The design of educational games and innovation: a case study based on design management

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ABSTRACT

Digital educational games have been widely used in educational practices. These games are considered as valuable artefacts that can be used to teach a broad range of subjects to different kinds of learners, thus performing a significant role in the internalisation of contents. A large number of companies, both national and international, develop this kind of media. However, the design of educational games is a complex task, encompassing multiple knowledge and several different stages of development. Companies must excel in order to succeed in this highly competitive market. Studies that focus on the connection between design management and game development are still unsatisfactory. With this in mind, this paper aims to contribute to this debate and to the digital educational game industry, by proposing the use of knowledge from design management as a way of improving strategic planning. From a design management perspective, this paper aims to identify ways to promote innovation during the development process of educational games. In order to do so, this study considers the process of development of games and the communication between the academic field and the industry. This research's approach is exploratory and qualitative, and this study makes use of a literature review and a case study. This paper offers a set of contributions focusing on innovation for developing digital educational games based on strategic design. Therefore, it provides useful information regarding the relevance of the use of design management by educational game companies. Moreover, this study provides a set of actions to improve strategic planning in these companies through a design management perspective.

Keywords: strategic design, digital educational games, innovation.

1 INTRODUCTION

Digital games are an entertainment media capable of captivating and retaining user's attention, their ultimate aim being to promote fun [1]. Data from a market research reveals that the digital game industry is growing, projecting digital games as the biggest artefact on the digital entertainment field, remaining ahead of motion picture and digital music industries [2].

The wide use of games for entertaining purposes, boosted by technological developments, and the need to create efficient educational strategies, indicate that games can also be used in contexts beyond entertainment, such as learning and training, for instance [3].

Digital educational games can be used to teach a broad range of subjects to a variety of learners, thus performing a significant role in the internalisation of contents [1][4].

Despite the positive trend in the use of digital games for learning, which accounts for the growth of the industry, there is a knowledge gap and a lack of formal techniques during the design process of these games [5]. This situation is partially due to the lack of communication between the videogame industry and the academia. Zaffari and Battaiola [6] observe that companies still apply very little scientific knowledge during the game development process.

The digital games industry still uses a design process based on the developer's experience and intuition, which despite relevant contributions, could restrict some important aspects of the game development process. Based on Chandler [7], we argue that a method based on the developer's experience works in lower complexity games and in smaller teams, wherein each member knows his/her role during the design process. However, the level of complexity in games has increased considerably over the years, demanding bigger and multidisciplinary development teams. Moreover, technological advancements require companies to release their games on different platforms and devices. Furthermore, those companies face a market challenge in attempting to innovate in the field, due to worldwide competition [7].

Thus, in order to be successful, a game company needs more than just developing fun games, it must to be able to manage multidisciplinary teams, develop marketing strategies, establish an innovation plan, and conduct market researches, among other strategic planning activities.

In this paper, we propose using knowledge from design management (DM) as a way to improve the strategic planning of the digital educational game industry. Best [8] explains that design management aims to manage successful people, projects, process, and procedures during the development of products, services, and experiences, which includes the game design field. Moreover, DM stimulates individual initiative, creativity and innovation in an organization [9][10]. DM is considered as a multidisciplinary approach, since it structures organizations in three levels, namely Operational, Tactical, and Strategic [11] [12].

Thus, this paper aims to answer the following research question: "How design management can be applied by a company to foster innovation during the development of a digital educational game?". Its aim is to contribute to the debate on how educational game companies can best promote innovation, emphasizing the importance of the design process and of effective communication between the industry and the academia. The specific goals of this study are:

- **To relate** concepts from design management to digital educational game development, more specifically those concepts associated to innovation.
- **To Establish** whether design management concepts are used by a game company, and how innovation is promoted there.

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This paper uses a narrative literature review [13], to discuss some specific aspects, including design management levels, concepts and practices for innovation, and game design process. In addition, we describe a case study developed in a digital game company in Brazil. This case study highlights how design management is applied during the development of an educational game and which approaches are used by the company to foster innovation.

The contents of this paper are organized as follows: Section 2 offers a theoretical foundation, covering concepts such as developing digital educational games and design management. Section 3 presents and discusses the case study we have conducted. In Section 4, 'Discussion', theoretical and practical data are compared, in order to highlight an exploratory set of contributions to foster innovation in digital educational games. Section 5 contains our conclusions and recommendations for further research.

