

# The Implementation of Videogames in Healthcare:

## The case of Nintendo Wii® in rehabilitation

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**Abstract**—The main objective of this work was to answer the question “How are videogames implemented in healthcare organizations to be used as therapy instruments?”. This question emerged in the intersection of the recent increasing interest in the use of this type of technologies in therapy, with the importance of the implementation process for organizations to use a technology in its full potential. A multiple case study was performed, using three cases of implementations of Nintendo Wii console as a therapy instrument in rehabilitation clinics. The cases were used to compare the implementation of the same technology in organizations with the same core activity. The implementation processes were characterized and compared in light of the well-established literature about implementations of technologies, which led to a preliminary conceptual generalization of the implementation of videogames in healthcare organizations when they are intended to be used as therapy tools, highlighting the key characteristics of such projects. From this research it was possible to conclude that when adopting a console such as Nintendo Wii with rehabilitation purposes, the adoption decision seems to be predominantly informal; the stage of preparation of the implementation (when therapists conveniently prepare themselves to start using the console in their treatments) is quite important for the implementation process; the implementation of a technology such as Nintendo Wii occurs as a mutual adaptation process although with characteristics of a learning implementation, where adaptations occur mostly in the adopter; and, even though there may not be in place the best conditions to use the technology in its full potential, the efforts to routinize it may help overcoming the resistance to use it that results from those lack of conditions.

**Keywords**—Implementation; Adoption; Healthcare; Rehabilitation; Videogames

### I. INTRODUCTION

Videogames are frequently considered to contribute negatively to health, since typically videogames are highly associated with a sedentary lifestyle, obesity, socially undesirable behavior, epilepsy, addiction, among others [1]. However, there have been increasingly more studies pointing out the benefits of videogames in different fields [1-5].

Furthermore, videogames are frequently perceived as a topic of interest for young people and children. However, some

studies prove that they have the potential to improve the quality of life for elderly [3, 5-7], namely to prevent problems that can lead to a loss of their independence, such as falls [3-5, 8].

The recognition of the potential of videogames to serve other purposes rather than entertainment, led to an increase in the number of studies about the suitability of videogames for such purposes, such as education [2], health [1], and fitness[3]. On the other hand, it also led to studies that question the relevance of videogames on those same practice [3]. Using videogames for the previously mentioned purposes raises several concerns: if the technology is suitable for its intended purpose, if it is adaptable to the context of use, if its results are long-term, among others. One of them relates to understanding how are videogames implemented to best meet their intended purpose. This paper addresses this later concern, specifically looking at videogames being implemented with the purpose of becoming therapy tools in healthcare organizations.

There are several challenges in the implementation process: namely, it is time and resource consuming, it requires the creation of new knowledge, and it develops in an ecosystem of interrelated actors [9]. The implementation of technologies in the healthcare industry has some peculiarities, specifically because of the nature of its activity (involving human lives), and the use of an unconventional treatment, such as one that uses videogames, can be particularly challenging [10].

One of the most studied videogame consoles is Nintendo Wii®, the console of Nintendo, usually when applied with the videogame Wii Fit® for healthcare [1] and fitness [3].

This work relies on a multiple case study about the implementation of the console Nintendo Wii® in rehabilitation organizations to be used as a therapy instrument, with the intent to provide a preliminary answer to the research question, “how are videogames implemented in healthcare organizations to be used as therapy instruments?”, create a preliminary generalization of the implementation process of such technologies for therapy, and provide directions for future research.

This paper is structured in five sections: Introduction; Theoretical Background, where the prior work in implementation research is presented; Methodology, a section

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that describes the methods used and how they provide validity and reliability to this research; Findings, where the contributions of this work are presented; and Conclusions, a section that presents the conclusions of this work.

## II. THEORETICAL BACKGROUND

As previously mentioned, it is frequently considered that videogames do not contribute for one's health. However, this perception is very restrictive, since some videogames are created precisely to promote healthy habits [11]. The literature divides videogames in three types: *casual games* (very simple games that are played occasionally just to spend some time), *core games* (the type of videogames that are built specifically for entertainment) and *serious games* (videogames with more serious purposes than entertainment, such as education or health) [12]. *Serious games* and *core games* can be used to bring some health benefits. *Core games* have a high potential for being used as pain distractors, which, if used correctly, can reduce expenses on painkillers, as well as eliminate their side effects [1].

