Games/Simulations for Health: Tracking Down the Evidence on Efficacy

Ulrike Dieterle, M.A., M.L.S.
Coordinator, Distance Services and Outreach
University of Wisconsin-Madison

Brief Overview of Games/Simulations for Health

Games have long been used in learning environments. The fun-factor has been used by teachers and trainers to increase and reinforce learning effectiveness. The use of virtual worlds for learning and exploring can be traced back to the days of MUDs (Multi-User Dungeons) and MOOs (MUD Object Oriented) text-based environments (Mon, 2009). While the integration of games into learning/training is, by no means, a novel idea, the marriage of advanced computer technologies and sophisticated graphics is a relatively recent trend. As high-end technologies have matured from the text-based products of the 1990’s to the graphical interfaces of today, interest in how to apply this synthesis is rising. Electronic games and virtual simulations are everywhere.

As we move between real and virtual spaces in our daily lives, there are increased expectations that game-like applications will be there. Three-fourths of students entering college today have played computer/video games since they were in elementary school (Oblinger, 2004). Many integrate games into their daily routines, whether through handhelds, laptops or spending time with friends in virtual communities. Games/sims are increasingly significant parts of our multi-tasking environments. They engage us, attract us and allow us to learn without even realizing it. Games, once primarily instruments of entertainment, now support learning/training initiatives, awareness raising, behavioral changes for better health, civic engagement, medical treatments and wellness (Sawyer, 2008).

The new learning and living modalities have not been lost on the healthcare sector. While healthcare has long embraced the use of simulators and mannequins for training and skills enhancement, health care professionals and educators have been cautious to embrace serious game applications for therapy, treatment, prevention and intervention. There are, however, indications in the growing body of literature that games/sims may be good alternatives or, at least, adjuncts to traditional practices. As games and virtual worlds become more powerful, they are getting more attention from even the most skeptical minded. The conventional wisdom, that games are unhealthy, have no educational benefit and, are generally a waste of time, is changing (Sawyer, 2008).

Three concurrent channels of change are converging to drive the way we learn, teach and communicate healthcare information.

1. The rapid evolution of advanced technologies is making it much easier to develop and access sophisticated immersive, interactive digital spaces.
2. There is a growing realization that interactive learning can be not only fun but also effective.
3. There is a growing level of expectation among children, adolescents and young adults that communication, learning and daily tasks should be interactive, engaging, challenge the senses and incorporate the best of evolving technologies.

Questions Explored

The literature review undertaken here focuses on serious games for health applications. Serious games are games that go beyond entertainment. As games and virtual environments are used in health
environments, the research, analyzing their efficacy, is also growing. The goal of this directed research is to evaluate what the published health literature tells us at this time, what levels of evidence are represented and if any trends can be identified. Questions asked before embarking on this research include: How much research is published on the topic of games and simulations in health in indexed journals? What is the literature reporting? Are the games proving effective in tackling some of healthcare’s more challenging issues? Are serious games being used effectively? What trends can be identified through the published literature?

**Methodology**

The National Library of Medicine’s database PubMed/MEDLINE <http://pubmed.gov> was chosen as the main resource for this literature review because of its size (over 18 million articles indexed to date), its scope (largest biomedical database) and because it is easily accessible to all via the Internet. PubMed/MEDLINE also provides a full citation structure, which includes text fields with medical subject headings (MeSH), publication types, year of publication and journal.

The medical subject heading (MeSH) “Video Games” provided the core search strategy. This MeSH term was chosen because it most closely defines the parameters of serious games, virtual simulations and virtual worlds within the PubMed/MEDLINE entries. This term was added to PubMed/MEDLINE in 1996. Its full definition is “a form of interactive entertainment in which the player controls electronically generated images that appear on a video display screen. This includes video games played in the home on special machines and on home computers, and those played in arcades.” This definition is interpreted broadly to include various forms of games-like, computer and video applications.

All references to and overlap with gambling were excluded from the search. The final search construction is “Video Games[MeSH]” NOT gambl*. Searching was limited to humans and by date range: 12/31/1990 – 12/31/2008. Some older records before 1996 are included due to reverse indexing by the National Library of Medicine.

Six hundred twenty-five unique article records were retrieved from PubMed/MEDLINE using this search strategy. Articles citations were moved to a bibliographic management system (RefWorks) and then to a Microsoft Excel spreadsheet where cells were isolated, sorted and sub-sorted to achieve individual counts of publication types (levels of evidence), publication dates, journals and MeSH terms used as major headings. Because information had to be manually manipulated, some margin of error may exist. Only major MeSH terms were analyzed to identify strong subject focus of articles. Secondary subjects were not included in this review. Concentrating on the major emphases of each article was construed as sufficient for this initial review.

