more responsive to the students they serve (Connor, 2012). There are many adult learning theories, including: andragogy, neuroscience, experiential, self-directed, and transformational (Gutierrez, 2018). Learning theorists have provided extensive literature attempting to elucidate the processes of learning, in individual and in group and social settings (McDougal, 2010). Moreover, since these theories employ mainstream educational research, it may benefit technical communicators to remain abreast of the emerging, technological advancements in educational learning methods. From the outset in the game development cycle, internal documentation, concept proposals, game designs and technical production manuals are being shared, read, revised and re-revised by a vast array of technical writers in many different roles (Moeller, 2014). As Stan Dicks stated in 2010,

"Although there is a big difference in how communicators write for a single source database versus how they write traditional documentation, they still fundamentally use words and images to help people accomplish their goals." Therefore, to determine if gamification can enhance adult learner educational experience, I must first evaluate adult learning theories. Throughout the study, the term "learning theory" will reflect the assumptions identified in the following, theoretical framework.

Andragogy

Knowles, M. S., Holton III, E.F., and Swanson, R.A. (2015). The Adult Learner, 8th Edition. [VitalSource]. Retrieved from https://bookshelf.vitalsource.com/#/books/9781317812173/

Andragogy referred to the specialized pursuit of effective curricular design and instruction delivery for adults (Knowles, Holton III, and Swanson, 2015). In 1968, Malcolm S. Knowles introduced andragogy to American educators as "A new label and a new technology" of adult learning (Merriam and Bierema, 2013). Andragogy differed from the traditional pedagogy model concerned with transmitting information and skills, whereas andragogy provides procedures and resources for helping learners acquire information and skills. The basic theories are extensive in the design of adult-oriented training programs (Merriam and Bierema, 2013). To further explore this claim, I evaluated andragogy to determine the value-addedness gamification may bring as an emerging, technological tool sympathetic to the transactional model of the adult learner. In 1980 Knowles popularized the concept of andragogy posited as a

set of four assumptions (figure 1) about adult learning characteristics, the last two assumptions included were in later revisions (Connor, 2012).

Knowles Andragogy Characteristics
1. Need to Know: Reasons for learning something
2. Self-Learning: Moves from dependency to increasing self-directedness
3. Adult Learning Experience: Draws on accumulation of life experiences to aid learning
4. Ready-to-Learn: Assumes new social or life roles
5. Problem-Centered: Wants to apply new learning immediately
6. Motivation: Learns by internal, rather than external, factors

Figure 1 Knowles Andragogy Assumptions

Andragogy professionalized the field of adult education by establishing a knowledge base unique to adult learners (Merriam and Bierema, 2013). Motivating factors suggested in this statement, falls in accord with Kapp's research on gamification that, "A key concept of game play is motivation" (Kapp, 2012). As an example, intrinsic motivation is when a learner opens a book and reads for self-fulfillment not because of some external reward (Kapp, 2012). The authors further state, "Learning is the construction of meaning from experience" (Merriam and Bierema, 2013), which highlights gamification valuable to the "adult learning experience". For example, at the beginning of an instructional game activity, the player may be required to create a virtual avatar for identification. Subsequently, the student's experience as an avatar can change their real-life perceptions. "Human knowledge is essentially collective, and social life constitutes an essential factor in the creation and growth of knowledge, both prescientific and scientific" (Kapp, 2012). This statement suggested gamification may also address the

andragogy characteristic, "ready to learn". Regrettably, andragogy is not without criticism. Brookfield (2003) called the theory "culture blind," and stated the concepts of self-directed learning and teacher as facilitator of learning may neglect races and cultures that value the teacher as the formal source of knowledge and direction (Connor, 2012). Yet, despite the centrality of moral concerns to the practice of adult education, the concept of moral learning was curiously absent from the literature of the field. Knowles, Holton III, and Swanson (2015) discussed strategies educators can use as "mediators of students and environments, not simply as givers of information and managers of behavior." One strategy includes making learning "authentic" through virtual field trips, case studies, and problem-centered learning (Merriam and Bierema, 2013). Regarding the "need to know" aspect of the adult learner, gamifying adult education was applicable as an informational learning tool (Kapp, 2012).

