

Out of Context – Understanding the Practicalities of Learning Games

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ABSTRACT

The aim of this paper is to highlight the lack of studies examining the contexts in which learning games are used. Learning game research tends to focus heavily on the game artefact by examining how different types of designs foster both engagement and learning and how well the axiomatic definitions of good game design correspond to sound learning principles. While the dissection of the anatomy of games is important, there is an overabundance of studies on learning games as isolated systems at the expense of examinations of the constraints, possibilities, and requirements imposed by their real-world context of use. Learning games that are intended to work in formal settings like K-12 classrooms constitute systems that significantly differ from the traditional game scenarios between game artefacts and their players. As of yet few researchers have set out to survey these systems in their entirety. This paper presents a small literature review of learning game research that highlight the absence of studies focused on understanding the practicalities of the development and use of learning games. The paper also juxtaposes the results of the review with outcomes of a study conducted “within” the identified gap to present arguments for why the current lack of practical research is problematic.

Keywords

Learning games, real-world application, literature review, learning environments

INTRODUCTION

Games are often lauded for their unique capacity to model the structures of complex systems, distil them down to their essence and present them to the player for him or her to experience and manipulate first-hand (Gee, 2003, Prensky, 2001). They invite the player to form an understanding of intricate subject matters based on participation and experimentation rather than mere observation, and thus they are often argued to have great potential as learning environments (Squire, 2011, Lieberman, 2006). The increasing amount of indicators that games can be valuable teaching tools has led to an increasing interest for including more game-based learning in school curricula as they might be a way to cater to students that seem starved for an educational format that makes use of their affinity for new technologies (Gee and Hayes, 2012, Linehan, et al., 2011, Srinivasan, et al., 2008).

However, whenever one attempts to lift a game with content that can be used for educational purposes into a formal educational setting (e.g. a classroom or structured computer lab), problems start piling up rather quickly (Egenfeldt-Nielsen, 2008, Egenfeldt-Nielsen, 2010, Wagner and Wernbacher, 2013). Not only are there inherent

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conceptual issues with the assumption that increased skill or knowledge of the contents of a game has any bearing on the world outside of it, even if the content is closely tied to a specific subject matter (Linderoth, 2012, Rick and Weber, 2009, Shaffer, 2012). There is also the simple, often glossed over, fact that many intricate components need to be properly orchestrated for even the most rudimentary play session to be made possible in a school environment and to even get to the point where the conceptual issues of learning games and their effects become pressing (Egenfeldt-Nielsen, 2008). Hardware availability, the teacher's grasp of the game, the students' gaming abilities, and the strict schedule limiting the length of the play sessions are but a few of the practical considerations you face when attempting to insert games in formal educational contexts (Egenfeldt-Nielsen, 2008, Macklin and Sharp, 2012, Squire, 2005, Wagner and Wernbacher, 2013).

It is important to realize that in the study of learning games, as with many other "genres" in the wider field of serious games, the produced artefact plays one role within a larger process, and understanding the context of use is as important as understanding the artefact itself (Alklind Taylor and Backlund, 2011, Nilsson, 2008). Learning games go through a great deal of challenging phases before they even reach the educational environment and the target recipient of the learning content (Wagner and Wernbacher, 2013), and once inside the environment the use of the developed game is no less difficult. So, while there has been plenty of interest and effort put into the learning games in recent years, introducing games into formal educational settings remains a rather elusive proposition due to the challenges that arise when these two worlds merge together. I pads and laptops are distributed to students, and learning game development projects are embarked upon without much deliberation on how these items can be properly utilised to assist students' learning and teachers' working situation (Klopfer, et al., 2009). Likewise, research within learning games and serious games has primarily been focused on isolating and describing the game artefacts and their virtues, and less effort is directed towards understanding how games fit into the contexts they are intended for (de Freitas and Oliver, 2006, Egenfeldt-Nielsen, 2006).

