

# Where Have All the (Educational) Games Gone?

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**Abstract:** With 91% of children ages 2 to 17 playing videogames at home (NPD, 2011), on average of seven hours per week (Woodard & Gridina, 2000), researchers and game developers are increasingly interested in the potential of implementing videogames or game-like environments into classrooms (e.g., see Baek, 2008). However, there are many challenges that prevent the implementation of video games in educational settings (Egenfeldt-Nielsen, 2007, p.63), and many educational games that are presented as under development in academic settings do not reach homes or classrooms. Through analysis of survey-based responses provided by educational game developers, producers, and marketers, this paper examines the barriers and difficulties that impede the development and availability of educational games. Findings indicate that the biggest challenge educational game developers face are finding collaborators to ensure subject-area accuracy and learning integrity. We discuss the implications of this and other findings for the educational game community.

## Introduction

The rush to modernize classrooms and improve instructional effectiveness has been a prevailing force since the inception of the education system. However, this push for change is not always embraced by educators and policy makers. Prior to the mass dissemination of blackboard technology in American classrooms in 1801, even this piece of educational technology was viewed with skepticism. Unsurprisingly, a similar path is taken whenever a new piece of technology is introduced into classrooms. Incorporating modern educational technology such as whiteboards, tablets, and educational games are just more recent attempts to improve the classroom experience. Drawing parallels to the resistance to other educational technological experiences (Cuban, 1986), videogame diffusion in schools is sluggish and encounters multiple obstacles from many parties including administrators, teachers and parents (Egenfeldt-Nielsen, 2010).

With 91% of children ages 2 to 17 playing videogames at home (NPD, 2011), on average of seven hours per week (Woodard & Gridina, 2000), researchers and game developers are increasingly interested in the potential of implementing videogames or game-like environments into classrooms (e.g., see Baek, 2008). We operationalize "implementation" as using videogames or game-like environments as part of a school curriculum. Yet, in the not-too-distant past, use of the computer and educational videogames were widely viewed as entertainment, or simply used as rewards for good behavior by educators and adults (Schrader, Zheng & Young, 2006). In short, there may be misconceptions and misunderstandings about the potential of videogame integration, or even how games might function in educational settings (Zheng, Young, & Gilson 2004). Researchers argue that if teacher perceptions toward educational games continue to be informed by negative personal experiences, the state of classroom integration will likely remain unchanged (Schrader, Zheng & Young, 2006). Even though a great deal of research has been conducted pertaining to the anxiety educators feel toward incorporating educational games in their classrooms, little has been done concerning the barriers educational game developers experience when creating or marketing their games. A clear challenge is for educational games to speak more directly to teachers and parents about their potential to increase learning, in ways that incorporate the tools and affordances that teachers view as educational. Incorporating such things into educational games, however, may be a barrier that developers will find difficult to overcome.

Thus, this paper aims to shed light on possible barriers and difficulties that may impede the development and distribution of educational games through a survey study of educational game developers, producers, and marketers. Below, we briefly discuss the surging popularity of using games for educational purposes and review previous studies that have investigated the diffusion of educational games in schools. This is followed by a description of our methods, findings, and a discussion of the implications of our results for the educational game community.

## Background

Stevens, Satwicz, and McCarthy (2008) argue it's no longer sufficient to view games merely as motivational, and because of the potential educational advantages games can offer (see Squire 2006; Shaffer, Squire, Halverson, & Gee, 2005), the interest in examining their pedagogical values has exploded. There is a surge of game-related research and a push to try to implement educationally-relevant games into classrooms. Yet, despite scholars who note the potential educational benefits games can offer (e.g. Gee, 2003; Squire, 2011), there exists a great deal of apprehension from educators and a number of glaring obstacles that impede the proliferation of educational games in classroom settings. These hurdles relate to the difficulty of documenting the benefits of game-based learning and finding ways to allow a teacher to explore and test the game. The latter issue, what Rogers (2003) calls trialability, is a primary factor in whether or not a game can be included into curricula.

