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A Framework for the Design of Digital Games with Therapeutic Potential by People in Recovery from Substance Use Disorders

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A Framework for the Design of Digital Games with Therapeutic Potential by People in Recovery from Substance Use Disorders

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This doctoral thesis is dedicated to my family, in particular to my parents Pedro Paulo de Souza and Maria Filomena Maia de Souza, my husband Fernando Roberto Proença and my son Gabriel de Souza Proença.

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"If I have the gift of prophecy, and know all mysteries and all knowledge; and if I have all faith, so as to remove mountains, but don't have love, I am nothing."
(I Cor. 13:2)

Abstract

Concerns related to mental health have been spread worldwide and computing has demanded efforts in the development of solutions to support therapies for mental disorders. Substance Use Disorders (SUDs) are no longer being treated as an individual health issue, but are also related to public and social health. Patients in recovery from SUDs are end users of therapy support systems and their involvement in the process of creating these computer systems has the potential to increase patients' autonomy and help with adherence to therapy. Studies involving the participation of end users in the construction of therapeutic systems were identified in the literature, however, in these studies, health professionals and patients participate more as information providers. Little is known about this population actively participating in the design of therapeutic solutions, more specifically, digital games with therapeutic potential. Considering this context, the motivation for this doctoral research arose from the intention to formalize a framework that could scale the design and development of digital games with therapeutic potential by people recovering from SUDs. The hypothesis was that delivering a specific design process for this population would increase the autonomy and empowerment of end users (health professionals and patients). Given the motivation to support the design and development of digital games with therapeutic potential for people recovering from SUDs, the objective of this doctoral research was to build a framework that corroborates the design and development activities by this population, providing more autonomy to those end users. In order to achieve this objective, the methodological path included, first, a Systematic Mapping (SM) carried out on computing in support of the therapy of mental disorders. In parallel, a case study was carried out with people recovering from SUDs at a Psychosocial Care Center - Alcohol and Drugs (CAPS-AD). Based on the results of the SM and the case study, it became possible to identify demands for the construction of the framework. To build the framework, the following were defined: i) a design process; ii) a set of rules for creating Conversational Agents (CAs) that can guide the end user in the design process; and iii) a web platform with an embedded CA to support the design

process. After completing the development of the framework, a second case study was carried out, at CAPS-AD in another city, to evaluate the framework. The results suggest that the use of the proposed framework aroused more interest, engagement, autonomy, and empowerment of end users in the design of digital games with therapeutic potential. The main contributions of this doctoral thesis are i) State-of-the-art study on computing to support the therapy of mental disorders; ii) Lessons learned from applying a design process by people in recovery from SUDs in a real-life setting; iii) Construction of a framework for the design of digital games with therapeutic potential by people in recovery from SUDs; and iv) Evaluation of the framework with end users in recovery from SUDs.

Keywords: End-User Design. Computing and mental health. Therapeutic games. Vulnerable population. Alcohol and drugs.

Resumo

Preocupações relacionadas à saúde mental tem-se aumentado em todo mundo e a computação tem demandado esforços no desenvolvimento de soluções para apoio à terapias de transtornos mentais. Os Transtornos por Uso de Substâncias (TUS) vêm sendo tratados não mais como uma questão de saúde individual, mas relacionados também com a saúde pública e social. Pacientes em reabilitação de TUS são usuários finais de sistemas de apoio à terapia e o envolvimento dos mesmos no processo de criação desses sistemas computacionais tem potencial de aumentar a autonomia dos pacientes, auxiliando inclusive na adesão à terapia. Estudos envolvendo a participação de usuários finais na construção de sistemas terapêuticos foram identificados, porém nesses estudos os profissionais de saúde e pacientes participam mais como provedores de informação. Pouco se sabe na literatura sobre essa população participando ativamente no design de soluções terapêuticas, mais especificamente, jogos digitais com potêncial terapêutico. Considerando esse contexto, a motivação para esta pesquisa de doutorado surgiu da intenção de formalizar um framework que pudesse escalar o design e o desenvolvimento de jogos digitais com potencial terapêutico por pessoas em recuperação de TUS. A hipótese foi que entregar um processo de design específico para essa população aumentaria a autonomia e o empoderamento dos usuários finais (profissionais de saúde e pacientes). Dada a motivação para apoiar o design e desenvolvimento de jogos digitais com potencial terapêutico por pessoas em recuperação de TUS, o objetivo desta pesquisa de doutorado consistiu em construir um framework que corrobore com as atividades de design e desenvolvimento por essa população, proporcionando mais autonomia aos usuários finais. Na busca de se alcançar tal objetivo, definiu-se um percurso metodológico a ser seguido. Primeiramente realizou-se um Mapeamento Sistemático (MS) sobre a computação em apoio à terapia de transtornos mentais. Em paralelo, aplicou-se um estudo de caso com pessoas em recuperação de TUS de um Centro de Atenção Psicossocial - Álcool e Drogas (CAPS-AD). A partir dos resultados do MS e do estudo de caso tornou-se possível identificar demandas para a construção do framework. O framework está constituído por: i) um processo de