This paper argues for the inclusion of a more practically oriented approach to understanding the viability of learning games in formal educational settings. Regardless of how well the subject matter is balanced with engaging gameplay, the final application and indeed the resulting usefulness of a learning game comes down to its accommodation for organizational factors, the recipient organizations' technology infrastructures, cultures, and teachers' and students' gaming literacy. When time comes for learning games to be applied to a learning context the issues regarding gameplay or its sound couplings with learning goals does not matter if the game cannot reliably function inside its intended environment. To make this case, the paper describes a literature review that highlights the lack of practically oriented research and brings up some problematic aspects of learning games that are rarely discussed.

OVERVIEW OF LEARNING GAME RESEARCH

The exclusion of the practical considerations of learning games' real-world application in game studies has been lamented for quite some time:

"The discussion of the educational potential of computer games have raged for more than 30 years. This discussion has been present in the public debate but also with varying degrees of intensity in the research community... [but] has ignored the more practical and self-evident problems inherent in the use of games in educational settings"

– Egenfeldt-Nielsen (2008, p. 30)

Furthermore, judging by more recent research, not much progress has been made to fill the void. In order to get an approximation of the severity of this gap in learning games research a review was conducted on the publications from three academic forums. The examined forums were two “broader” game studies conferences as well as a strictly game-based learning focused journal: the *Digital Games Research Association (DiGRA)*, *Foundations of Digital Games (FDG)*, and the *International Journal of Game-Based Learning (IJGBL)* respectively.

The published papers were filtered through a series of search terms applied on paper titles and abstracts (*learning, gamification, classroom, student, teacher, and school*) and each paper was subsequently evaluated to decide whether or not they were in fact examining learning games. The individual examination of each paper was a necessity since the keyword searches would include papers on games for health and on how the act of creating games can be educational. Since this paper is concerned with examining research on games that intend to teach through their content, research on what can be learned through the development of games or, for example, how manual dexterity can be trained through gameplay was not considered relevant. The filtration process limited the original number of publications (approximately 840¹ papers) to 104 papers:

- 13 papers from FDG conference proceedings (spanning 2009-2013)
- 41 papers from DiGRA conference proceedings (spanning 2003-2013)
- 50 papers spanning all IJGBL volumes (spanning 2011-2013)

The papers were grouped into eight different categories according to what they aimed to contribute to the learning games discussion (see Table 1). The categories were primarily inspired by the *Analysis-Design-Development-Implementation-Evaluation (ADDIE)* model from the field of instructional system design (Gustafson and Branch, 2002).

Educational potential 1. Games and learning principles	A
Game quality and creation 2. Design tools and techniques 3. Development tools and techniques	D D
Users, application, and environment 4. Attitudes towards GBL 5. Using games in formal contexts 6. Properties of formal contexts	I
Evaluation and assessment 7. Research methodologies 8. Learning effects and outcomes	E

Table 1: The eight categories used during the literature review and their mapping to the ADDIE model.

The ADDIE model describes the process of creating instructional systems by dividing it into phases (Moore, et al., 2002); analysing and understanding the overall purpose of the solution; designing the system components; developing the system; implementing it and

using it in its intended setting; and finally assessing and evaluating its impact during and after use. For the purposes of this review, the phases were “transposed” to better describe the lifespan of a learning game and subsequently divided into sub-categories to provide a more granular description of the reviewed papers.

It is important to note that the literature review should not be considered as an exhaustive investigation or definitive quantitative analysis on learning game research. The review is based on a small segment of game studies and is primarily intended to highlight how material published in game conferences and journals tend to examine learning games. The method of categorization was devised by the author alone and is, as evident by the use of the ADDIE model, influenced by research in instructional system design. Research in that field tends to be more practically oriented, and thus its general outlines constitute an interesting framework to compare learning game studies with.

The selection of publication venues is admittedly quite limited; there are certainly more journals and conferences publishing material on the subject of educational games out there. DiGRA and FDG were chosen for this review because of their inclusion of a wide variety of games-related research. Due to their size, recognisability, and the breadth of research they publish, their publication archives can be used as sedimentary records of the broad field of game studies. While more niched venues might provide more detailed deliberations on nuances in specific sub-genres of games research, DiGRA and FDG can provide comprehensive cross-sections of how the scholarly climate has shifted and changed throughout the years. IJGBL was chosen to compensate for the generality of the conferences and to represent communities specifically oriented towards learning games. While there are several other publications that could be suitable additions to the review, the three venues chosen have a beneficial straight-forwardness to them. Publications like the serious games research staple *Simulation & Gaming* (S&G) or the *European Conference of Game-Based Learning*, for example, require more sophisticated tools of filtration as their treatment of a “game” as a term and object of study is ambiguous. For example, S&G papers are not very particular about differing between systems, environments, simulations, and games² and to avoid ambiguity of what “learning games” refers to in this review the publication was excluded entirely. To conduct a review of that magnitude while maintaining cohesiveness, filtration methods and categorizations would need to be developed and conducted by a committee that cover a wide range of expertise in the area of games and serious games rather than a sole author.