Evaluation of Gamification Theory

Kapp, K. M. (2012). The gamification of learning and instruction: Game-based methods and strategies for training and education, 1st Edition. [VitalSource]. Retrieved from https://bookshelf.vitalsource.com/#/books/9781118192009/

Games support social activities to motivate exercise, training, or skill development (Nacke, 2015). The idea of incentivizing people is predictable, but the term "gamification" didn't enter the mainstream vocabulary until 2010 (Kapp, 2012). It is suggested gamified applications provide insight as emerging, trendy, gameful complementary phenomena (Deterding, Dixon, Khaled, & Nacke, 2011). Gamification is a multidisciplinary concept spanning a range of theoretical and empirical knowledge, technological domains and platforms driven by an array of

practical motivations (Dichev and Dicheva, 2017). The statement suggested aligns with Knowles'

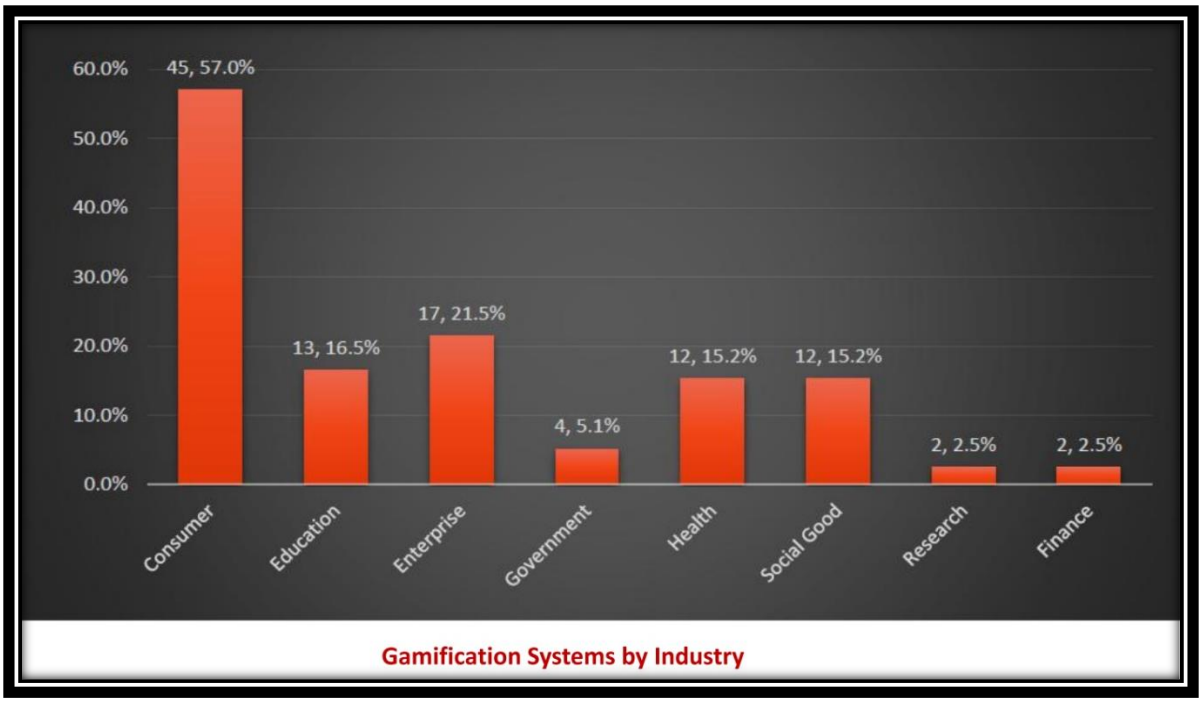

FIGURE 1. FLOW DIAMGRAM OF THE STUDY SELECTION PROCESS

Retrieved from http://scholar.aci.info/view/14b17afb5db00160009/14b197d7b8c0b2a014d

research in that, "A key concept of game play is motivation" (Kapp, 2012). In an attempt to best capture the underlying concepts and practices, gamification has been defined in several ways, such as "the use of game design elements in non-game contexts" (Deterding, Dixon, Khaled, & Nacke, 2011), "the phenomenon of creating gameful experiences" (Hamari, Koivisto, & Sarsa, 2014), or as stated by Werbach (2014), "the process of making activities more game-like" (Dichev and Dicheva, 2017). Gabe Zichermann who wrote the book Game-Based Marketing, defines the term gamification as the "process of using game thinking and mechanics to engage audiences and solve problems" (Kapp, 2012). Figure 1 identifies "non-game contexts", which referred to industries outside of game play. Nacke and Knowles collaborated to provide a framework for gamified education in this conclusive statement, “Games engage players to

overcome self-imposed challenges by means of intrinsic motivations." Knapp likewise identifies future implications in the following summary:

> *A focus on gamification increases engagement, relevance, and immersion and assists with the transfer of learning to the actual situation. Educators will be called upon to match different game strategies with theory driven learning content to create the right learning outcome. College faculty, learning professionals, and others in the field of learning and education must gain knowledge of how gamification techniques can be used in a variety of settings to improve learning, retention, and application of knowledge* (Knapp, 2012).