design; ii) um conjunto regras para criação de Agentes Conversacionais (ACs) que possam guiar o usuário final no processo de design; e iii) uma plataforma web com um AC incorporado para apoiar o processo de design. Após a conclusão do desenvolvimento do framework realizou-se um segundo estudo de caso, no CAPS-AD de outra cidade, para avaliação do mesmo. Os resultados sugerem que o uso do framework proposto despertou mais interesse, engajamento, autonomia e empoderamento dos usuários finais no design de jogos digitais com potencial terapêutico. As principais contribuições desta tese de doutorado são i) O estudo do estado da arte em computação para apoio à terapia de transtornos mentais; ii) As lições aprendidas com a aplicação de um processo de design por pessoas em recuperação de TUS em um ambiente de vida real; iii) A construção de um framework para o design de jogos digitais com potencial terapêutico por pessoas em recuperação de TUS; e iv) A avaliação do framework com usuários finais em recuperação de TUS.

Palavras-chave: End-User Design. Computação e saúde mental. Jogos terapêuticos. População vulnerável. Álcool e drogas.

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Acronyms

ADs Anxiety Disorders

ADHD Attention Deficit Hyperactivity Disorder

ASD Autistic Spectrum Disorder

CAPS Psychosocial Care Centers

CAPS-AD Psychosocial Support Center - Alcohol and Drugs

CA Conversational Agent

CAs Conversational Agents

DDs Depressive Disorders

DSR Design Science Research

DSM-5 Diagnostic and Statistical Manual of Mental Disorders

GMH General Mental Health

HCI Human-Computer Interaction

MQs Mapping Questions

MG Minas Gerais

NDs Neurocognitive Disorders

NDDs Neurodevelopmental Disorders

OHC Online Health Communities

PD Participatory Design

SP São Paulo

SSP Schizophrenia Spectrum and Other Psychotic Disorders

SAM Self-Assessment Manikin

SDs Substance-Related and Addictive Disorders

SUDs Substance Use Disorders

SS Suicidal Behavior Disorder and Self-injury

SM Systematic Mapping

SUS System Usability Scale

TAQ Technology Acceptance Questionnaire

TSs Trauma- and Stressor-Related Disorders

USA United States of America

WHO World Health Organization

Contents

Chapter 1

Introduction

Substance Use Disorders (SUDs) affect 35 million people worldwide (OLAFSSON; WALLACE; BICKMORE, 2020), being a widespread and hazardous public health concern (HEYER et al., 2020). SUDs are characterized by the inability of an individual to reduce the use of a substance (e.g., alcohol or illicit drugs) (HEYER et al., 2020). The breadth, low cost, and ability to be personalized and customized make the technology potentially a good way to support SUDs therapy (SCHMITT; YAROSH, 2018). Therapeutic digital games, for example, have the potential to be well employed in the SUDs context. Game design can also contribute to the recovery process, complementing traditional treatments (HEYER et al., 2020), enabling users to express their opinions in the first person, and building computational systems that can help them better adhere to the prescribed treatment. In this context, this research sought to investigate ways to support the design and development of digital games by people recovering from SUDs. In such a way that they have more autonomy, feel empowered in creating games, and can express themselves through the design and stories created for the games, without depending on the direct intervention of computer professionals.

1.1 Context, motivation and problematic

World Health Organization (WHO) predicts that by the year 2030, mental illness will be the main burden of disease worldwide. SUDs are a type of mental disorder that causes more than 500,000 deaths per year worldwide (TERRA, 2021). Considering this projection, advances in technology create opportunities for close collaboration between computing and mental health researchers (WADLEY et al., 2018). The literature points to computational solutions related to the therapy of patients with mental disorders. A

Systematic Mapping (SM) (Chapter 2) carried out points to therapeutic solutions related to anxiety, dementia, depression, and stress, among others. But of the 87 works selected in SM only three are related to SUDs (SHEN; SHEN; CHIA, 2019; BHATTACHARYA et al., 2017; SCHMITT; YAROSH, 2018).

Shen, Shen e Chia (2019) developed a mobile application to support healthy habits in people with chemical dependency and did not report whether there were people other than the authors participating in the development process. Bhattacharya et al. (2017) conducted interviews with education and health professionals to outline directions for technology design to support therapy for patients with cigarette dependence. Schmitt e Yarosh (2018) reported patient participation in defining a taxonomy for design implications in Human-Computer Interaction (HCI). Workshops of the Participatory Design (PD) were held with the intention of collecting information from patients.