2 DESIGN MANAGEMENT (DM) AND THE INDUSTRY OF EDUCATIONAL GAMES

In this study, based on Kapp [14], we consider digital or computer games as an interactive system composed by challenges, abstraction of reality, rule-based environment, immediate feedback, and quantifiable outcome. Those features provide engagement and emotions. The overall purpose of these features is to provide an entertainment experience. Digital educational games are games which are associated to an academic topic or subject, and whose aim is to foster learning. To help the player to achieve a learning outcome, educational games make use of entertainment features in addition to instructional ones [15].

In Brazil, the number of game companies has been increasing due to advances in broadband internet, and to the easier access to development tools. The development of mobile and web games has been considered a trend since 2009. Also, the popularization of smartphones and tablets have greatly influenced the game market worldwide. In the past, the development of digital games focused only on consoles and desktops, which required an expensive design process with limited tools. Consequently the game market was flat. [16]

Most game companies in Brazil are small, with revenue of less than R\$ 240,000 per year [16]. Furthermore, those companies are relatively new (less than five years old).

In 2013, Fleury, Sakuda, and Cordeiro [16] studied 133 Brazilian game companies. Overall, these companies have developed 1,417 games, being 621 educational digital games (43.8%), and 509 entertainment games (35.9%).

The game market sector is a highly competitive market. The growing demand for web and mobile games requires successful innovative ideas from the companies, and design knowledge can help companies achieve this. Strategic perspective represents a significant part of the fundamentals of design management [10], which may help a company to achieve its goals.

Design management (DM) can successfully manage relations between different areas in a company, such as design, management, marketing, and business administration. Furthermore, DM covers internal and external roles in a company, such as customers, designers, administrators, project teams, and other stakeholders [8]. Thus DM is not only suitable but also a requirement for the digital game industry.

The use of design in the management of an organisation is empowered with the emergence of 'management 2.0', which brings a set of changes and new requirements to the management system [9]. Creativity and innovation become key-elements for the contemporary market [9]. These requirements demand a broader management from the company [8]. It entails changing the traditional management style (hierarchical) to a management approach that promotes personal initiative, creativity, and innovation in all level of the organization [9][10].

This innovation-driven management is gradually applied to the organization's culture. However, design does not limit itself to developing aesthetics ("beauty"), despite its importance. That means to say that, during the development process of a product or a service project for instance, an organization can use design management to improve the strategic level beyond aesthetics. [10][17]. In this study, we consider digital educational games as an intangible and interactive product, which makes a design management application more implicit [11]. However, it is equally important for a game to be successful on the market.

Design management translates and explains design as a value model through four basic powers: Design as differentiator, integrator, transformer, and good business [10]. In this context, design encompasses a broad range of tasks at the three levels of management: operational, tactical, and strategic [8]. These three levels of management are described on table 1 [12] [11].

Level	Description
Strategic	This level focuses on the strategic plan, i.e. how the organization represents itself on the market based on their mission, vision, and value statements. Thus, design at strategic level can be summarized in the relationship among design, strategy and organization culture [12].
Tactical	This level considers the implementation of activities that are likely to provide strategic decisions. Designing at tactical level manages teams, processes, and systems of specific business [12]. For instance, it fosters trainings, establishes partnership with universities, and invests in research among other activities that may connect strategic to operational level.
Operational	This level implements the plan made in the strategic level. For example, in developing a product, packages, services, internal and external product communication are created. Designing at operational level provides physical and tangible products, services, and experiences. This level is the least influential in an organization management plan [12] [20].

Table 1. Levels of design management. Source: based on Best [12]; Chhatpar [20].

Similarly, Seidel [18] identifies the four roles of design-led strategy, connecting valuable design management contributions to business development (table 2).

The strategic level of design management is the most relevant level, for it regards design as a mechanism able to add value to products and services.

Table 2. The roles of design-led strategy. Source: based on Seidel	[18]; Roda and Kruken [11].
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Roles of design-led strategy	Main characteristics		
Strategy visualizer	It seeks to develop actions for visual projections for future company strategy (short-term, medium-term, and long-term planning). Strategies are considered social demands, trends, and actions that are likely to impact the company's position on the market [11][18]		
Core competence prospector	It seeks to build organization core competences, i.e. it shows how the company differs from its competitors. The company considers the users as a prospector, and uses data from the marketplace [18].		
Market exploiter	It seeks to identify a wide range of information regarding the users and the marketplace. This role is similar to marketing consulting, which strategically covers trends and market insights [18].		
Design process provider	It seeks to develop strategies for improving the design process. This role focus on the organizational structure and promotes the emergence of new strategies at lower levels of the organization [18].		