In addition to difficulties encountered on the administrative side of implementation, issues are also related to teacher usage of educational games in classrooms. For many educators, videogames are unfamiliar media with conceptions of such games ranging from simple arcade games to hyper-sexualized and immensely graphic virtual environments (i.e., the *Grand Theft Auto* and *Call of Duty* series) (Rice, 2007). These general perceptions can understandably foster uncertainty about the utility of games in the minds of educators. Even for those educators who have been exposed to wider varieties of games, and educational games in particular, their breadth of exposure still may be limited, detracting from their understanding of the potential gains from games (Schrader, Zheng & Young, 2006). However, there is reason for optimism in that, in terms of the relative advantage (Rogers, 1995) of games, teachers believe in games' motivational capability. In studies by FutureLab (Williamson, 2009) and the European School Network teachers (Wastiau, Kearney, & Van den Berghe, 2009) motivation was listed as a predominant reason for why teachers would use games...with around 25% of all teachers recognizing the motivational strength of games (Egenfeldt-Nielsen, 2010, p. 65).

For games to have a meaningful place in education, changes in educators' perceptions of what games are and what they are capable of is necessary (Schrader, Zheng & Young, 2006). Such an understanding can only be achieved by encouraging game literacy before actual classroom use. As Shaffer (2006) mentions, "the only way you can help young people become a discerning player is to become literate yourself. . . . When you can't read, it is hard to tell whether a book is bad or whether you just don't know enough to read it. The same is true for games" (p.192).

When considering implementation of games in the classroom, a number of issues must be considered. Rogers (2003) mentions that one factor influencing adoption of an innovation is its compatibility within the environment in which it is being implemented. With games, compatibility entails educators using games that work well within the subject they teach. Baek (2008) notes that if teachers do not thoroughly examine how a game may fit into their curriculum, the selected game may not provide the desired educational effects. Time to actually experience a game and determine how it can be related to the curriculum, however, may be problematic given teachers' current responsibilities and workloads (Klopfer & Yoon, 2005). Teachers wishing to use games in their classrooms must often develop alignments to curriculum standards on their own, which can also be a potential barrier to implementation given the time required to do so (Rice, 2007). If a game is not easy to use, or solutions to problems cannot be quickly mitigated, teachers could be reluctant to consider using videogames as a part of their curriculum (Kebritchi, Hirumi, Kappers & Henry, 2009). With this in mind, it is important to also be aware of the difficulties that educational game designers and developers may face to address these concerns.

This study attempted to ask specifically about the effects of the barriers noted in the literature as coming from educators, to examine whether the requirements demanded by teachers are being addressed by game designers and developers. Specifically, we noted that many educational games that were discussed or presented at academic and professional meetings and conferences do not appear to be made available to educators. We wondered where those games, developed by educators and educational game designers and presented to educational professionals, ended up—what were the barriers to availability from the developers' and designers' perspectives, and did these barriers match those presented by teachers as hurdles to overcome for educational games.

## Methods

### Research design, participants, and data analysis

An exploratory mixed method (qualitative and quantitative) online survey was used to collect data. The survey had branches built into it to allow examination of different experiences with educational game development. For example, participants who stated they had developed an educational game but had never intended to market it were asked a different set of follow-up questions than those who said they had attempted to market their game but failed. Therefore, the number of questions a given participant would answer differed depending on the branches

taken during the survey. In total, the survey had twenty-five unique questions. Four used a 5-point Likert scale (e.g., How much effort (time, money, resources) have you and your team put into making the educational community aware of your game?), five were open-ended, (e.g. What general questions or comments would you like to provide to educational game developers?) and sixteen were multiple choice/check-box questions (e.g., What supporting educational materials are available for your game?). The survey is available on request from the author in printed form, although it was administered online using the Professional version of SurveyMonkey (www.surveymonkey.com).

Attendee lists of two popular gaming conferences (Games4Change and Games+Learning+Society) were extracted from those conference websites for 2011 and 2012. Additional, personal contacts of suggested respondents were also incorporated into an initial mailing. In total, 386 people were invited to participate in the survey via email invitations and, after two follow-up reminders, 172 participants (~45%) completed it. Of these, 142 (~83%) indicated that they had been involved in the development of an educational game and answered questions related to their involvement and the game they developed. The results reported below are based on the answers from these 142 participants. Participants had multiple roles in the development of the game they selected. A majority of the participants were project leads or principle investigators (45%), and 39% were game designers. There were very few public school educators or administrators (3%).

Qualitative data analysis was facilitated by statistical analysis software, SPSS 20, and answers to open-ended questions were coded inductively by creating themes of responses.