PsycINFO and CINAHL were searched through the EBSCOhost interface. Neither showed significant numbers of articles involving games and virtual worlds or simulations. Their low numbers had no impact on this review.

**Findings**

This literature review of 625 articles resulted in a broad spectrum of evidence including 93 clinical trials of which 39 are randomized control trials, 62 comparative studies, 45 review articles, 4 meta-analyses and 1 practice guideline. Journals publishing articles on this topic most often include Cyberpsychology and Behavior, Epilepsy, Journal of Adolescents, Pediatrics and Archives of Pediatrics and Adolescents. And, while many research studies remain small and inconclusive, the rate of articles reviewing this subject area has increased dramatically from 2000 to 2008 showing an increased interest by researchers.
Two identifiable areas of study currently exist - one looking at potential uses of serious games/sims in structured environments to improve health and, the second, as extracurricular activities associated with adverse effects.

- Literature in this area is growing in volume
- New technologies are being incorporated into health contexts
- Detect shift away from analyzing negative impact to exploring health benefits
- Indexed literature of virtual worlds, e.g. Second Life, is still limited

Medical subject headings most frequently assigned to the 600-plus articles were plotted and analyzed. Older, pre-2005, articles tended to focus more on the negative aspects of exposure to playing video games for entertainment, while more recent literature explores the benefits of serious games used in therapy, interventions, programs and training. More serious games, both large and small, are being produced at a more rapid pace to address increasingly critical health problems, e.g. the national obesity crises is generating a flurry of studies on the efficacy of games to encourage exercise, promote healthy diets and promote prevention. Studies of “exergames,” or games to promote physical activity for all generations, are appearing in traditional journals. Exercise games such as Nintendo’s Wii Sport and Wii Fit or Konami’s DanceDanceRevolution (DDR) are proving that game technologies have many and varied uses. Their appeal and application are cross-generational. They proving to be not only inviting and engaging, but also healthful. An entire sub-field of research and development is growing around exergames, combing various types of exercise applications with game formats. As active learning takes the front seat, many realize that serious games technologies offer new options. Serious games have become cool calorie burners and engines for change.

Evidence found in randomized control trials focusing on games/sims shows that exergames such as DDR do reduce sedentary behaviors, that video game training can improve cognitive acuity in older adults, that Web-based games can be effective teaching formats for medical students, that electronically motivated activities can serve as interventions to better health and modify behaviors leading to positive change. Obesity prevention remains one of the most consistently studied areas and early evidence indicates promising results can be attained by incorporating serious video and Web games. Games are also used as distinctive therapy for children undergoing painful procedures. Games teach children to wash their hands and prevent outbreaks of MRSA. Games and virtual spaces have been successfully used with patients of stroke, PTSD, mobility limitations and other disabilities/conditions.

The evidence represented in PubMed/MEDLINE searches are often based on small studies. Higher levels of evidence, e.g., meta-analyses, are not numerous in this field, but are expected to grow in relation to the growth as use grows and lower levels of evidence multiply.

Conclusions

This review captured a snapshot of the published literature available through 2008 in bibliographic databases indexing health information which discusses the interactions of video games, computer games and virtual spaces in conjunction with health-related topics and issues. It is an overview, not an inclusive review. Searching PubMed/MEDLINE, PsycINFO and CINAHL provides a baseline for continued study. More detailed studies are recommended.

The consistent growth, the innovative approaches and the identified health benefits described in the literature of this area support the words of James Paul Gee who stated that digital games hold great promise for human development. Games and simulations present critical learning components necessary for 21st century survival skills (Gee, 2009)
References


Author Summary

**Ulrike Dieterle** is the Distance Services and Outreach Coordinator at Ebling Library for the Health Sciences, University of Wisconsin-Madison. She provides instruction in health resources, evidence-based information-seeking and health information literacy to healthcare professionals, public librarians, K-12 populations, researchers, educators and the general public. She is the academic liaison to the UW-Madison School of Nursing where she works with undergraduate and graduate students, faculty and staff. She has taught online courses, works with distance learning and service issues, has developed training programs for school nurses, clinicians and community-based researchers and has presented widely to national and international groups. Recent research explores the impact of serious health games and virtual world simulations and their impact on health practices and learning environments.

Address: Ebling Library, Health Sciences Learning Center
University of Wisconsin-Madison
750 Highland Ave
Madison, WI 53705-2221

E-mail: udieterle@wisc.edu
URL: [http://ebling.library.wisc.edu/liaison/udieterle/rica.cfm](http://ebling.library.wisc.edu/liaison/udieterle/rica.cfm)
Phone: 608.262.8025
Fax: 608.262.4732