Design is, therefore, a well-known concept in business circles, and so is its application in business strategy. However, several authors point out a gap between the world of designers and the world of managers. In order to bridge this gap, business managers need to become familiar with the potential of design to create value in companies. Similarly, designers should also become aware of the relevance of management in a project [8][10][19].

This gap between designers and business managers stems from the different cultural interests of each field. On one hand, design is mostly qualitative with regard to creativity and innovation. On the other hand, management is fundamentally quantitative and precise, constantly measuring data and profits [17][19][20][21], see figure 1. Chhatpar [20] proposes that, in order to be more successful on the market, companies should combine methods, ranging from innovative design to traditional business management methods. However, setting and adjusting those methods is one of the biggest challenges that contemporary management faces. Thus, game design, which is part of the design field, aims to create and study games, whether digital or non-digital [22]. According to Rolling and Adams [23 p. 4] game design is a process that can be summarized in the following steps:

- Imagining a game
- Defining the way it works
- Describing the elements that make up the game (conceptual, functional, artistic, and others)
- Transmitting the information to the team that will build the game. [23 p.4]

Thus game design encompasses the entire production cycle required to release a digital product to the market [6]. As a result, game design practices need to take into account not only creative design aspects, but also strategic design management.

Best [8] explains that, in order to successfully release a product, service or experience to the market, extensive support by different people with different knowledge and experiences is required.



Figure 1: Differences between business and design fields. Source: based on Joziasse [17]; Lockwood [19]; Chhatpar [20]; Waters [21].

According to Best, the way in which people, processes, and purely for the sake of projects are managed directly affects the results. In other words, it projects do not need to

projects are managed directly affects the results. In other words, it determines their market's success or failure. Moreover, the innovation provided by design comes from the fact that, contrary to problem solving, which takes into account a single professional perspective, design is a collaborative effort that considers multiple points of view [24].

In summary, this paper considers two aspects which we believe will foster innovation in digital game companies, namely the role of the development process and the role of communication between the game industry and academia. These aspects are described hereinafter, considering innovation in digital educational games from a design management perspective.

2.1 Innovation through design management

Innovation has been considered as a worldwide watchword that allows companies to survive on the market, besides enhancing its competitive advantage [10]. There are many kinds of innovations, but when focusing on products or services, there are two main categories [25, p. 5]:

- **Incremental innovation**: Improvements within a given frame of solutions ("doing better what we already do");
- **Radical innovation**: A change of frame ("doing what we did not do before"). [25, p. 5]

Norman and Verganti [25] remark that most design studies on innovation focus on radical innovation. Radical innovation is what everyone (e.g. companies, designers, business managers) aspires, since this category is responsible for creating something completely different from other artefacts in the world, therefore providing a core competence which enhances the company's market advantage [8]. A successful radical innovation takes, in general, approximately 5 to 10 years to be conceived, and another few years to be fully accepted by users [25]

In contrast, incremental innovation refers to small changes in a product or service to enhance performance, reduce costs, increase sales or popularity of products, and sometimes simply to release a new model of an existing product [25]. Thus, this category of innovation is based on knowledge and competences that the company has already acquired [8]. In general, incremental innovation takes a short or medium period of time to be applied, ranging from 2 months to 2 years [10]. Therefore, a company can achieve design-driven innovation by investing in research and development, and in so doing forging a partnership with universities.

Mozota, Klöpsh and Costa [10] state that transforming scientific knowledge in innovation is an elementary necessity of the market. Innovation derived from academic research can be categorized as radical, because it requires a long-term strategic planning from an organization, such as researching a new technology, for instance. Through academic research, it is also possible to make incremental innovations focusing on medium-term strategy planning. For example, a research with users or a research which considers new approaches for the game design process.