While this limitation is not ideal, reviewing the chosen venues served the purpose of this paper. The review was conducted to examine whether there is still any validity to this author’s (Berg Marklund, 2013) as well as Egenfeldt-Nielsen’s (2008, 2006, 2010) and other researchers’ claims that the real-world application of games is given little attention by the games research community (McClarty, et al., 2012, Klopfer, et al., 2009). It is also important to note that the categorization used in Table 1 is not intended as a proper taxonomy of learning game research, but was rather devised to make the literature overview easier to follow.

Distribution of Reviewed Papers

After categorizing all 104 papers an indication of what aspects of learning games researchers tend to focus on emerged rather clearly (see Figure 1). The most common subject of examination was ways to improve the quality of gameplay in learning games (44 papers), often through devising guidelines for how to better balance what is usually referred to as “engagement” factors and “learning” objectives. Investigating whether

games and gameplay corresponds well to learning principles was also a common research topic at 25 papers.

In general, studies focused on establishing reasons why games should or should not be used for educational purposes by describing games' linkage to learning principles, and how learning games should be designed to both engage students and represent subject matters and learning objectives. In line with the statements made previously by researchers, there were noticeably fewer studies investigating how games are used and how they fit into formal educational environments.

Focus of papers

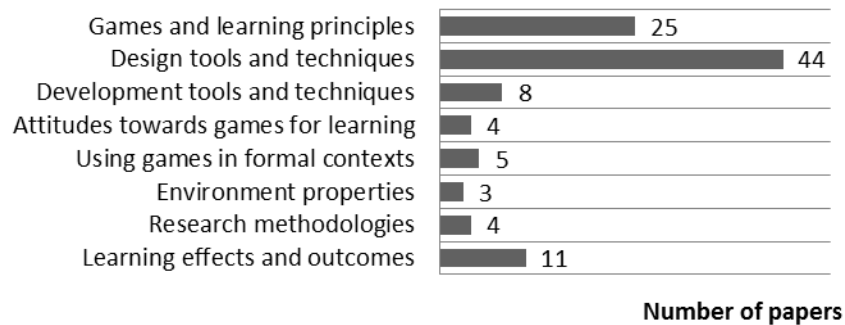


Figure 1: An overview of research foci in studies examining learning games.

The Common Approaches

In order to contextualize the findings of the literature review, the different categories will be broken down and discussed in some more detail. While the purpose of this paper is to discuss where research on learning games is lacking, describing what studies tend to focus on adds some important context. To this aim, a brief description of the common approaches used in the different types of studies will be provided along with some specific examples from the investigated literature as well as relevant sources from outside of the review's scope.

Games and learning principles

One of the more common themes in learning game research is explaining the educational potential of games and gameplay (Blumberg and Ismailer, 2009, Gee, 2009). This is often done by coupling established pedagogical principles to common game design principles and parts of games' "natural" anatomy, for example in Becker (2005) and Medina (2005). A few examples of research along these lines were given in the inaugural paragraph of this paper, and this category of research probably does not require much more elaboration. Games' potential virtues as educational tools were described in the early days of learning game research (Malone, 1981, Malone, 1980). But, since both games and pedagogical principles are continuously evolving, new ways of considering games' educational values are frequently discovered and elaborated upon. It should be noted that not all studies reach conclusions that support the notion that digital games and gameplay are naturally conducive to deep or effective learning. For example, Wechselberger (2013) presents the issue caused when students frame learning activities as game activities which can prevent in-depth reflection on the experienced content, and Linderoth (2012) discuss

how games' ways of providing and conveying affordances to players can inhibit valuable learning processes.