## Results

### What kind of educational games are being developed?

The survey revealed 103 unique games developed or under development. Among these, 57% were completed games, 15% were in beta, and 13% were in alpha stages. In terms of platform, a majority of the games were developed as web-based games (~38%), PC games (~30%), or mobile games (~24%). A majority of the games developed were in the subject areas of mathematics and science (~41%), followed by social studies (~8%). Middle school students (~34%) were the main target for educational games developed by respondents in this survey, followed by primary school students (~19%), and high school students (~16%) (see Figure 1).

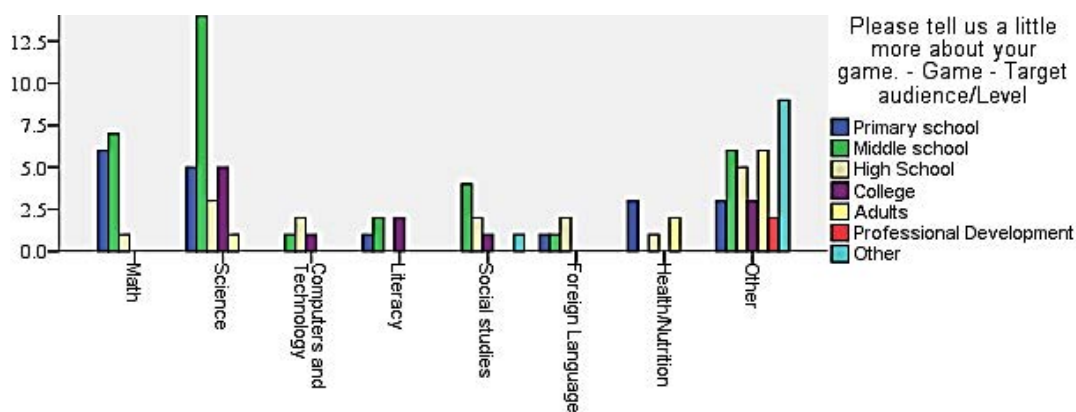


Figure 1. Target audience by target subject area distribution

Games were a result of projects that were: publicly-funded as a federal, or state research project, e.g., by NSF, USDOE, and so on (~23%); a private, non-for-profit research project, e.g., funded by a foundation or NGO (~22%); a university, college or other class project, with or without institutional funding (~12%); a dissertation or master's thesis project, with or without institutional funding (~9%); a commercially-funded development project, e.g., funded by a commercial publisher or the like (~6%); a personal (unfunded) project for one's own purposes (~4%); or other (~3%).

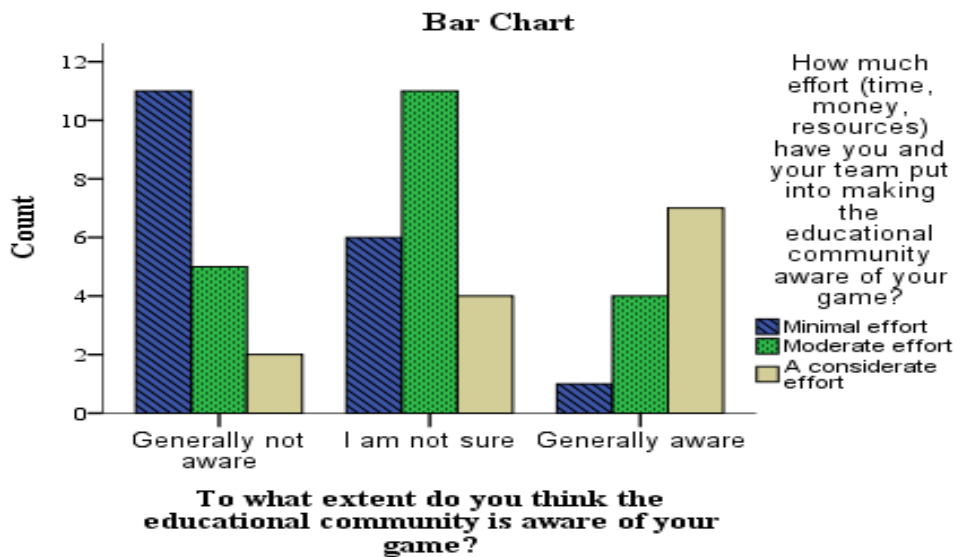
### Public availability and awareness of educational games

More than half of the games reported (n=56 or ~53%) were publicly available, and a majority of those were free

(81%) and self-published (~70%); ~11% were available for purchase, and all were available on publishers' websites or could be acquired by contacting their developers.