Academia plays a critical role in the growth of the game industry, particularly the industry of digital games for learning. Academia can provide the industry with expert staff, appropriate settings, and motivation to foster consistent innovation. One obstacle faced by academia, however, is the frequent lack of funding. Also, whereas companies in the game industry avoid taking risks, as a single mistake could lead a company to bankruptcy, taking risks and making mistakes are part of the academic process. For example, academia can take on a high-risk project or pilot and test new ideas purely for the sake of learning. This does not mean that academic projects do not need to offer value and provide results to the funders and partners. Those results (value), however, may be in the form of products or knowledge/learning. [26]

Hence academia should not be seen by the game industry as a less valuable alternative, but rather as a favourable environment for innovation and for the creation of ideas and technology [26]. In addition, academia fosters studies that can improve processes, models, and frameworks. Such studies can help game companies to innovate, taking into account the relevance of the management aspect and by using a well-structured design process.

2.2 The role of the design process

This study considers design as an application of human creativity for specific purposes, in order to solve problems or explore opportunities [27]. Therefore, design, through the design process, needs to attain goals, meet deadlines, and conform to budgets, among other things. Contrary to general belief, design is not an intuitive activity as it performs a set of well-planned and structured activities [24].

Holston [24] draws attention to the fact that the absence of a welldefined design process in a company, results in the repetition of activities, adding more time to the project's completion and causing the recurrence of the same mistakes. According to Holston, the design process acts as a tool for managing problem solving and enhancing interdepartmental communication.

Despite the expansion of the game industry, and the fact that games for learning have been used in a range of situations, the industry's basic knowledge and formal techniques of game design continue to represent one of the main drawbacks of this media development. In addition, the game industry's development tools and methods are limited and non-standardized if compared to software development [5]. Consequently, a large number of Brazilian game companies do not use a design process or a formal method for developing their games [16].

Chandler [7] explains that, game companies do not use a formal process, but rather begin the game production without a management planning for the development cycle. The author describes as a possible reason for that the fact that game companies may be afraid of stifling creativity. A further reason for that, already mentioned in this study, may be the designers' lack of knowledge of management and strategic planning.

Therefore, the design ladder developed by the Danish Design Centre is a useful model for rating the companies' use of design. This model consists of the four steps described below [28] (figure 2):



Figure 2: The Design Ladder.

Source: adapted from Swedish Design Industrial Foundation [28].

- **First step (Non-design**): Design is overlooked by the company.
- Second step (Design as stylist): Design is considered useful solely for aesthetic issues or final physical form of a product.
- Third step (Design as process): Design is used as a method integrated early into the development process.
- Fourth step (Design as innovation): Design is used by the company to renew the total business concept.

In the following section we describe a digital educational game approach. This approach aims at establishing relations between management design and the game design process, thus it takes into account the team members and the design process phase.

2.3 Design of digital educational games

As pointed out before, the development of digital games involves multidisciplinary staff, i.e. several professionals and roles. This will vary according to the scope of the project and the size of the company. However, it is possible to summarize the main categories and the professionals that comprises game development. The categories were adapted for this paper based on Chandler (7), see table 3.

Besides the foregoing categories (table 3), game development encompasses other departments of the company, those that are not directly involved in the game creation, but which are nonetheless essential for the release of the game. For instance, the departments responsible for the creation of graphical materials, marketing campaigns, and sales plans, all contribute to the successful release of the game [7].

Categories	Professional	Main characteristics	
		This category comprises administrative professionals, e.g. a CEO,	
	Vice president	who supervises the project manager or producer. Although the CEO	
Administrative	Chief Executive Officer	may be concerned with the team production daily task and interacts	
	(CEO)	directly with the project leaders, his/her main interaction is mostly	
		with the project manager.	
	Executive producer	This category of professionals focuses on efficiently managing the	
Production	Producer	game development team. Thereby, these professionals respond to the	
	Project manager	company's CEO.	
	Art director		
Art	Lead artist	This category comprises the professionals who create the full game	
	2d/3d artist	graphical aspects (assets), e.g. characters and setting.	
	Animator		
	Technical director	This category is fundamentally composed by engineers and	
Engineering	Lead engineer	programmers, who use programming language to write the game	
	Engineer/programmer	code.	
	Creative director	This category comprises a wide range of designers with different	
Design	Lead designer	expertise. Designers are the ones responsible for creating an	
	Designers	attractive and immersive game experience for the player.	
Quality	Land QA tastar	This category of professionals aims to test the quality of the game	
Quality	Tester	during the development process. These professionals conduct a	
assurance testing	105101	number of tests in order to detect any bugs in the game.	