Design and development tools and techniques

The design and development processes involved in the creation of learning games are frequently subject to investigation. There are many differing perspectives on how a learning game should be designed and developed in order to make good on their perceived educational potential (Franzwa, et al., 2013, Engström, et al., 2011, Whitton, 2011). Some developers and researchers factor engagement and the integrity of “traditionally” sound game designs higher than educational content, whereas some take the opposite stance and value correct subject matter representation higher (McClarty, et al., 2012, Egenfeldt-Nielsen, 2011). Some stand between these two camps and champion a direction where concessions are made both in how we appraise gameplay and educational processes (Bogost, 2008). The behaviouristic paradigms that dominated the educational game landscape in the past has been on a continuing decline since the Edutainment game market collapsed in the late 90s (Ito, 2009). New pedagogical principles are now influencing learning game research and development, and the lenses through which examine them are becoming more nuanced as a result (Ratan and Ritterfeld, 2009, Egenfeldt-Nielsen, 2006).

Out of all the reviewed papers that investigated ways to improve the design of learning games only five included studies where games were used in a formal setting, and only one proposed design improvements aimed to facilitate formal use (Rikke, 2007). The other four evaluated the design primarily on the games' ability to engage or educate their players during play sessions. Studies on development processes, while rarer than design research, usually had the same general approach: few of the studied cases were based in formal settings and the focus was placed on examining how development can be conducted to improve the quality of gameplay while including educational content.

Learning effects and outcomes

When evaluating the educational effectiveness of learning games, researchers tend to aim at finding a balance between engagement and learning in their studies (Rai and Beck, 2012) - they often evaluate what has been learned and how engaging the learning process was in the eyes of the student. A study on the effects of console gaming in schools conducted by Groff, et al. (2012) is an example of this approach as it contrasted console play with other school exercises. Many studies aim at examining the educational outcomes of using learning games in comparison to what is often referred to as “traditional teaching methods”. These studies make statements both regarding whether the players learned anything, and how fun or engaging the learning activity was for them (McClarty, et al., 2012). The promise of learning games being environments where learning can happen in an engaging and experiential way seems to mark out a framework which research in the field often follows as researchers conduct studies where the validity of this promise is examined.

Less Explored Areas

The conducted literature review suggest that while there are lively discussions regarding learning games' educational potential and design, deliberations on how they are practically utilized and the properties of their context of use are quite sparse. This observation has, as previously mentioned, been made in previous research as well (Kirkley, et al., 2005, Klopfer, et al., 2009, Egenfeldt-Nielsen, 2010) but it is seldom based on the outcome of structured reviews. While different design approaches have been

invented and put to use to provide new ways of balancing engagement with learning, there has not been much progress when it comes to finding sound methods for how learning games can be developed to ensure that the end product is actually useable. As described earlier, discussing the design of games is useful for examining the inner workings of them and how different game elements can fit together to create an experience. But, merely understanding this aspect of games is like understanding which ingredients can be combined to make a good meal without knowing the process of mixing them together, which cooking utensils to use, or even how to set the table for people to be able to enjoy it once it is done.

Out of the 104 reviewed papers, eight was considered to be conducted with the expressed intent to investigate the properties of end-user contexts or the application and use of learning games. Four of these papers relied on surveys and interviews to get teachers' perspectives on how games fit into formal educational settings from a practical standpoint (Becker and Jacobsen, 2005, Kirriemuir and McFarlane, 2003, Razak, et al., 2012, Tan, et al., 2012), three papers described case studies where games were developed and implemented into their intended contexts of use (Petley, et al., 2011, Wagner and Wernbacher, 2013, Saridaki and Mourlas, 2013), and one paper took an ethnographic approach to understand how the practicalities of the use-context affects learning (Chia-Yuan, 2007). All four papers based on surveys and interviews conclude that educational institutions are largely underprepared to receive educational tools as technologically advanced as digital games. The case studies present a somewhat broader picture by being able to describe aspects of development and implementation in more detail, but also conclude that the realities of formal educational environments present obstacles that cannot be solved just through clever design choices.