*Serious games* have played an important role in healthcare for a few years. All three big companies of the videogame industry (Microsoft, Nintendo and Sony) supply *serious games* for their consoles, but the most prominent company in that field is Nintendo [5-7]. Therapists are now starting to use those consoles as a way of treatment for several types of injuries.

Nintendo Wii®, the first console where games are played with movement, has been recently studied as a therapy instrument. Some of those studies conclude that its videogames provide benefits for health, particularly in geriatrics and rehabilitation [3, 5, 7, 13].

Most of the authors consider that the use of Nintendo Wii® in rehabilitation is complementary to convention therapy and never a substitute. However, some authors, such as Laver, Ratcliffe, George, Burgess and Crotty [13], contest its appropriateness for rehabilitation. Those different perceptions of its usability can be (or not) related with how the console was implemented in those studies, emerging this way the necessity for study the implementation of the console.

Combining the implementation definitions of Linton (2002), Klein and Sorra [14] and Greenhalgh, Robert, Macfarlane, Bate and Kyriakidou [9] it is possible to define implementation as a process that begins when a technology is adopted by the organization and ends when it is completely routinized or abandoned. The decision to adopt a technology does not ensure its implementation and assimilation in the operations of an organization. To fully obtain the economic and competitive advantages that a technology can offer it is fundamental that the implementation process succeeds.

This work uses the framework proposed by Choi and Moon [15] to classify the implementation process. Choi and Moon [13] suggest four forms of implementation: 1) mechanical, 2) learning, 3) reinvention and 4) mutual adaptation, according to where adaptations occur during the implementation, in the technology and/or in the adopter.

Mechanical implementation involves implementing the technology without changing its original design or the way its users perform their work. Learning means that during the implementation users are prepared to become more skillful to use the technology, which could mean changing their values, skills and work behavior depending on the requirements of the technology, but the technology is not changed. Reinvention involves the adaptation and modification of technology so it can fit better to the adopter's work activities, but the adopter is not changed. Mutual adaptation involves changing both the technology and the adopter in order to adapt to one another.

Leonard-Barton [16] states that the need of adaptation comes from misalignments between the user's environment and the technology as they are in their original conceptualizations. Therefore, they need to go through some adaptations to converge to a point where they are aligned with each other, when the technology is used in its full potential and adds value to the user's activity.

Leonard-Barton [16] refers to those adaptations of the technology and the adopter as "cycles of adaptation". She argues that such cycles can involve a variation in magnitude, i.e., adaptations in the technology and adaptations in the adopter may have different degrees of impact: they can be proportional (significant changes or small changes in both sides – technology and adopter) or be significant in one of them and small on the other. According to the same author the adaptation should be neutral, since some other authors consider it undesirable and others consider that is mandatorily positive, it is defended in this work that mutual adaptations can take either beneficial or detrimental forms and that is the management of the implementation process that will make the difference. Leonard-Barton [16] argues that during the implementation of an innovation adaptations are needed in the user environment (which includes what Choi and Moon [15] call members of the organization and social context) and in the technology (the innovation), because there will be misalignments between both that have to be overcome in order for the implementation to be successful.

It is possible that the implementation process fails. Implementation failure occurs when, in spite of the decision to adopt, the targeted users use the technology with a frequency, consistency, and regularity below the required levels for the adopter to benefit from its full potential [14]. Still, failure can reflect a flaw in implementation or a shortcoming in the technology itself [14]. Some of the factors that lead to implementation failure are related with how people react to the change brought by the technology to the organization. When a technology is implemented sometimes the targeted users are not prepared for it, not due to lack of knowledge, capabilities or resources, but due to lack of motivation, influenced by system antecedent (contexts for innovation that differ between organizations, with some structural and some cultural features that have been shown to influence the innovation assimilation) or the impact that the technology might have in their activities [9]. Technologies threaten to disrupt organizational routines when their use involves interdependent users [17], which means that users need to interact in order to create new routines. In most of those cases an adaptation process is

necessary, since that technology does not fit the user environment as it is before the implementation. Therefore, it is common that the implementation of the technology requires changes in the technology and in the adopter [16].

According to Greenhalgh, Robert, Macfarlane, Bate and Kyriakidou [9] the technology should present a set of features in order to a successful implementation: relative advantage (compared with other options); compatibility (with the key players); trialability (the ability to try out the technology); observability (of its advantages); (the possibility of) reinvention; fuzzy boundaries; risk that the technology has attached to itself; task issues (if it can perform the intended tasks; (user's) knowledge required to use it; and augmentation/support by the supplier.