Table 3. Game deve	opment team. Source:	based on Chandler [[7]	l

The development of digital games for learning requires the collaboration of experts from several fields, professionals who are responsible for controlling the game quality, such as content experts, pedagogy experts, phycologists, and instructional designers. Nevertheless, most educational game companies only have a small number of professionals, resulting in one professional being responsible for several of the above mentioned areas [4].

Chandler [7] defines game production as a basic cycle-consisting of four phases: preproduction, production, testing, and wrap-up (postproduction). Figure 3 below illustrates these phases and highlights the relations between the game design production cycle and the design management levels.

As it can be seen in figure 3, the strategic level of management is established by the administrative department and only happens in the preproduction phase. This can restrict the possibilities for innovation, both during the development process and in the final product, as it does not take into account the views of management and production team on the strategic decisions.

Process phase	Management level	Categorie	Professionals
PREPRODUCTION • Project plan • Definitions	STRATEGIC	Administrative	CEO
PRODUCTION Implement plan track progress	TACTICAL	Management Production	Project manager Lead artist Lead engineer Lead designer Lead QA tester
TESTING • Validate plan • Prototyping (iterative)			
POSTPRODUCTION • Postmortem (Archive plan)	OPERATIONAL	Production	Programmer Artist Designers Tester

Figure 3: Relation between the game design production cycle and design management levels. Source: based on Chandler [7] and Best [12]

The other game production cycle phases (e.g. production, testing, post-production) are only considered by game companies at the tactical and operational management levels. Hence it is not clear

how the scientific knowledge is managed during the game production cycle.

To sum up, based on the literature review, we highlight the relevance of the use of strategic design by game companies to promote innovation, particularly when facing the highly competitive online market Studies on the gap between design management and game development are still unsatisfactory [29]. With that in mind, we have conducted a case study in a Brazilian game company. The purpose of this case study is to highlight how, from a design management perspective, we can increase opportunities for innovations.

3 CASE STUDY: (COMPANY A)

Based on this paper's goal, the adopted case study approach was a single case [30], moreover the unit of analysis was **the Company** A^2 , that is situated in Curitiba city, Brazil. This company was selected once it develops digital educational games, and additionally has a partnership with an **Innovation Centre**³. This case study was oriented by a protocol that set a frame of operations and includes all the steps and necessary elements to properly conduct this study. The protocol summary is described on the following list:

- **Phase 1** Invitation: the company was invited to take part in the study by e-mail. Before agreeing to participate, the company was informed about the research's purpose and structure.
- Phase 2 Company profile: the researchers surveyed elementary data concerning the company's profile. The main sources were the company's digital materials (e.g. games, interviews) and website. In addition, the researchers designed an online questionnaire so as to identify specific characteristics of the company. The questionnaire was answered by one of the company's CEO.
- **Phase 3** Company analysis: based on the literature review, the researchers produced a script for a structured interview. This interview aimed to collect data on the company's management, game development process and innovation practices.

Before the interview, the company project manager was informed of the research and signed a consent form. The questions asked in the interview were organized in four categories: company management, innovation, development process, and developmental team.

• **Phase 4** – Data triangulation: The evidence from different types of data sources (literature review and case study) were cross-checked to ensure the accuracy of the information [30] [31].

3.1 Company profile

Company A was founded in 2012. It was initially a game company but in 2014 it expanded becoming a game and digital apps company. The fast development of the company was due to a partnership with an Innovation Centre, after the company founder and CEO won the Microsoft Imagine Cup. This is a well-known award sponsored by Microsoft, and students and researches from all over the word take part in it.

This partnership between Company A and the Innovation Centre aims to produce games and apps for mobile and cloud based technology. The main goal of Innovation Centre is to provide technologic training for students, thus promoting entrepreneurship opportunities. A University⁴ is also involved in this partnership. This partnership will benefit the university by empowering its startups.

Company A's headquarters are located in Curitiba, Brazil. The company's main activities are developing digital games (for entertainment or learning), developing apps for mobile devices, and consultancy.