The increased popularity of online role play games, in such industries as health, retail sales, and social media led to a proliferation of gamified, collaborative, and learning techniques. Learning and development professionals must follow that trend or be left behind (Moeller, 2014).

Annotated Bibliography Part II

Adult and Health Informatics Education

Adult Education

The expert texts I reviewed illustrated andragogy and gamification can be used promote adult learning in a dynamic and motivating way. The following evaluated works further correlate the use of gamification as an effectual and engaging learning tool in adult education.

Dichev, C., & Dicheva, D. (2017). Gamifying education: What is known, what is believed and what remains uncertain: A critical review. International Journal of Educational Technology in Higher Education, 14(1), 1-36. doi:10.1186/s41239-017-0042-5

This comprehensive, empirical study actively explored and supported gamification (mainly for its potential to motivate) in education. Motivation is one important characteristic of adult academic achievement, which influences the effort and time a student spends engaged in learning online. I found the visual aids and tables about gamifying education useful as an evidence-based quantitative measurement in support of gamification. One critical gap identified in the text suggested, although simulations can help overcome insufficient motivation and engagement, there were a lack of studies evaluating the effects of gamified simulation-based learning.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (Sep 28, 2011). From game design elements to gamefulness. Paper presented at the 9-15. doi:10.1145/2181037.2181040Retrieved from http://dl.acm.org/citation.cfm?id=2181040

The authors in this article investigated comparative definitions of gamification. In a direct quote, that substantially impacted the direction of my research, the authors stated, "We believe that "gamification" does indeed demarcate a distinct but previously unspecified group of phenomena, namely the complex of gamefulness, gameful interaction, and gameful design, which are different from the more established concepts of playfulness, playful interaction, or design for playfulness." Results encouraged the use of gamification (as a self-directed activity tool) situated within the

socio-cultural trend of "ludification", which is the introduction of playfulness into our lives and culture. The four authors have over 75 technology-related articles between them. Therefore, I found this article useful as a solid reference, in support of further research into gamifying education.

Looyestyn J, Kernot J, Boshoff K, Ryan J, Edney S, Maher C (2017) Does gamification increase engagement with online programs? A systematic review. PLoS ONE 12(3): e0173403. https://doi.org/10.1371/journal.pone.0173403

These South Australian authors presented research that brought a global outlook regarding online student engagement. The authors used eight databases in this literature review and the results determined individuals will probably remain engaged in an activity if they find it enjoyable as well as of value. Findings in this article established gamification as a concept that first emerged in a computer games context in 2002 and became more widely known from about 2010. Conclusive research supported the use of gamification to determine the effects of gamification in online student engagement. I found this study necessary to substantiate further research is needed in gamified education.

Rondon, S., et al. (2013). Computer game-based and traditional learning method: A comparison regarding students' knowledge retention. BMC Medical Education, 13(1), 30. doi:10.1186/1472-6920-13-30

These Brazilian authors presented a case study to determine knowledge retention in game-based learning. Students were chosen randomly to participate in one of the

learning methods meanwhile the data analyst was blinded to which method of learning the students had received. The findings indicated game-based learning compared to traditional learning in general and in short-term gains, while the traditional lecture still seemed more effective in improving students' short and long-term knowledge retention. This conclusive finding supported the need for further research into gamification as a knowledge retention tool for adult learners.

Young, S., & Nichols, H. (2017). A reflexive evaluation of technology-enhanced learning. Research in Learning Technology, 25, 1-13. doi:10.25304/rlt.v25.1998

This article explores the experiences of two academics in a UK Higher Education Institution who have embedded digital learning approaches within their curriculum delivery. This article aimed to provide a reflexive account of improving student experience with learning technologies and offered insight into how student engagement can be enhanced with such digital tools. The article concludes with recommendations for embedding technology, whilst acknowledging the well-established value of face-to-face interaction. I found this evaluation particularly useful as a comparison to the approach taken in my study.