### III. METHODOLOGY

Three case studies were performed to observe the process of implementation of the Nintendo Wii® in physiotherapy clinics and rehabilitation centers. The objective was to learn about the process of implementation, specifically looking at the adaptations that occurred during that process, in order to understand which form of implementation [13] might be expected when implementing videogames in rehabilitation, the acceptance and adaptation of therapists to the console, and the results of the implementation, such as patients' and professionals' acceptance.

Three case studies were performed: two concerning small physiotherapy clinics, where Nintendo Wii® was used in physiotherapy treatments, and one concerning a public rehabilitation center with a private management, where Nintendo Wii® was used in occupational therapy treatments<sup>1</sup>.

The two physiotherapy clinics (Case 1 and Case 2) are private clinics located in two different Azores's islands (Faial and Pico). Both use Nintendo Wii® as a therapy tool for physiotherapy. The rehabilitation center (Case 3) is located in the North of Portugal, in the metropolitan area of Oporto. It is a public institution with private management, where Nintendo Wii® is used as an occupational therapy tool.

It was possible to compare implementation of the same technology with very similar purposes of use in slightly different contexts – small private clinics serving small population areas (Faial and Pico have approximately 1.5000 habitants each) versus big public centers (metropolitan area of Oporto has approximately 1.700.00 habitants), privately managed, located in high-density urban areas. This sampling

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<sup>1</sup> According to the Chartered Society of Physiotherapy from the United Kingdom "Physiotherapy helps restore movement and function when someone is affected by injury, illness or disability" (<http://www.csp.org.uk/your-health/what-physiotherapy>), while, according to The American Occupational Therapy Association, Occupational Therapy "help people across the lifespan in the things they want and need to do through the therapeutic use of everyday activities (occupations)" (<http://www.aota.org/About-Occupational-Therapy.aspx>). In another words physiotherapists treat injuries or illnesses while occupational therapists prepare the patient to certain (daily) activities.

strategy allowed for external validity to this work, which helped guarding against observer bias [18, 19].

#### *Data Collection*

All the organizations were contacted directly by telephone and e-mail. They were invited to become a case study, according to a case study protocol that was prepared and sent to each one of them beforehand. The first contact and some informal conversations with the therapists started in the end of 2015. Then, in each case, semi-structured interviews were performed in 2016 (between January and July).

A case study protocol was prepared for each of the three cases, with interview guides, built after getting familiarized with its context. Such protocols were divided in the following four sections: a) purpose and motivation for the case studies; b) procedures of data collection b1) Who to Interview; b2) Data Collection Plan; b3) Preparation of interviews; c) Interview Guides; and, d) Informed Consent Form. The use of such protocols provided reliability to this research [18].

In Case 1 there were performed three interviews to the only three physiotherapists of the clinic (which are also partners of the clinic), while in Case 3 there were performed 6 interviews to part of the occupational therapists from that center. Unfortunately, in Case 2 it was only possible to conduct one interview. However, as the clinic only has two physiotherapists (with occasional contract of one intern), who are married and own the clinic, the representativeness of that interview justifies the inclusion of this case study in the research.

The possibility to perform a third case study in Case 3 came up later from new contacts. The physiotherapists of Case 3 do not use Nintendo Wii® in rehabilitation, but the occupational therapists do. Six interviews were performed in this center, two occupational therapists who do not use the console in their work and four occupational therapists who use it.

All the interviews, were semi-structured, recorded and conducted in quiet spots of the workspace. There was some information taken from e-mail exchanged and informal conversations that took place after the interviews to check or complement some data. The researcher also visited the workspace of the therapists in all the organizations and observed while therapists were using Nintendo Wii® in therapy treatments.

#### *Data Analysis*

The interviews were transcribed immediately after being conducted to ensure constant comparison [20]. The transcriptions were rigorous and accompanied by several notes taken during the interviews.

The software used for Data Analysis was NVivo, version 11.11.

Initially the data was coded, using descriptive and simultaneous coding [21, 22]. Due to the specifications of physiotherapy and occupational therapy, and the differences between the small private clinics and the big rehabilitation



center, it was convenient to use coding schemes slightly adapted for each of the extremes.

All the interviews were coded and that information was then crosschecked to compare information obtained within the same organization and across organizations.