According to the BNDES [32] classification, Company A is a micro company with an annual revenue of less than R\$ 2,4 million. The company employs eleven professionals (internal team), and some temporary staff, who is recruited depending on the project (external team). The management comprises three departments: administrative, management and development/production. Figure 4 below illustrates how these departments and their team members are organized according to the design management levels.



Source: based on Chandler [7]; Cruz [29]; Project Manager [33]

² We have decided not to reveal the company's name in order to protect its identity. Thus, we have used the codename "Company A".

³ The Innovation Centre is part of an international corporation from the technology field. We have decided not to reveal the centre's name to protect its identity.

⁴ We have omitted the name of the University to protect its identity.

In the following sections (3.2 to 3.4), we describe in detail the data from Company A, provided by the Project Manager⁵ who took part in the study interview. The data is organized according to the three levels of design management (strategic, tactical and operational) [12].

3.2 Strategic level

The Project Manager [33] explains that the company has no mission, vision or values statements, whether internally or externally to the organization. For him, the lack of formalization of these statements constitutes a problem.

According to the Project Manager, the company's mission statement fits with the Innovation Centre's purpose, which is to help the community where the company is located to develop games and apps, particularly those created for mobile devices by universities. Regarding vision, the company's main goal is to depend less on external projects, and have more independence to do internal projects (team interests). As for values, the interviewee highlighted that the company has a high product quality standard for their games. He also pointed out the internal team appreciation. According to him, the company's actions demonstrate respect for the collaborators, for example, letting the members of the team express their ideas. The company believes that valuing the staff leads to better team performance. Above all, the Project Manager [33] mentions that the company core competence is a partnership with the Innovation Centre, and the carefully selected team members. According to [33] him, the company is capable of doing any project related to digital games.

Innovation in Company A is deeply associated with the Innovation Centre partnership, who constantly provides hardware and software updates, supplies team training, organizes workshops and webcasts, among other things. However, during the game development process, there are no opportunities for innovation, mainly due to tight deadlines [33]. Furthermore, the project manager was not aware of the company's innovation plans, because only the CEO (administrative department) has this information.

3.3 Tactical level

Company A's game development process can be summarized in the steps illustrated in figure 5, which are similar to the game production cycle proposed by Chandler [7]. The company's internal team is responsible for the company's game development process. Also, most of the company's digital educational game projects involve a pedagogy expert, who is aware of learning approaches and technical norms. The partnership with a university makes this contact with the pedagogy expert easier, besides boosting playtests with students from Marista schools in Curitiba.

According to the Project Manager [33], Company A is now one of the most important Innovation Centres in Brazil, due to its participation in conferences, published materials, project incomes, and taught courses. All this strengthens the company's partnership with the centre, making it easier for the company to obtain new technologies and information. The interviewee states that one of the company's goals is to strengthen this partnership even more and to increase the company's opportunities.

Furthermore, the partnership with the university has improved the company's physical environment, which is composed by large and informal rooms arranged so as to promote teamwork. Thanks to this partnership, staff members now have a ludic room based on the game universe. The room is equipped with videogames and a barbecue grill, among other leisure time equipment [33]. The company has been working on the mobile cloud market, thus its major current threat is global competition, as approximately 500 to 600 games are released per day. However, the interviewee had difficulty mentioning the names of the local competitors (e.g. city of Curitiba and surrounding metropolitan area). According to him, the company was not worried about its competitors in the previous year. [33]

As for receiving awards, the company has been awarded the Microsoft Imagine Cup, the most important award in the field. This has greatly increased the company's market advantage. This award has provided the company with contacts and given it more visibility According to the Project Manager [33], this award has allowed the company to flourish.



Figure 5: Development process of educational games. Source: based on [33].

3.4 Operational level

The company has used SCRUM to manage game development, a methodology originally from the IT field. Additionally, the company has used field research, trend study, and client meetings. It is important to highlight that the company has a marketing expert working as a social media professional, collecting data alongside the project manager [33].

The distribution of digital games varies according to the client and the budget. Digital games are usually available at digital stores such as Google Play and Apple Store. These games also have their own websites, which are built according to the visual corporate identity.

4 DISCUSSION

This section offers some observations and an exploratory discussion by way of data triangulation. We consider Company A's design management aspects, particularly those associated to innovation.