For those games that are not publically available (n=44 or ~43%), there three main reasons were given: the project needs more time in development or production (~66%), there are funding issues (~23%), and there are technical issues with the game (~21%).

When asked about the level of awareness about their game within the educational community, only 26% of the participants reported that they thought the public was aware of their game, while 35% thought the community was not aware of them at all, and the rest of our respondents said they were not sure about public awareness. The most common responses indicated that our respondents put forth relatively minimal effort at enhancing awareness or providing publicity to the educational teaching community, as noted in the following, representative quote: "We have presented it at conferences and made it available on our web site." However, some participants reported their considerable effort to reach education communities. For example, one project lead said, "I sent out an email to every art and science coordinator in the UK, and [the game] is listed on the TES website - a popular education resource in the UK."



**Figure 2. Participants' reported effort to make the educational community aware of their games and how much they think the community is aware.**

The most effort (moderate to considerable) to make educational game communities aware of a particular game appeared within games that came from publically-funded, federal, or state research projects (~15%), or private, non-for-profit research projects (~14%). The main venue for promotion of our respondents' educational games was through academic conferences and conducting research in schools. The least effort was given to publicizing an educational game that was the result of a dissertation or master's thesis project (~8%).

### Availability of supporting educational materials

When asked what types of supporting educational materials exist for the games they developed, some respondents identified more than one type of available educational supplement. The most common was lesson plans (~22%), followed by game demos (~19%), evaluation materials (~18%), teacher guides (~18%), implementation tutorials, (~16%) and links to State or National standards (~14%). No supporting educational material was provided for 17% of the games. The findings indicate that all games with lesson plans have links to State or National Standards, as do many of the other types of supplementary materials.

### Greatest challenges developers encounter

We asked participants to rate the most challenging, the second most challenging and the third most challenging issue they faced with regard to developing their game, other than finances (which we felt would be a common concern and that was discussed in other areas of the survey). To analyze this question, we assigned weights to the responses as follows: three points to items listed as the greatest challenge, two and one point, respectively, to the second and third greatest challenge.

Finding collaborators or resources to ensure learning integrity (1st rank n=16; 2nd rank n=14, weighted score = 46) was the predominant issue identified. This was followed by finding a programmer (1st rank n=14, weighted score = 42), and finding collaborators to ensure subject-area accuracy (2nd rank n=11, 3rd rank n=17, weighted score = 41), which were essentially tied and following by finding collaborators to conduct effectiveness research (1st rank n=12, weighted score = 36). This result was surprising, as we expected that finding a programmer would be the major issue faced by educational developers. The fact that finding collaborators to ensure a game had fidelity to learning was the major issue reported, and that finding collaborators to ensure subject area accuracy and conduct game effectiveness research ranked so highly as challenges for designers speaks to the need for collaboration between educational game designers, educational content-area specialists, and educational researchers.

## Participants' open-ended questions and comments to educational game developers

Fifty-two people wrote open-ended responses to this question: What would you like to say to educational game developers? Four main patterns/categories emerged:

- 1) Learning or educational challenges + game design (n=27): These were related to how design aspects of games should fit with the instructional goals. Here is a representative comment: "... *Too often the game comes first and thus it becomes not as strong of a learning experience (or afford the transfer of skills) as it could be. The game needs to be designed as an engaging experience, but not at the expense of your learning objectives.*" [ID114 ]
- 2) Budget/business aspect (n=3): These comments highlight some of the challenges that educational game developers may encounter from a business point of view. A representative comment is: "*We had a hard time finding a 'yellowpages' of game developers - both U.S. and internationally-based. That would be a good resource -- as our game is a federally-funded game, U.S. firms are preferred in some of the roles in the project, but as it is a game for developing country players, local firms in the developer role was a logical consideration too.*" [ID66]
- 3) Commercial games vs. educational games (n=9): Some participants commented on differences between commercial games and educational games as well as how commercial games may be used instead of developing lower educational games with lower production quality. A representative comment is: "...*why develop educational games when you can use commercial ones?*" [ID85],
- 4) Awareness (n=8): These comments aim to make educational game developers aware of the process of development. An example comment is:

The biggest mistake I see is when domain experts try to lead game development projects having no experience. This mistake happens and then a crappy game gets released - or more likely the project fails so badly that no game gets released. Every time this happens the field is hurt because then funders are more leery of funding new games. A negative spiral ensues. The field needs more success stories. The few success stories typically result when a domain expert pairs with real game developers and real education researchers. It is even better when there is a viable commercial angle. A promising development is the venture capital that is going into educational games. These teams are typically not in universities. [ID67]