A development focused case study conducted by Wagner and Wernbacher (2013) concludes with some remarks on how previous research has been insufficient in mapping out the impact the practicalities of formal settings have on learning game development:

“A larger research question arises from the fact that our research suggests that the formal educational use of games requires a significant amount of learning process management through a teacher or trainer. This contradicts opinions that games are excellent tools for self-directed learning and would indicated (sic) that it is difficult if not impossible to achieve economies of scale in educational game development.”

– Wagner & Wernbacher (2013)

WHERE DOES THIS LEAVE US?

While games are evidently used in various degrees in classrooms today, the prophesied impact of learning games on education have not yet been as significant as many would have hoped or anticipated (Egenfeldt-Nielsen, 2010; Klopfer et al., 2009). This slow growth can be attributed to several factors. Papers from 2003 (Kirriemuir and McFarlane) and 2005 (Becker and Jacobsen) brought some basic practicalities of formal contexts up for discussion without much elaboration. The same issues are, however, also brought up in later publications as being relatively novel (Wagner and Wernbacher, 2013, Petley, et al., 2011, Tan, et al., 2012) which suggests that there has not been much progress when solving core practical issues of learning game use in the interim. The discourse is becoming more sophisticated, however, and tends to use a more nuanced rhetoric when it comes to describing the reasons why learning games are difficult to employ in formal educational settings. Older publications tend to lament the resistance of educational systems to readily employ learning games and attribute it to educators being woefully misinformed or unable to grasp the immense educational potential of games. Newer

publications tend to take a more nuanced approach and consider eventual shortcomings of learning games to be a product of dubious ad-hoc development processes, the impractical nature of games as educational tools, and the fact that games are not as inherently conducive to learning as previously thought.

On this note, the previously popular argument that teachers are averse to using digital games as part of their curriculum does not seem to be particularly accurate. In a study conducted in 2009 by Wastiau, et al. (2009) including over 500 teachers from 27 European countries, 70% of the teachers polled already had some experience using games in school activities, 60% of the teachers not yet using games were interested in starting doing so, and as few as 10% of the polled teachers were of the opinion that games have no place in schools. A similar effort was done in the US, where 1048 in-service and 656 pre-service teachers were surveyed on their opinions and experiences with using games during their classroom activities (Ruggiero, 2013). While there were variations in the amount of teachers who had experience of using games for teaching compared to the European study (46% in the US as opposed to the 70% in Europe), a common overall opinion were that games could play an important role in classroom activities (Ruggiero, 2013). However, while they were not actively dismissive of games, more than half of the polled teachers in the US had no inclination to start using games in their teaching (Ruggiero, 2013). Here, it is important to keep in mind that the two surveys were conducted differently, but the differences in their results do indicate some differences between US and Europe in terms of practice and attitudes. Regardless of the positive attitudes towards game usage in the US being in the minority, however, there is still an audience of significant size that are eager to use games in formal education. Claims that learning games' progress into formal education is primarily hampered by teachers being unwilling or averse to using them because they consider games decadent or frivolous seem to no longer be valid.

The apprehensions that educators do have can nowadays be attributed to more practical concerns. While researchers have constructed plenty of guidelines describing how learning games can be designed to be both engaging and educational, guidelines for producing learning games with high practical utility are almost non-existent. To alleviate this issue as well as point out some important factors often overlooked in learning game research, this paper will conclude with some observations made during recent case studies on formal educational contexts and learning game development conducted by the author. In favour of brevity, the interview comments and other results mentioned here will not receive much elaboration (they are mainly used to outline and anchor obstacles of learning game development and use to tangible examples and statements). A more detailed account of the case studies can be found in Berg Marklund (2013).

The case studies involved both developers (two studios that had 3-5 years of experience developing learning games for formal use) and educators (three teachers and two principals working in a school for children in grades 1-9, or 6 to 16 years of age) creating or attempting to use learning games for and in formal settings. The results drawn on here will mainly be the outcomes of interviews and workshops carried out during those processes. The main line of inquiry focused on mapping out factors that developers and educators thought posed the biggest obstacles to pursuing learning game development as a business or learning games as educational tools.