Mozota, Klöpsh, Costa [10] and Best [12] state that the strategic level of design management is based on mission, vision and value statements, and is strongly associated with the way companies present themselves on the market. As the case study data shows, the company studied does not offer these statements in a formal and descriptive way. This has concerned the researches, for this may affect the company's strategic planning, restricting the opportunities for innovation. It has also made us consider the

⁵ In order to protect the company's identity, we have used the codename "Project Manager" for the professional who took part in the study interview.

possibility that this situation is recurrent in other Brazilian game companies.

We argue that a possible cause for this limitation is the gap between design and management, as stated by Lockwood [19]; Chhatpar [20]; Joziasse [17]; and Waters [21]. Since game design is usually associated to creativity, most design professionals do not fully understand or are not aware of business management. This can be the reason why innovation is inhibited in the educational game market.

According to Seidel [19], in a company, the main purpose of the strategic level is to establish a core competence. In the case study, the project manager considered the team members as a core competence for the company, because for him different members of staff can develop games using different approaches. Moreover, in the tactical level, the team is very often trained. The interviewee explained that the company offers an environment that promotes creativity and teamwork, wherein all employees can share personal ideas and thoughts.

Nevertheless, when the topic is strategic and innovation plan, we noticed that this is only managed at the highest level of the company's administration, and does not include the game development team. This creates problems for the organizational structure [19], limiting communication between the three levels of management. Furthermore, this management gap negatively affects the plan for fostering both radical and incremental innovations.

The partnership between the company and a university can foster innovation, as it supports the digital educational games development. Moreover, it makes it possible for pedagogy experts to assist during the game design process. It also allows for interaction with target users. Those benefits are mentioned by Klopfer, Osterweil, and Salen [26]. However, despite the relevance of pedagogical expertise for educational game design, these professionals have a limited participation across the design process, working only on the company tactical level, thus not covering the strategic level.

The partnership with the Innovation Centre provided, among other things, funding for new technology and research. This, however, can be seen as a disadvantage, as it can make the company overly dependent.

The technology award received by Company A has result in many partnerships and market visibility. In addition, the company has been participating in many national and international conferences, in order to promote their games and services.

As for market competition, the company's lack of concern about their market competitors is worrying. The company is not aware of its competitors although they can influence the market, thus affecting the company's profits.

Finally, the company design maturity is achieved: design as process. The company no longer neglects design or considers it solely for aesthetic issues [28]. The company has integrated design in the development process. Design, however, is not as yet seen as an alternative to fostering strategic plan.

The foregoing discussion on data triangulation (literature review and case study) is consistent with the aim of this study: "to provide a set of contributions to promote innovation in educational games, emphasizing the design process and the communication between industry and the academic field". These contributions are listed below.

• Establishing mission, vision, and value statements as an initial requirement for a strategic plan during the game production. This allows planning for short-term, medium-term, and long-term incremental and radical innovation through the company's culture.

- Emphasizing and sharing with the team members the company's core competence, that is to say, what differentiates the company from its competitors.
- Exploring and being aware of the market trends, and actions from the main competitors. Furthermore, the game company needs to gather information from the user.
- Participating in national and international conferences to increase the company's visibility, brand awareness, and to establish partnerships.
- Establishing partnerships with research centres or universities, in order to have access to experts, game users, and gather knowledge from innovative researches.
- Using a game design process that involves multidisciplinary teams in the digital educational game development, and covers the three design management levels.
- Including pedagogical experts and other game team members in the game strategic plan definition.

5 FINAL CONSIDERATIONS

This study shows that the design of digital educational games can benefit from useful contributions from design management, particularly with respect to innovation issues. However, the strategic design approach is seldom used in the educational game design field. There is a gap between the theoretical aspects presented in the literature and the practical approach of the researched company.

Design management is restricted to the management of projects, as only the tactical and operational levels are contemplated by companies. Although such an approach takes account of the game development, it limits innovation. One reason for this constraint is the industry's lack of knowledge about how design can improve a strategic plan.

Furthermore, this study highlights that partnership with a university is a valuable resource for the company. This partnership greatly improves the educational game design process, helping the team to create a successful final product.

This study's contributions lie in that it provides information regarding the importance of the use of design management by educational game companies. In addition, it provides a set of actions for the improvement of strategic planning in these companies through a design management perspective. However, it is important to stress the exploratory approach of this study. Thus, the contributions are primary and demand future studies. Nevertheless, the results presented here represent a useful focus for further investigation with other companies in future studies.

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