Interviews were retrospective, which allowed for a chronologic order of events to be designed for each case study, starting at the first time that the therapists heard about the use of Nintendo Wii® as therapy tool, throughout the learning process, the adoption decision, the utilization and until the moment of the interview.

Within case analyses were focused in describing the barriers for adoption, the difficulties of using Nintendo Wii®, the learning process, the Nintendo Wii® use (adaptations, additional technology used with the console, patients' pathologies treated using Nintendo Wii®), and the advantages and disadvantages of using Nintendo Wii®, and the reaction of the patients to its use.

The explanation that was build based on the within case analyses was intended to provide this work with internal validity [18].

For a cross-case analysis the information resulting from the within case analyses were compared [22] and supporting tables were built (presented in the results section). Data was displayed in a simpler way, which made it easier to analyze the results of each case study and compare them with the other cases results.

#### IV. FINDINGS

According to the data collected, Nintendo Wii® is the most suitable, of the three mainstream consoles (Nintendo Wii®, Sony PlayStation 3® and Microsoft XBOX 360®), for rehabilitation. This suitability derives from its vast number of games that require movement and from the existence of the peripheral Nintendo Wii Balance Board®. Such peripheral is exclusive for this console and allows playing making use of the lower limbs, which is fundamental to the rehabilitation of these specialties of care.

In all three cases, the adoption decision was informal and participative, and was made by the targeted users. According to Linton [23] this adoption decision triggers the beginning of the implementation process.

The moments of adoption decision had influence in the design of the workspace. In case studies 1 and 2 it was before the clinics initiated their activity, while in case 3 it was shortly after the beginning of the center's activity. Therefore, in cases 1 and 2 it was possible to plan the accommodations for the console previously, while in case 3 the console had to be accommodated in the space that was available and considered the most appropriated (without any particular planning), since the center was already operating when Nintendo Wii® was adopted.

In the three cases, as the therapists were the decision-makers, the adoption did not have a negative impact in the implementation process. Besides, in case 2 the workspace was fully adapted to the console and there were no complains about incorporating the console in the daily activity. However, in cases 1 and 3 the spaces were not adapted to the use of Nintendo Wii®, even though in case 1 the decision to adopt was made before opening the clinic, as previously mentioned. In that case, the location of Nintendo Wii® lacked space and privacy, and there was an excess of stimuli that distracted the patients, since at the beginning those questions were not contemplated due the fact that it was the first time that the physiotherapists would use the console in such space. In case 3 the problem with the location of Nintendo Wii® was that there were no separated rooms for children and adults to use the console, which created uncomfortable situations for children to use the console.

Nintendo Wii® may be divided into five modules: the console; Sensors Receptor; Balance Board; Controllers (Wii Remote and Wii Nunchuck – a second remote that is used in games that involve moving the two hands); and, Games (in the three case studies the games used were Wii Fit®, Wii Sports® and Wii Sports Resort®).

With this division, it is possible to identify small improvements that make Nintendo Wii® more suitable to physiotherapy. When most of the interviewees were asked about what could be modified to better suit Nintendo Wii® to the therapy context, they suggested adding some conventional therapy instruments to the controllers or the balance board in order to use the potential of the games, with the challenges they are looking for.

The most problematic module seemed to be “Games”, due to the lack of games specifically conceptualized for rehabilitation. As it is suggested by Klein and Knight [24], many technologies are imperfect. In the case of Nintendo Wii®, its games are not conceptualized and ready for the rehabilitation context. Consequently, this technology is imperfect for that context, which could lead to a use less frequent than required to take full advantage from its benefits, as it was observed in the case 1, where the physiotherapists mentioned that the game that they most use is too time consuming due the fact that it is design for personal use. That problem is not referred in case 2, even if it is referred that more specialized games would be useful. In case 3 it was not referred directly that something made them use less the console, but it was referred that they would use it more if they had the appropriate games.

According to the therapists, Nintendo Wii® presents several advantages: its cost is relatively low; it is the only console with a peripheral device like Nintendo Balance Board® (which was referred as being one of the main advantages that this console has against its competitors); it is very interactive; and, it provides a good feedback, which is easy to understand. In general, the interviewees referred that the console is more motivating for patients than the traditional

methods. Moreover, it is very adaptable, and provides a large range of degrees of difficulty and of movements that are possible to work.