Infrastructure and Reliability – Competing Against a Book

In this case, infrastructure in formal settings refers to the condition of the resources needed to support the use of learning games in classroom environments. Examples of

resources are teachers' available working hours, their technical know-how and gaming literacy, the funds available to support pursuits of new educational tools, availability and maintenance of technological devices necessary for play scenarios, organizational structures, etc.

The teacher's ability to manage gaming activities is crucial in the use of a learning game. The teacher needs to understand the game in order to understand what students are doing within it, and be able to translate game progress to curriculum progress and learning goals. The teacher also needs to be proficient in setting up play sessions in a limited amount of preparation time, assigning tasks, and supporting their students during the play sessions. Teachers also serve the important role of conduit between learning context and play context, and need to know how to contextualize the game content to the subject matter being taught. The organizational culture of an educational institution also has to be receptive to games as a medium. As previously described, acceptance towards games has increased in recent years (McClarty et al., 2012; Ruggiero, 2013; Wastiau et al., 2009), and the interviews held with educators during this research indicate the same. But, there are still teachers, principals, and parents that remain somewhat wary of games in schools, and with valid reasons. In order for a game to find traction, an organisational culture that understands games and knows how to contextualize the content and qualities of games to students and parents is necessary. These types of cultures are hard to cultivate by educators too as games manifest something of a cognitive disconnect in educational processes. As the interviewed principals both stated, there is some trepidation among principals and teachers when it comes to adopting instructional systems whose inner mechanics are largely indecipherable to them due to the opacity of modern technologies. It should be noted that, unlike attitudes in previous decades, principals' and teachers' reservations to using learning games were not rooted in concerns on negative psychological effects of gameplay (e.g. fostering violent tendencies).

On the technological side of things, all necessary components need to be continuously available and reliably support teachers' working processes. During interviews, teachers frequently brought up "reliability and continuity" as absolutely crucial requirements for any learning game to be an attractive or even feasible proposition for large-scale implementation. Simple practicalities like device availability and reliable ways of conducting play sessions are necessary to retain continuity in play-based lessons and the technological infrastructure of schools can make them difficult to maintain. There are also more complex matters of being able to monitor play sessions, either in real-time in order for teachers to moderate classroom play sessions, or in order to store information from sessions for student assessments. It is important to realize that traditional means of education provide easy methods for assessments and evaluations, and in contrast learning in games can seem indecipherable and difficult to codify. To support this, the learning game can be developed with teacher involvement in mind, and provide specific guidelines for how the teacher should discuss and evaluate play sessions by traditional means. The game *Global Conflicts: Palestine* (Serious Games Interactive, 2007) take this approach and provide instructional manuals for teachers that explain how play sessions should be introduced and how debriefings can be conducted to both contextualize the game experience in the subject matter being taught and to evaluate students' understanding of it. Another approach that is somewhat more advanced and technical is to implement ways to track various metrics from play sessions, for instance providing data of where students journeyed in a game, what characters they talked to and what dialogue options were chosen, or how the student interacted with the game world (Kickmeier-Rust and Albert, 2008). Making such data available for teachers is, however, only valuable if

the teacher knows how to interpret it, so it can require some training on the part of teachers. But, built-in means for student assessment can be a potential way to make a learning game more appealing for teachers (Alklind Taylor, 2011).

Another issue that was brought up in interviews and directly observed in the case studies where learning games were put to use in smaller classroom setting was the restraints put on learning games by organizational practices in formal education. Working structures commonly found in educational institutions are somewhat antithetical to the way games function. School days are normally scheduled in a way that fragments play sessions. If lessons within a specific school subject are spread out over an entire school semester, there will be few classes per week for the subject. This has some implications for how games need to perform and their ease of use, as well as how they need to be designed in order to provide a solid game and learning experience rapidly. In entertainment games, players can spend several consecutive hours to get deeply immersed or engaged by a game experience and to familiarize themselves with the game's mechanics and interface. Placing fixed limitations on play-time and length of interims between game sessions interrupt the rhythm of normal gameplay. Getting back into a game and entering a state of mind where you can get enthralled by the experience can take time, and designing learning games as lengthy epics may for this reason be a poor choice. Episodic gaming, or independent and bite-sized game challenges could be more serviceable in the fragmented environment of formal education. Similar problems brought on by the "rhythm" of formal education is brought up by Egenfeldt-Nielsen (2008), who also elaborates on the issues of creating game experiences suitable for audiences as heterogeneous as an average classroom of children.

