

On the Development of Learning Games

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ABSTRACT

The use of games in educational contexts is a highly popular subject of discussion among game scholars, educators and legislators alike. And although the potential of games as educational tools has been evangelized with varied intensity for a long time, examples of successful executions of the concept are still sparse. This has been attributed to many different factors, for example an inherent incompatibility between games and education, and various organizational and technological barriers for implementing games in educational contexts. While the merit of these factors is still under study, there's no question that developers of learning games are faced with many obstacles, some of which that aren't encountered in 'traditional' video game development, and we currently lack a firm understanding of the specifics of these obstacles and how they can be traversed. The PhD project presented in this paper approaches this issue by identifying the inherent challenges of, and proposing new methods and models for, learning game development.

Categories and Subject Descriptors

K.6.1 [Management of Computing and Information Systems]: Project and People Management – *Systems analysis and design*;
K.8 [Personal Computing]: General – *Games*.

General Terms

Design, Human Factors, Theory.

Keywords

Game-Based Learning, learning game development

1. INTRODUCTION

Digital games have been prophesized as tools that can revolutionize the way we educate and instruct since they entered the public eye in the early 70s [3, 16]. Much research has been focused on understanding the effects games have on their players and describing the benefits of using games as didactical tools by analyzing their effect on learning performances, collaborative behavior, engagement in subject matters, etc. [3, 4, 11, 18]. There is, however, less research available that examines how a product that is entertaining, educational and useful should be developed given the circumstances Learning Game (LG) developers work under [7, 11]. The clients and recipients of LGs often approach developers with specific learning goals in mind, but with very little experience or knowledge regarding what kinds of gameplay

or game systems are suitable to support these goals, feasible to create, or what other titles they're competing with when vying for the players' time and attention [5, 17]. Likewise, developers can enter LG development projects with design visions that don't accommodate for the educational needs of the recipients due to a lack of understanding regarding the subject matter being taught and the context in which the game is supposed to be used [7]. This makes for an awkward situation for participants on each side of the development process, and one that is different for every development project as requirements, ambitions and competencies are constantly shifting both between and within organizations as well as development studios. As a result of this, researchers and practitioners in the field of LG tread water by continuously resorting to ad hoc processes as there are no established general frameworks for development that help balance the 'serious' content of the taught subject matters with the experiential nature of the game [5, 7, 8, 11]. This in turn has led to stagnation in the field, and the foreseen and much anticipated impact of LGs still remain heavily ensconced in the realm of the theoretical [3]. The purpose of my PhD research is to identify and characterize common challenges LG developers face during development projects, and to present general models that can be used to anticipate and navigate these challenges.

2. Learning Games

In their taxonomy of Serious Games (SG), Sawyer and Smith define LGs as games that "[use] gameplay to enhance motivation to learn, engage education, or to enhance effectiveness of content transfer or other specific learning outcome" [14]. The reason for proclaiming this research as specific to LG development is that SGs is an umbrella term spanning a very wide range of games with a purpose beyond just providing engaging experiences. Games developed by a company to market a product, games that encourage exercise, and games for social change are all examples of SGs. In order to limit the scope of my research and to clarify whom the final contributions may be useful to, the term LG will be used instead of the perhaps more wide-spread term SG.

Using games to educate is an endeavor with a long tail, and there's a healthy body of research describing the effects and results of using them [19]. However, the development of LGs hasn't received nearly as much attention as their potential and virtues as finished products [11]. It is difficult to find guidelines that describe how the divergent elements of educational content and gameplay can be combined in LGs and that speaks to the unique challenges faced by their developers [4, 5, 7]. Attending to the needs of an unfamiliar audience, obliging the client's will, keeping the core educational content intact while also creating a good game experience is a difficult task. In contemporary LG development, practitioners often resort to using guidelines from traditional software- and game development, and most of the research done on LGs has a strong connection to precedents set in these fields [6, 7]. This is problematic, as neither field takes the

unique challenges that LG developers face into account. Software development is usually focused on achieving utilitarian goals and requirements, whereas game development is more focused on the experiential nature of games and interactive storytelling – neither of which cover the complexities that arise when utilitarian and experiential aspects need to be harmonized in one system to convey specific meaningful content. Furthermore, the practice of game development still relies on a high level of intuitiveness and is still of a quite alchemical character [6].

In short, reliance on methods that have proven useful in game development or general software development is perhaps not an entirely sound premise and as a result LG development often becomes conducted through a fair amount of guess-work and from subjective experiences [7]. The very idea of LGs requires us to work against core concepts of both traditional education and games simultaneously [2], and thus the process of creating them can't be seen as identical to the development of games or traditional educational material. For the craft of LGs to progress and transcend its reliance on ad hoc processes we need to establish general frameworks and descriptions for how LGs can be developed, and how the challenges of combining experience and utility can be approached.