But at the same time, it has some barriers that impede its use and make the therapists resort to it less times: it is more time consuming than the traditional methods, since the console is very interactive; it requires a lot of personalization of the player before starting the game; and, it gives “lectures” and advices to the users. Furthermore, it was also referred that it is too easy to “cheat” the console sensors in a way that facilitates the exercise, which requires that the therapist have to supervise more carefully the exercises. Other barriers to the use of Nintendo Wii® by the therapists are the age, cognitive and physical limitations of patients.

From the previous observations concerning the workspace where Nintendo Wii® is used and from some of the barriers identified to the use of the console, such as how easy it is to cheat (requiring high efforts of supervision), it is then possible to conclude that the degree of adaptation of the workspace where the console is located, influences its use in rehabilitation treatments.

Even before the decision to adopt, in cases 1 and 3, the therapists started learning about the new console by performing a few experiments by themselves and with some patients. This can be considered a pre-implementation stage since most of the therapists were not prepared to use the console in therapy and they needed to collect information about its use before deciding to adopt it. In case 1, some experiments with patients took place even before the idea of opening the clinic, since the physiotherapists had the opportunity of trying the use of the console with some handball players that they usually treated. In case 3, some of the occupational therapists had already used Nintendo Wii® in former internships. Such experiences evidenced to help both for the adoption decision and in the learning process with the implementation, which is in line with Choi and Moon [15] argument that the implementation process sometimes involves a series of controlled experiences and that it is not an automated process. Other learning instruments were also used by the therapists, such as papers and videos about the use of Nintendo Wii® as a therapy tool, and a formal training about how to use it in rehabilitation. In case 2, those experiments were performed after the acquisition of the console by the clinic.

In these implementations, there were two groups of users: the therapists and the patients. It was observed that therapists, in general, have a high degree of readiness to use Nintendo Wii® in rehabilitation, since they are used to new technologies and the decision to use the console was made by them, not someone in a higher position of the organization's hierarchy.

Patients can be divided in children, adults and seniors. In the cases 1 and 2 none of the patients refused to use the console, even though some seniors needed some persuasion. In the case 3 some patients refused to use the console, but it was also referred that those same patients refused all the

therapies that include new technologies. Children in general are quite willing to accept new technology and seem to instantly know how to use it. Their level of readiness can be considered as high, or even exaggerated since while they are prepared to use the console without problems, they also are able to easily find out how to cheat its sensors. Adults are scarcely referred during interviews, but generally they accept well using the console, just requiring some explanation of what they will do and why they will use the console. Seniors are the group that benefit the most from using Nintendo Wii®, since it is especially effective in helping to reduce fall episodes [3-5, 8]. However, at the same time this is the group of patients with more difficulties to use it because generally they have sparser contact with new technologies.

These categories of patients are important since they influence substantially the implementation of Nintendo Wii®. The refusal of some of them lead to a difficult implementation of the console, while the high level of readiness of the console by children can lead to a need of a tight control and, therefore, to a change in the role and practices of the physiotherapists. Each category of patient has its specificities that influence the use and the perception of the console: children need more control, elderly need privacy and an adapted space, among others.

In the three cases it was observed that the adaptations for the use of Nintendo Wii® involved using it with Freeman Boards, Bobbath Balls, and other therapy instruments to adapt its mode of operation to the therapy needs. Adaptations of the adopters' practices involved new learning (mentioned previously) and adjusting work practices and treatments to better suit the use of this technology. Furthermore, specific adaptations were made to adjust the console to the needs and condition of particular patients, such as having the patient seated using a game where it is supposed to be standing up, or register the characteristics of the patient different from the reality to make the game easier (for instance, register a smaller weight).

It is thus possible to identify that the implementation of Nintendo Wii® in rehabilitation happens as a Mutual Adaptation process, where both adopters and the technology go through a process of adaptation. Physiotherapists and occupational therapists had to learn about how to use Nintendo Wii® in therapy, to adapt how they perform some treatments to make use of the full potential of the console, and to define how Nintendo Wii® would be played in therapy sessions, which has significant differences from its use for entertainment, because external equipment, such as the Freeman Boards, is used with the console, and the games are played in a different way to be more adapted to the treatment requirements.