Health Informatics Education

Health Informatics is a specialty that combines the skills of both Health Information Managers and Health information Technicians. Responsibilities of health informatics include collecting, analyzing, presenting data in digital format, and supporting of healthcare information to nurture partnerships between a patient's various healthcare providers. Health Informatics plays a critical role in the push towards global healthcare reform by applying informatics concepts,

theories, and practices to real-life situations to achieve better health outcomes (USF, 2018). The following evaluated works further correlate the use of gamification as an effectual and engaging learning tool in health informatics education.

Khosrow-Pour, D. B. A., Mehdi. (2017). Trends in healthcare information technology and informatics. (pp. 3805-3815) IGI Global. doi:10.4018/978-1-5225-2255-3.ch330 Retrieved from http://ncsu.summon.serialssolutions.com/2.0.0

This authoritative fourth edition encyclopedia is a widely inclusive, well-established source designed to disseminate the most forward-thinking and diverse research findings. With critical perspectives on the impact of information science management and new technologies in education settings, including but not limited to computer science, education, healthcare, government, engineering, business, and natural and physical sciences, it was a pivotal and relevant source of knowledge that reinvigorated my research into gamification, health education, and technical communication within the field of information science and technology.

Tóth, L., Adorjani, A. K., KATAI, Z., Sapientia University, & S.C. Neogen S.A. (2014). Multi-sensory informatics education. Informatics in Education - an International Journal, 13(2), 225-240. doi:10.15388/infedu.2014.04

These European authors developed a didactical method identified as "Multi-Sensory Informatics Education", to improve the teaching-learning process of sorting and recursive algorithms. The technologically and artistically enhanced learning curriculum presented has the potential to promote intercultural computer science education. The

context supported the adult learning characteristic of intrinsic motivation as a determinative influence on increasing students' engagement. Although the healthcare industry is not the audience targeted in the article, the findings are relevant and should be considered.

White, E. J., Lewis, J. H., & McCoy, L. (2018). Gaming science innovations to integrate health systems science into medical education and practice. Advances in Medical Education and Practice, 9, 407-414. doi:10.2147/AMEP.S137760

This paper introduced gaming as a lens to magnify Health Systems Science (HSS) integration into the scope of medical education and practice. Health systems science (HSS) is an emerging discipline addressing multiple, complex, new perspectives to accelerate changes in medical education and practice to meet the needs of evolving populations. The authors brought a wealth of collaborative knowledge from varied disciplines. The consortium agreed "In health care, where errors can result in dangerous injuries or loss of life, game-science innovations (GSI) hold the promise of safe environments for practice, attainment, assessment, and fine-tuning of skills crucial to improve real-life outcomes. The authors further concluded "existing literature is fundamentally favorable toward gamification uses, benefits, and outcomes."

Kostenius, C., Hallberg, J., & Lindqvist, A. (2018). Gamification of health education. Health Education, 118(4), 354-368. doi:10.1108/HE-10-2017-0055

This article provided an exhaustive framework for understanding gamification solutions as well as a generative model for designing future teaching and learning in health

education. I found this article necessary research to bridge to Kapp's (2015) concept of cognitive apprenticeship (grounded in the theory of situated cognition), which suggested learning is naturally tied to authentic activity, context, and culture. The authors highlighted four distinct and related ways in which games have been used and might be used in higher education. The categories are fluid, and each encompassed a range of activities and ways to use games, which further supported a correlated adult learning concept that, “the student and the environment in which they are learning are dynamic cannot be separated in an analysis of learning” (Merriam and Bierema, 2013).

Novel Curriculum

Making the most of emerging technology may help minimize the delay between graduation and fully functioning health care professional. The following evaluated works further correlate the use of gamification as an effectual and engaging learning tool in novel curriculum.

Campbell, S.M. et al. (2012). Treating the healthcare workforce crisis: A prescription for health information curriculum. Retrieved from http://lib.myilibrary.com?ID=54222

In 2012, the professors at the University of Alabama proposed the following, "In order to provide students with an education that equips them to work with HIT resources in the different areas available in the healthcare field, it is necessary to build a curriculum that includes courses from several different traditional healthcare specialties as well as information systems." They presented strong statements throughout, for example, "Traditional university training programs that require a student to choose between being a technologist or a healthcare practitioner are inadequate." "As Hersh (2010)

notes, a well-trained HIT professional should have knowledge not only of information technology, but also of healthcare, business and management, and other disciplines." They proposed, "It is necessary to create a new degree program that blends the elements of a traditional information systems curriculum with the healthcare environment training that will be needed to work in a hospital or other healthcare organization." I found this claim valuable to further my research into novel curriculum for higher education.