3. Related research

While it's not the first publication on the potential of games as educational tools, *What Makes Things Fun To Learn? Heuristics for designing instructional computer games* published 1980 is among the earliest and it marks an important milestone in games research as it specifically dealt with digital games and established a basic vocabulary for discussing how they could be used to engage students [10]. Since these early publications, the scholarly effort focused on examining games has been rising rapidly [19]. Games that are aimed at increasing academic engagement and performance make up the majority of titles and are the most common subject of research within the field of SGs; as of 2009, for instance, 63% of all SGs were focused on academic learning [13]. LGs' history, however, hasn't been characterized by unrelenting success or popularity. The demise of Edutainment in the late -90s/early -00s, for instance, clouded the concept of using games for learning in an air of failure and for a while the game industry has been careful not to have any educational aspects associated with their game titles [16]. The fall of Edutainment was swiftly followed by the inauguration of SGs, a term describing all games with a purpose beyond solely providing an engaging experience [14]. Since then, the potential of such games have begun to be better defined, and along with it the issues that need to be resolved in order to make good on this potential are becoming clearer.

Most of the research aimed at solving these issues is treating them as obstacles that can be overcome through improved methods for game design, and they are often expanding certain models found in game studies and making them more appropriate for LGs to do so [1, 7]. I argue that this stance is based upon somewhat dubious assumptions regarding games as well as didactics. There are many more factors differentiating LGs from games than merely their responsibility to convey subject matter specific content: play becoming a mandatory activity has several altercations as player's perception of the activity changes due to the context of play, there's externally enforced time limitations on gaming sessions, you need to provide translations from gameplay goals to learning goals to help teachers assess student progress and knowledge

development, you can't expect a certain level of gaming literacy from your players, etc. [8, 15]. With these hurdles in mind, improving the design of LGs is certainly important and an essential part in ameliorating the issues LG developers face, but it's just one piece of the puzzle. While design methodologies are important and help developers balance the experience with the educational content within LGs, they don't delve into the process of implementation and application. This focus may be a product of LGs (and by extension SGs) being deeply rooted in the field of game studies, which also has a strong focus on discussing the design of games rather than their development [6].

4. Problem statement

The overall goal of my research is to highlight the unique characteristics and challenges inherent in the craft of LG development. The contributions of the research will be generally applicable development models that can help developers navigate the unique requirements and challenges they face when approaching a LG project.

Given the contemporary situation for LG and SG development, as well as the implications and conclusions from the presented theories, my research poses two problem statements:

P1: While the field of LGs has historically been strongly intertwined with the field of games, the process of both designing and developing a LG is in essence largely incommensurable with the process of designing and developing video games.

Taking the issues of the audience's varied gaming literacy, knowledge, transference, needs for assessment, time limited game sessions, and mandatory play into account – design and development models for LGs need to be largely independent of models found in game design and development.

P2: In order for a LG to be useful and have a positive impact, not only does it need to be a quality software artifact, but also a package solution that takes the implementation of the artifact into an educational or organizational context into account.

This presses the issue of LG development as a process that goes far beyond the design of a game with instructional content. Describing means of making the implementation of the game into its intended context a manageable process is a big part in making more successful and useful LGs.

5. Research Approach

In order to examine these statements with the overarching goal of alleviating the reliance of ad hoc development processes in mind, my PhD project will progress following a series of objectives:

O1: A literature and product survey aimed at identifying common and current issues with the design and development of LGs. The literature survey will provide a foundation of theories and methods previously established within the field, as well as a description of the concurrent problems LGs face. The product survey will be helpful in identifying common approaches to LG design, and provides an insight into how research in the field corresponds to praxis.

O2: Conduct a literature survey to identify theories and practices in the design and development of games and information systems that can be useful when establishing solutions to the problems found from O1. For instance, the field of information systems has also experienced issues caused by an abundance of ad hoc practices and the proliferation of ambiguous terminology, and

have made efforts to solve these issues [12]. This objective thus mainly aims to collect valuable and relevant conclusions and results from LGs' neighboring fields, and when appropriate they will be elaborated upon in order to make sure that they fully accommodate for the peculiarities of LG development.

O1 and O2 will provide a theoretical foundation that the work in the following objectives will be based upon. Continuing onward from there I will focus on proposing and evaluating new models and theories for LG development:

O3: Use identified issues, theories and models to establish new theories and models to be used in LG development. Through action research within a couple of partnering companies that work in the field of LGs, new models and theories will be created and evaluated in LG development scenarios.

O4: Building on the previous objectives, I will propose new generic models for LG development. This objective is the final execution of the overall goal of this PhD project.

6. Conclusion

The PhD project presented in this paper aims to investigate, describe the cause of, and propose solutions to, the reliance of subjective experience and ad hoc processes in LG development. While there has been much research aiming to examine the learning effects of games [4], and questioning how and if games can be used to teach [9, 16], there has been little academic effort focused on examining the practice of developing games to be used in educational contexts [11]. The research that is available and deals with the craft of making LGs is mostly concerned with finding ways to find compromises between game experience and learning goals through design methods, and is frequently expanding on concepts found in game studies [1, 7]. I argue that the design is only one part of the solution, and my research will treat LGs as systems that need to take educational context and other external factors into account as well as the design and properties of the software itself.

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