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Evaluating Efficacy and Validating Health Games

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Evaluating Efficacy and Validating Games for Health

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For Peer Review

Abstract

The field of games for health is growing rapidly but many games for health are not validated for their use as a tool to improve outcomes. The few research studies that do exist are often poorly designed that their conclusions cannot be considered valid evidence to support or refute efficacy. Based on lessons learned from the field of digital game based learning in education and recent efforts to systematically review games for health in meta-analyses, guidelines are suggested for conducting high quality efficacy studies on games for health.

The Problem

The field of games for health is growing dramatically. Major funding agencies are supporting the development of innovative games to train, educate and even enhance treatments for patients. Hospitals and medical schools are developing their own computer simulations and serious games to train health care professionals. Conferences that specifically address games for health are being organized and attended in impressive numbers. The publication of the *Games for Health Journal* suggests that the interest and activity in this area has attained “critical mass”.

An Internet search combining the name of any of the top diseases with “game” will turn up a number of examples. However only a handful have undergone a rigorous scientific evaluation to validate their use as tools that contribute to the health and wellbeing¹. Of those that have been evaluated, inferences regarding their effectiveness are virtually impossible to make given the weakness of the study designs²⁻⁵. Exceptions are seen in evaluations of games used to promote physical activity, physiotherapy, and healthy eating⁶⁻⁸.

A foreshadowing of things to come?

If we fail to conduct rigorous research on games for health, we may be destined to experience the same situation facing the proliferation of serious games in education. This field is known as digital game based learning (DGBL), and was enthusiastically embraced to address the problem of decreases in students’ motivation to pursue academics, deteriorating study habits, and drops in academic performance⁹. A recent

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3 article in the New York Times¹⁰ reported that the marketing claims of educational
4 software companies were not consistent with research evaluating the efficacy of these
5 programs conducted by the What Works Clearinghouse (WWC), an initiative of the U.S.
6 Department of Education's Institute of Education Sciences (IES). WWC investigations of
7 math software found inadequate standards of evidence to make any conclusions about the
8 effectiveness of most math educational software they reviewed¹¹⁻¹³.
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17 The reports on the DGBL programs from available on the WWC website revealed
18 that the WWC did not conclude that the software had no impact on learning. Rather, they
19 concluded that the studies conducted on the DGBL programs were so poorly designed
20 and conducted that they could not be reviewed no matter what the findings of the
21 individual studies were. As such, there is inadequate evidence to draw any conclusions
22 regarding the impact of the educational software programs on outcomes in the schools.
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32 In addition, the conclusions of the WWC reports are eerily similar to the
33 conclusions of recent reviews of games for health applications. A recent meta-analysis on
34 games to train health professionals concluded that the lack of high-quality research
35 neither confirms nor refutes their efficacy³. While meta-analyses on interactive
36 technologies for health that include games do show areas of effectiveness^{14,15}, they still
37 state that conclusions are still limited due to poor research design and reporting of
38 studies.
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48 **Guidelines for Future Research**

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50 Future research evaluating the effectiveness of games for health to improve
51 outcomes should be driven by the following guidelines. These guidelines are based on
52 lessons learned from educational software and ongoing efforts to integrate quantitative
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3 research on games for health. These guidelines are aimed to place research on games for
4 health in the best possible position to be considered
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8 ***Ground your game in theory.*** The first step to conducting a good validation trial
9 begins during the design phase¹⁶. A number of researchers in DGBL have been calling
10 for more rigorous research in order to develop guidelines for making effective digital
11 games for learning¹⁷⁻¹⁹. They argue that the lack of coherent theories and models in the
12 field of DGBL is the root cause of the lack of clear and established guidelines for making
13 effective DGBL. Similarly, a theoretical approach guiding the development of games for
14 health provides a good basis for testing hypotheses based on those theories in subsequent
15 research evaluations.
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27 ***Conduct a randomized trial.*** The year 2011 saw an impressive and sharp increase
28 in the publication of randomized trials on games for health compared to previous years²⁰⁻
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Include adequate control groups. Implicit in conducting a randomized trial is
inclusion of a control or comparison group to which participants are randomly assigned
to which that researchers are blinded. A recent study compared people who cycled to
music or to an interactive cycling game found that cycling to music was equal to or better
than cycling to a video game and cost much less money²³. This is very valuable
information that could only have been revealed by comparing the game to another
motivating but less interactive activity. Blinding of treatment assignment is often difficult

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3 for participants in these types of trials but researchers should be blind to treatment
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5 assignment when evaluating the data.
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8 ***Recruit an adequate number of participants.*** Conduct a power analysis well
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10 before you even design your study. It is advisable to conduct power analyses even before
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12 designing your game to ensure that the game is focusing on a problem that the game can
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14 adequately address and that you can recruit adequate numbers of participants in your
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16 research trial to assess the game's impact¹⁶.
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20 ***Include objective measures of health.*** Incorporate standardized measures in your
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22 research to facilitate comparisons across studies and combining self-report with objective
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24 measures. Most evaluations of games for health assess cognitive, affective, behavioral
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26 and biological functioning via self-report¹⁴. Ideally, self-report should be combined with
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28 objective measures of health outcomes²⁴. An excellent example of this is a randomized
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30 trial of game for diabetes control published 15 years ago²⁵. Researchers found that
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32 although children who played the diabetes game did not show increases in knowledge
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34 about diabetes or glycemic control, their communication about the disease increased,
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36 their self-care behaviors improved, and most impressively, they showed a significant
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38 decrease in urgent care visits compared to children who did not play the game during the
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40 year of follow-up, an objective indicator of the game's impact on health.
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46 ***Monitor and report potential negative side effects.*** Evaluations of games for
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48 health should attempt to monitor the use of their game for negative side effects. Possible
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50 negative side effects of playing games although rare can include such as seizures due to
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52 photosensitivity and tendinitis²⁶. Other side effects can include excessive and addictive
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54 use of games. Research investigating the consequences of excessive gaming and playing
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3 violent video games^{27,28} requires us to monitor the safety of these interventions.
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6 ***Publish, even null results.*** The problem with studies with small sample sizes is
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8 that they often lack power to show an effect even if one really does exist. Thus, they are
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10 often rejected for publication. This phenomenon of null-findings (or even negative
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12 effects) not being published is known as the “file drawer” problem²⁹. If we put our null-
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14 findings in a file drawer, future meta-analyses of games for health research will be biased
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16 to show positive effects. Existing journals often recognize this need and will publish null
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18 findings.
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22 **Conclusions**

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24 Our standards for validation of the growing number of games for health need to
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26 be raised. Studies that show dramatic and impressive effects of games for health will be
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28 overlooked and disregarded if they are not conducted according to the guidelines above
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30 and others that reflect basic standards for providing valid research evidence. The
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32 guidelines are provided in a very simple form. They are not exhaustive and do not
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34 adequately acknowledge the complexity of carrying them out in the real world. It is a
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36 difficult task but the future of our endeavors depends on high quality research to drive the
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38 current enthusiasm and activity in this field. The *Games for Health Journal* provides us
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40 with a forum to share this knowledge and work together in this effort.
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