In what concerns the scale of adaptation and according to Leonard-Barton [14], external equipment was introduced in small cycles during their experiments, a minor adaptation, since the console did not suffer any change in itself, only a few external equipment was added, i.e. new modules were

introduced to be used with the technology [14]. Even though the method of implementation in all those cases is classified as mutual adaptation, it is important to highlight that the implementation method is perceived as a case of learning. The deepest change, i.e. the largest cycle of adaptation happened in the adopter side, since it was necessary to acquire new knowledge and develop new routines [14], and to adapt the workspace and the rehabilitation methods, i.e. the business processes. Consequently, it is possible to conclude that in the three cases the implementations happened as mutual adaptations, but with a strong learning nature, due to the imbalance of adaptations implemented in the both sides (large cycles of adaptation in the adopter's side and small cycles of adaptation in the technology's side).

## V. CONCLUSION

This work was motivated by the importance of the implementation of technologies in the healthcare industry, and was focused on the implementation of videogames (namely the console Nintendo Wii®) in rehabilitation (physiotherapy and occupational therapy). The main goal was to understand how Nintendo Wii® was implemented in rehabilitation clinics. An inductive multiple case study with three cases was conducted to achieve this goal.

This work is expected to bring some contributions to the literature about implementation in healthcare, more specifically the implementation of videogames in rehabilitation, a topic where research is still scarce.

From this research emerged that what makes Nintendo Wii® the most attractive console for rehabilitation purposes are two main factors: the highest number of games available for the console that can be easily adapted to serve for rehabilitation purposes because they require the player to move, and the ease of use of the peripherals available for the console, which provide a mode of playing that is appropriate for rehabilitation exercises.

This study also led to the conclusion that in the three case studies the decision to adopt Nintendo Wii® was simple, informal, and made by the users of the technology, leading to not having particular influence on the implementation process. All the clinics went through a pre-implementation stage, which was important to conveniently prepare the implementation process, namely by collecting information about its use before deciding to adopt it and taking better adoption decisions, and in case 2 the adaptation of the workspace where the console would be used, which made easier the creation of new routines associated with using the console. It was possible to observe that the moment of the decision to adopt the console influenced the possibility to appropriately design the workspace for using it.

In two of the cases, the implementations were preceded by a series of controlled experiments to test the use of the console in rehabilitation, which helped deciding whether to adopt the technology or not, and helped the learning process required to be able to use the console. Moreover, the console was

imperfect. Its games are not conceptualized and ready for the rehabilitation context. Consequently, in some cases it lead to a less frequent use than it is required to take full advantage from its benefits, ultimately leading to a decreasing use of the technology.

The implementation occurred as a mutual adaptation, although it had strong characteristics of a learning process because the adaptation efforts in the technology and in the adopter were imbalanced: in the adopter side the implementation involved large adaptation cycles (creating new routines and changing the physical workspace and the business processes), and in the technology side it involved small cycles of adaptation (including new modules to be used with it in rehabilitation treatments). In such implementations, where there are different users, in this case therapists and distinct categories of patients there are also different levels of readiness to use the console and different perceptions about its usefulness, which influence the implementation, since some users refuse to use it and others are difficult to convince in its use. Furthermore, those distinct levels of readiness and perception influence the adaptations that the workspace need for receive the console. Finally, although Nintendo Wii® is not being used in its full potential, when there is resistance to use it this phenomenon of incomplete implementation is amplified, while when the console becomes routinized this phenomenon is mitigated.

Although it is possible to draw several conclusions from this work, there are some limitations that need to be acknowledged. Case 3 is located in a location with very distinct characteristics from the two physiotherapy clinics and has a much bigger dimension and different structure than those two other cases. Those differences are important to bring diversity to the study and to contrasts between cases, but at the same time the differences may bring some "noise" to the study that may influence the analysis.

Several directions for future work have been identified. There is a need of more research on the implementation of videogames in the healthcare industry. It would be important to perform further case studies in other healthcare providers that also use videogames as therapy tools (Nintendo Wii® and other consoles). For instance, there seems to be potential for some videogames to work as painkillers, and the adoption and results of those therapies would also be interesting to consider. It would be interesting to study the impact that the participation and support of the manufacturer of an entertainment console could have in the implementation process. Furthermore, research is needed to analyze whether it is viable to invest in the development of videogames targeting healthcare purposes, and more specifically rehabilitation purposes, since the existing games not being designed for rehabilitation and requiring some adaptation efforts are the module that is making this adoption more difficult. However, until now it is not possible to determine if it would attract investors.

Furthermore, videogames have the potential to play a role in other domains, e.g. education. Although some research can be found in that domain, it would still be interesting to expand research on the implementation of videogames in several other serious domains of application.

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