Fan, K., Xiao, P., Su, C. (2015). The Effects of Learning Styles and Meaningful Learning on the Learning Achievement of Gamification Health Education Curriculum. Eurasia Journal of Mathematics, Science and Technology Education, 11(5), 1211-1229. https://doi.org/10.12973/eurasia.2015.1413a

According to these Taiwanese authors, the framework for instructional design derived from Meaningful Learning and followed the principles of digital game-based multimedia models, which supported "learning with fun". In light of this research, I discovered several digital game strategies used to improve learning outcomes for adult learners.

Mozelius, P. and Rydell, C. (2017). Problems affecting successful implementation of Blended Learning in higher education: The teacher perspective. International Journal of Information and Communication Technologies in Education, Vol. 6: 1, p. 4-13.

Blended learning environments in higher education is an emerging trend in the 21st century. The definition of blended learning is so broad any learning environment in higher education might be included. Many research studies reported the pros and cons

of blended learning from the university and the learner perspective. The author identified changes in current curriculum can be made to improve learning outcomes to prepare novice graduate students to perform responsibly and reflectively as industry professionals. However, "incorporating gamification into online education must be designed carefully otherwise there is a risk for low motivation and high drop-out rates" (Mozelius & Rydell, 2017).

Technical Communication

The following evaluated expert texts reinforce the supposition technical communicators have a unique opportunity to make an important contribution to the game development industry.

Dicks, R.S. (2010). Digital Literacy for Technical Communication, 1st Edition. Chapter 2 [VitalSource]. Retrieved from https://bookshelf.vitalsource.com/#/books/9781135236755/

R. Stan Dicks, PhD spent a lifetime working and teaching in the field of technical communication. Dicks truly impacted my understanding of digital literacy for technical communicators. Dicks impressed the importance of remembering that current and coming trends in technical communication have largely to do with the technology associated with expressive translation. In order to insert ourselves properly into the technical strategies of gamification content documentation and strategy, we must brand ourselves as value-added and essential in cost reduction, cost avoidance, and increased profitability. In support of this point, White, Lewis, & McCoy stated, "technical communicators must consider the future opportunities, challenges and responsibilities to stay relevant in the context of gamification documentation." Many technical communicators would agree

chapter two was a road map for future advancement congruent to success in game development and design documentation.

Moeller, R., M. (11/2014). Computer Games and Technical Communication: Critical Methods and Applications at the Intersection. [VitalSource]. Retrieved from https://bookshelf.vitalsource.com/#/books/9781472426420/

Associate Professor Moeller put a collection of his works together in this 2014 anthology to identify a myriad of points that highlighted the role technical communication plays as an integral part of the game development industry. Several research studies recognize trends in content strategy to advance the field of technical communication in game development technology. As the author reminded the audience "ethos and ethics have always been connected through technical writing." Moeller went further to reference a quote from Peterson (2004) that stated, "technical communicators have a place in the multibillion-dollar gaming industry." Throughout the sixteen chapters of this textbook, Moeller reiterated the opportunities and lack of tangible intersection between computer game software developers, technical communicators, and documentation practices. Compelling questions centered on why technical communication, as a locus of practices and professionals, remains virtually unseen in the gaming industry.

Discussion

From informal topics of interest to higher education courses, online learners engage in a wide variety of activities. Gamifying education incorporates game design elements into educational activities to increase motivation. Gamification creates an environment for self-directed learning, which is a key determinant of andragogy. Studies suggested gamification methods

increase enjoyment and engagement (Looyestyn J, Kernot J, Boshoff K, Ryan J, Edney S, Maher C., 2017). A strong indication has been presented that gamification is warranted in higher institutional environments. This requires a fundamental change for educators, from didactic teacher to facilitator of learning.