Regardless of specific solutions for these types of issues, educators and developers should be aware that learning games require a great deal from a school's infrastructure in order to work well. Awareness of strengths and shortcomings in the educational setting's infrastructure can be as important during learning game development projects as understanding the details of the taught subject matter. Learning games are working against the grain in these situations, and are in direct competition with educational tools and practices that are more familiar and suitable for the way education is currently structured. Learning games either need to match the level of accessibility and reliability of books, lectures, and whiteboards, or prove that their educational value surpasses those tools to such an extent that the added difficulty of using them still results in a net gain.

Market Realities and Return on Investment

As pointed out by Wagner and Wernbacher (2013), achieving viable economies of scale with learning games for formal use is not an easy task. Increased motivation, retention, deeper learning, and the ability to interact with and experience a subject as a participant are some of the benefits usually touted when the merits of learning games are evangelized. But with the issues of audience heterogeneity, practical obstacles inherent in formal education and development costs, can learning games provide enough return on the significant amount of investment needed to create, implement, and use them?

Return on investment is essentially a two-variable equation, and for interviewed principals and teachers the return is not "what does the game teach?" but "how much better is the game for learning than previously used methods?" As previously mentioned, the pedagogical value of new teaching tools is not judged in a vacuum but in comparison to other available methods, and primarily methods already being used. Learning games for formal education are always competing against other methods of education, and it is

in many cases an uphill battle as the infrastructure of educational institutions is built to support more traditional educational methods. Learning games need to break into a context that is not currently built to support them, and in that context perform better than means that teachers and students are previously familiar with and adept at using.

As for investment, learning games are once again in a position of some difficulty. But the severity of the investment varies depending on how the recipient organization is acquiring the learning game. A common approach is to commission the development of a learning game to cater to specific educational needs, but there are also some examples of off-the-shelf solutions that are not specifically tailored to the practices of a specific school. Both of these approaches have their own benefits and shortcomings. Tailor-made games will adhere to local school practices well, and will likely require less preparation and specific game-knowledge of the educator since the game has already been specifically adapted to the subject matter and classroom environment. Off-the-shelf games are likely to be cheaper up-front since development has in effect been taken care of without the monetary involvement of the school. But, the game will not be developed with the specific school or classroom in mind, and thus the effort of adapting and re-working the game falls upon the educator.

The trade-off between off-the-shelf and tailor-made games is primarily how one wishes to distribute investment. Off-the-shelf games are cheaper in game development and maintenance costs, but their necessarily general structure place heavier onus on the side of the educator. The infrastructure, teaching-styles, and student characteristics that are unique to the specific school are not specifically catered to, so the schools need to make these adaptations and re-interpretations of the game content themselves to make it usable for their teaching goals. Tailor-made games take the specific concerns of the educator in consideration to a further extent, and will also be built together with the educators that intend to use them. This results in a game that is more directly suitable for educational use once it has been developed, but educators will need to make resource investments on creating and maintaining the product's functionality (e.g. spending teachers' work hours on design workshops and tests of the game, maintenance costs, and paying developers for their services). Compounding this issue is the fact that educators usually do not have spending money lying around to develop and experiment with new educational tools. This severely limits the possibilities of establishing long-term maintenance of a tailor-made title, and can be prohibitive to incremental and evolutionary development along the guidelines established in instructional system design.

From the perspective of developers, the return on investment equation is troublesome as well. Both of the developers interviewed during this research stated that they had some difficulties remaining profitable. The two developers had widely different business strategies, one selling licenses of their educational game to schools and the other looking for clients that could commission projects from them. Each of these strategies is inherently troublesome, but neither is impossible to make profitable. The difficulties of the learning games market boils down to the size of the market, the properties of the customers, and development costs. The amount of money a school can spend on material for individual students, or entire subject curriculums, is often severely limited. For example, the budget for Swedish schools are approximately 1000 SEK (~115 €) per calendar year for each student in grades 1-6, and 1750 SEK (~200 €) in grades 7-9. This money needs to be distributed over all the subjects a student takes throughout the year, so buying individual game licenses for students in specific subjects would require the game to be sold quite cheaply. The alternative is to buy more flexible school licenses not bound

to specific students, which can allow for higher pricing per license but overall fewer long-term sales. Currently, the market is also limited in size as there are a finite number of schools that are viable customers with the necessary preconditions to support the use of learning games.