Participants posed several questions that need to be answered by the educational game community. Some of the questions are: "*What specific characteristics of games make them good carriers of educational content? In what ways are they superior (or are they superior) to other forms of interactive educational software?*" [ID56] or "*How can games make content available to all diverse learners? Those with hearing loss, visual loss, retardation, paralysis, etc.*" [ID12]

## A need for an educational game venue/archive

Participants were asked if they would be willing to provide their game(s)' details or a link to their game to share with the education community if there was an open, educational game-resource archive. The majority of participants (64%) said "yes," they would, 32% said "maybe," and 4% said "no." Among those who showed interest in such a venue, 48% provided internet addresses of their games and information about the games.

There was no statistically significant difference in what type of game developer and what development platform or content area) would be interested in such an archive. One of the participants reacted to the idea of such an archive by stating, “*That sounds like a great idea! I’d be happy to provide details of my game once I’ve developed the improved version and the supplementary materials.*”

## Conclusion and Discussion

In this study, we asked ourselves: “where are all the (educational) games that have been developed over the last few of years and presented at popular game related conferences (GLS 2011-2012 and GDC 2011-2012). Results indicate that the educational game community, indeed, is developing an increasing number of games targeting various age groups, as well as content areas. (It is important to note that some participants who indicated that they have been involved in the development of an educational game are also developing other games as well. Although not analyzed for this paper, about 105 additional games that have been completed or under development were reported.) The most popular target age group for these games is middle school students and the most popular content areas are mathematics and science. While a majority of reported games are freely available, little effort is being made to make educational game communities and classroom teachers aware of these games, which is a shame: If teachers and students don’t know about these games, how can they play, have fun and learn from them?

We also would like to note that we excluded data from non-developers and those who created materials to make 3<sup>rd</sup> party, usually entertainment, games available to teachers to use for educational purposes. Sites like “Minecraft Teacher” (<http://minecrafteacher.tumblr.com>) or “Teach with Portals” (<http://www.teachwithportals.com/>) are such sources.

While researchers argue that more efforts should be made to raise teacher and parental awareness of potential educational benefits (Baek, 2008), these findings tell another story. We found relatively few educational games to include supporting educational materials—things that teachers say are a hurdle to adoption. As Kebritchi et al. (2009) note, “Although teachers have been mandated to use technology in the classroom, they have not been given the proper professional development to help facilitate this integration.” (p.135) Such materials may include: teacher manuals, student activities, integration strategies, assessment guides, lesson and unit plans, and teacher aids (Kebritchi, Hirumi, Kappers & Henry, 2009). Having lesson plans and links to core standards facilitates support and implementation in classrooms. Educational game development communities should be aware of this and develop lesson plans for their games as supporting materials. The development and availability of supplemental materials to assist educators is pivotal to any future adoption of educational games. Such efforts can also help increase understanding of how videogames can be situated within teachers’ existing goals and knowledge of learning and instruction (Turkay, Hoffman, Kinzer, Chantes, & Vicari, in press).

The most common challenge educational game developers have is finding collaborators to ensure subject-area accuracy, followed by finding collaborators or resources to ensure learning integrity. This finding calls for efforts from the education and educational research community to collaborate with educational game developers. A strong collaboration between educators and researchers, and educational game developers, is a must for development of high impact games and their diffusion of into schools. Educators and researchers must have training in game literacy, and educational game designers must collaborate with game-literate educational content experts and researchers if acceptance and implementing of games into classrooms is to occur.

As educational game development reaches maturity, our results call for a venue where educational game developers can make their games public, and where both educators (teachers and administrators) and educational game developers can have access to play these games, test their effectiveness, and most importantly, use them to aid students’ learning. As Hughes, Greenhow, & Schifter (2006) argue, educators and developers have to combine their knowledge of instructional technology with their knowledge of content and pedagogy to advance the development of sound educational technologies.

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## **Acknowledgments**

This work was supported in part by Microsoft Research through the Games for Learning Institute and the Teachers College Game Research Lab. The content and opinions are solely the author's. Mention of trade names, products, or organizations does not imply endorsement. The authors thank Jenna Marks, Wen (Ariel) Zhang and Francis McGeaver for help in survey preparation and Shu-Yi (Heidi) Hsu for her comments and editorial assistance.