Gamification and Online Adult Education

Changing career paths and encouragement of lifelong learning has made available a wide range of online education programs designed for older adult learners. Despite the plethora of journals and books devoted to adult learning across the world, we are miles away from a universal understanding of adult learning (Brookfield, 2017). Hewlett Packard has estimated what is learned in a Bachelor of Engineering program is outdated or "deconstructs" in 18 months, and for technology related fields the half-life is even less. As explained heretofore by Knowles, adult learners seek experiences worth their time, and relevant to their lives. Education should be learner centered, and educational models should be relevant enough to sustain adult learning theory. Gamification is a potent tool for addressing the characteristic of "need to know", in which learners discover for themselves the gaps between where they are now and where they want to be. Gamification is likewise the perfect tool for the learning needs of mature adults, which may lead to better outcomes due to greater confidence, self-awareness, and problem-solving abilities gained through life experiences.

Gamification and Health Informatics Education

Health Informatics students must become self-directed, lifelong learners "for jobs that do not yet exist, with technologies that have not yet been invented, to solve problems that we don't even know are problems yet (Merriam & Bierema, 2013). The overwhelming demand in EHR's

and health information systems, overall, has created a personnel shortage that is skilled in both technology systems and healthcare management. Health informatics students engage in revenue driven calculations and statistical data techniques. Therefore, gamification becomes an effective strategy to increase engagement as established in the literature reviewed. While health information managers (HIM) and the technicians that design, support, and use health information technology (HIT) have traditionally been coevolutionary, ongoing changes in health information system and workflow has yet to address the growing the HIM/HIT workforce. Online university training programs that require a student to choose between studying health information technology or management are inadequate. Subsequently, a program that spans such a wide field of specialties, products, and geographical regions must stay abreast of current and emerging roles and trends. As Hersh (2010) notes "a well-trained HIT professional should not be versed only with information technology, but also with healthcare, business and management, and other disciplines." The continued research in support of andragogy speaks to the durability and utility of Knowles' framework for planning and implementing programs for adult learners. Andragogy's appeal presented the possibility that educators who encounter it can relate the characteristics to their learning experiences and in so doing, then transition to planning substantial curriculum for adults. As an adult learner and recent online HIM graduate, I agree with these corresponding points and propose a review of current HIM/HIT curriculum to include practical, problem-oriented and motivating gamification elements. In order to satisfy the new health information workforce demands, a combined HIM/HIT online health informatics systems gamified degree program needs consideration. However, health informatics students

require clinical practicum in a face-to-face environment. A potential solution may be a blended learning curriculum.

Gamification and Novel Curriculum

Mozelius identified a blended learning environment as the opportunity to combine the best of a traditional classroom education with technical learning enhancements (Mozelius and Rydell, 2017). The prime objective created a richer learning process for motivating students by combining face-to-face sessions with corresponding online activities (Bourne & Seaman, 2005) with a multi-sensory overload that could satisfy the needs for various study techniques and adult learning styles (Mozelius and Rydell, 2017). Adult education professionals should develop and debate adult learning models separately from the goals and purposes of their respective fields. For example, Nagelhout (1999) delineated four primary literacies that instructors should actively encompass in an adult learner curriculum: rhetorical, informational, visual, and technological. An evaluation of expert works indicated gamification successfully integrates andragogy, primary literacies and game thinking technology to engage people, motivate action, promote learning, and solve problems. In light of the (face-to-face and technological) needs of online health informatics students, I propose a new online HIM/T program incorporated with gamification activities that support the core assumptions of andragogy in a blended learning curriculum. Such a proposal should also consider the dearth of emerging technologies available for new programs (Campbell et al, 2016). Further research is required to better determine whether an original framework to support the complexities of gamification for health professionals should also be designed.

Gamification and Technical Communicators

Technological research is an important and fundamental provision of substantial increase in our authority as technical communicators to study the processes of learning, and consequently improve approaches and strategies to reconfigure user-experience (McDougal, 2010). Dicks, a pioneer in the industry of technical communication for many decades, capitulated the value the industry receives as essential was determined by the support economy of customer demand. One opportunity identified for technical communicators to insert ourselves as valued in game development sciences is our digital literacy. According to Moeller (2014), formative writing literacies in game development are difficult to parse through due to the game-based jargon and virtual persona concepts. Thus, technical communicators must stay ambient to novel concepts in computer science to remain relevant in the 21st Century. Knapp (2012) stated in his chapter four takeaway, “Better learning outcomes for instructional games may be the result of including instructional designers in the game development process.” Cargile Cook extended this point further and reasoned, "today, technical communicators should be multiliterate, possessing a variety of literacies that encompass the multiple ways people use language in producing information, solving problems, and critiquing practice" (Moeller, 2014).