Producing Arguments from Artificial Environments

Before summarizing the outcomes of this paper, there is another point to be made regarding the problematic way learning games are currently being researched. Beyond the problems relating to the exclusion of real-world applicability, there is also an inherent problem in the methods employed to make statements regarding the effectiveness of games as teaching tools. The problem is that learning games' properties as teaching tools are often evaluated in "artificial" educational environments. In order to make a game scenario work well enough to be tested, researchers often contribute significantly to the infrastructure of the educational context. The researchers often step in as game and technology experts and assist in setting up the correct technological infrastructure to make play sessions work smoothly. They also often supply the learning game to be studied which alleviates any monetary concerns of acquiring licenses, thus influencing educators' perceptions of return on investment. While the current state of the average classroom environment makes these interventions necessary for studies to be carried out at all, it is problematic that the interventions seldom are subject to critique or discussion in learning game research or elaborated upon in research results of individual studies.

CONCLUSIONS

There has been plenty of work detailing and mapping out the internal structure of learning games as "game products", but comparatively little work done to understand the context they are to be used in. A municipality, school, or classroom environment is not an empty vessel to pour a learning game into, and a game's impact will not be determined solely on how well it balances subject matter representation with notions of good game design. The context matters. It contains factors that put constraints on what a learning game is "allowed" to do, but also elements that can facilitate play sessions and alleviate some of the pressures of what learning games need to convey through their design.

Constant proclamations of games' virtues as learning environments can be a major disservice to educators if they are not also followed by clear declarations of what types of use-contexts the positive conclusions are drawn from and where similar results can be expected. Researchers seldom make the distinction between structured formal usage and informal play or are not aware of the importance of making it, and conclusions made regarding the educational potential of learning games are often derived from artificially supported teaching contexts that are not representative of the average educational environment. This leads to a situation where the primary output from the research community is that games are potent and useful learning aids, which encourages educators and developers to pursue them with little knowledge of what is required to develop, implement, use, upkeep, or sell learning games in practice.

Learning game studies need to produce more research that examines the practicalities of using games as teaching tools. Creating good learning games is not just a matter of design choices that improve the dynamics between the game and its player or balances engagement and learning principles, it is also a matter of working with the peculiarities of formal education as a context of use. Bogost describes the nature of learning games as *"a massive rejection of the customs of both videogames and education. ... If we want to have educational videogames, we are using games against the grain, and education against*

the grain" (Bogost, 2008, p. 161). Working with formal contexts will require concessions in how we think about gameplay and game design, but also how we think about educational practice and organization (Bogost, 2008). The formal context is not always a constraining factor, and it provides several unique opportunities that can create new types of gaming scenarios and ecosystems. The lack of practically oriented research is thus not only a limiting our understanding of how learning games can be used effectively, but it is also a missed opportunity to discover new areas and means of application.

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ENDNOTES

¹ It is difficult to produce an exact total number of papers since the digital DiGRA library collects abstracts as well as full papers from conferences, I did not sift through all listed papers in the library to ensure that the [Abstract] tags were reliably applied.

² From S&G's guide for authors, retrieved 2014-05-15 from www.unice.fr/sg: "Simulation/gaming is to be taken in its broadest meaning, to encompass such areas as simulation, computerized simulation, internet simulation, gaming, simulation/gaming, serious games, educational games, training games, e-games, internet games, video games, policy exercises, day-in-the-life simulations, planning exercises, debriefing, analytic discussion, post-experience analysis, modeling, virtual reality, game theory, role-play, role-playing, play, active learning, experiential learning, learning from experience, toys, augmented reality, playthings, structured exercises, education games, alternative purpose games, edutainment, digital game-based learning, immersive learning, brain games, social impact games, games for change, games for good, synthetic learning environments, synthetic task environments."

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