Implications

Ethical Concerns

A need to examine the ethical concerns encompassed in partnership of technology and health education regarding rhetorical technique, virtue, and expediency remains. Katz (1992) brings to our attention, educators and technical communicators must consider (the idea) that rhetoric is

the transparent, intended result of equal parts credibility, emotion, and logic. Therefore, we must carefully avoid creating the refashioned dialectic traditions we were changing in the first place. This is usually a result of expediency frosted atop deliberation seeking a means to an end, but not necessarily an end (Katz, 1992). In other words, gamification is a tool and not the answer to the rise in educational costs. As Jane McGonigal, author of Reality is Broken, states, "Gamers are ultimately super-powered, hopeful individuals" because they have become virtuosos of four key concepts through their interactions with games: urgent optimism, social fabric, blissful production, and epic meaning. Results suggested a need to include ethical study objectives in electives to facilitate ethical programs throughout the curriculum and encourages students to adopt structured approaches to complex ethical issues including cross-cultural negotiation and to enhance global health training activities. As Moeller (2014) introduced ethos and ethics in the role of technical communicators, the results of this study also affirm the need for a focus on ethics in health education curricula for the adult learner. However, the utilization of gamification is good; we must continue in research to uphold the moral responsibilities as professionals.

The Digital Divide

> The concept of the digital divide originated in the mid-1990s. The term referred to a lack of internet access among racial and ethnic minorities, persons with developmental disabilities, those of low socioeconomic status, and/or those living in geographically remote areas of the country (Stellefson, Chaney, and Chaney, 2008). The phrase also encompassed contextual issues such as access to technological hardware and software,

and the skills, resources, and literacy necessary to operate and benefit from digital applications (Stellefson, Chaney and Chaney 2008). In 2012 Zickuhr and Smith (2012) introduced the Pew Internet Project, which surveyed 2,260 adults age 18 and older in both English and Spanish to measure differences in Internet use in the United States. The study found Internet access was inaccessible to one in five United States adults, particularly Spanish-speaking senior citizens, individuals with less than a high school education, and those in households earning less than $30,000 per year (Merriam & Bierema, 2013). This poses a problem for the adaptation to gamification in education programs directed at two-year colleges and short-term certification programs. However, the report indicated the use of mobile phones “changed the story” for certain groups traditionally represented in the digital divide. For example, young adults, minorities, those with no college experience are more likely than other groups to say that their phone is their main source of Internet access” (Stellefson, Chaney, and Chaney, 2008). Although bridging the digital divide remains an ongoing national concern for many industries, the expansion of interactive technology in adult education may play a primary role in further reduction (Merriam and Bierema, 2013).

Mayumi Kominami, et al. (2007) suggest, however, that the digital divide may be simply illusory driven by cultural inequities such as income and literacy. A decade later, the evolutionary nature of the digital divide should be reconsidered in respect to today's increasingly technological world. Suggestions in this annotated bibliography have been made about how educators can enable the use of technology to better address, and subsequently shorten the digital divide.

Limitations

One limitation discovered, during my research, included the lack of published curricula information, which means educators are unwilling to act collaboratively regarding this already time-consuming educational method. Additional research is necessary for further advancement in the direction of novel curriculum.

The larger limitation revealed during the literature analysis, included the lack of available online health informatics game activities available online to review. The problem resulted from the lack of evidence-based research studies focused on the use of educational efficacy in gamified curriculum. Further research is required to determine the use of element standards in gamification activities for health informatics education.

Conclusion

The vagaries in the digital world over the last decade cause adults, in this generation, to expect advanced technology in social, retail, and health communication. Similarly, adult learning should elevate from traditional facilitator learning methodologies to dynamic multi-sensory learning experiences. Especially when health care education directly affects patient and population outcomes. Studies show gamification may potentially provide safe learning environments to practice critical problem-centered and decision-making skills. Research of technology and ethical implications maximize the idyllic role of technical communicators to further advance in the realm of gamification (as far as documentation, information design, and content strategy is concerned). Gaming technology holds promise to engage and equip health

informatics students with the knowledge and skills required to be responsible and responsive health professionals. Ultimately the goal is to empower graduate students, which work in complex technical systems, to navigate health information, reduce costs, and improve patient outcomes throughout the 21st Century.

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