The participation of end users in the construction of therapeutic systems for mental disorders was also identified in papers covered in SM. These papers used co-design techniques (WILSON et al., 2019; LEE; YAMASHITA; HUANG, 2020; RANDALL; ŠABANOVIć; CHANG, 2018; SAS; HARTLEY; UMAIR, 2020), PD (RANDALL; ŠABANOVIć; CHANG, 2018; ALVAREZ-JIMENEZ et al., 2018; UNBEHAUN et al., 2018; GOMES et al., 2020; SCHMITT; YAROSH, 2018), co-development (SIMM et al., 2016) and user-centered design (WACHTLER et al., 2018). In the papers identified, it was possible to observe health professionals and patients as providers of information in design processes for building computational solutions for therapy. However, little is known about this population actively working in the design and development of digital games with therapeutic potential. Garcia et al. (2019), GARCIA (2019) describes a game engine for developing digital games that were applied to people in recovery from SUDs. The activities carried out were guided and had the collaboration of computing and health professionals. The research had no therapeutic intention and did not follow a specific design process, however, the authors observed that the co-creation of games showed the potential to empower users and provide more confidence in themselves (GARCIA et al., 2019).

The motivation for this doctoral research arose from the intention of creating a design process that could scale the design and development of digital games with therapeutic potential for people in recovery from SUDs. The hypothesis was that delivering a framework with a specific design process for this population and reducing the need for interventions from computer professionals would increase the autonomy and empowerment of end users (health professionals and patients).

Seeking to investigate people in recovery from SUDs by designing digital games in a real-life scenario, design and development activities for therapeutic digital games were carried out at Psychosocial Support Center - Alcohol and Drugs (CAPS-AD) in the city of São Carlos / São Paulo (SP) - Brazil (Chapter 3). CAPS-AD is a public service that

provides support to people in recovery from SUDs. An open door and daily care service aimed not only at treatment but also at the family, social, and community reintegration of service users (LACERDA; FUENTES-ROJAS, 2016). The service has the participation of multidisciplinary teams, made up of social workers, psychiatrists, psychologists, occupational therapists, nurses, and nursing assistants, among others (ROCHA, 2017). The rehabilitation of SUDs is related to inclusion initiatives through social, cooperative, productive, and income-generating activities. Social inclusion is also important in the context, aiming to exercise citizenship and develop autonomy (SANCHES; VECCHIA, 2018).

The design and development activities provided discussions about harmful and protective actions in SUDs, providing an opportunity for users to express themselves. Participants were able to carry out the activities, however, they needed support from computer professionals and some activities had to be adapted. The research results point to demands aimed at evolving the strategies used to improve the autonomy of end users and reduce direct interference from computing professionals.

1.2 Objective

Given the motivation to support the design and development of digital games with therapeutic potential by people recovering from SUDs, the objective of this doctoral research was to build a framework that corroborates the design and development activities of this population, providing more autonomy for end users. More autonomy in this context is considered to be the ability of end users to apply design and development activities with the least possible intervention from computer professionals.

The framework was built with the following composition: i) a design process considering the SUDs context; ii) a set of rules to create Conversational Agents (CAs) that support and guide end users in recovery from SUDs in the design and development process of digital games with therapeutic potential; and iii) a Web platform where end users in SUDs recovery can apply the design process, guided by a Conversational Agent (CA). The framework is presented in detail in Subsection 1.4.1.

1.3 Method

For this doctoral research, six main steps were considered, using an appropriate research method for each step. Figure 1 presents the methodological path containing each research step.

Firstly, a study of the state-of-the-art was carried out about computing in support of the therapy for mental disorders. This study used the systematic mapping research method. The research was carried out looking for papers published from 2015 to 2020,

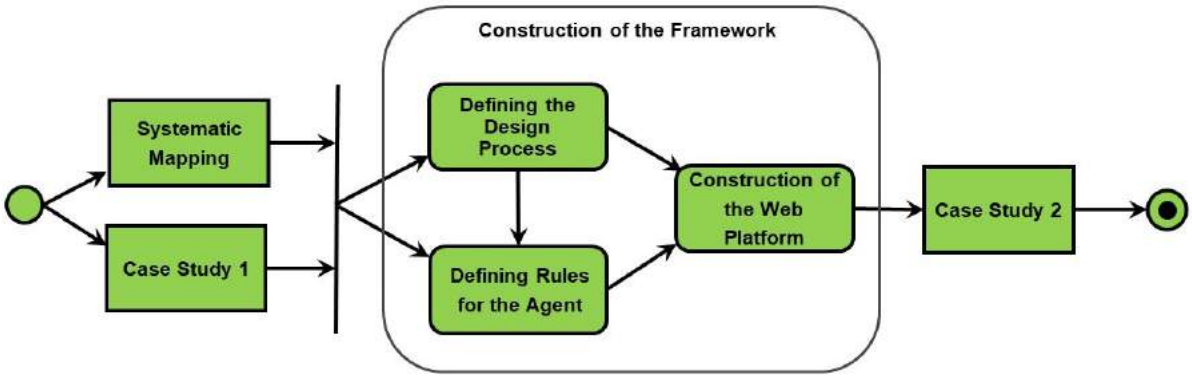


Figure 1 – Methodological Path.

in the research bases of ACM Digital Library, IEEE Xplore, and PubMed. After applying inclusion and exclusion criteria, 87 articles were selected for SM, and its results are presented in Chapter 2.

Parallel with the SM, a study was carried out with users, applying a case study with the target audience in a real-life scenario. For this case study, the SemTh (SOUZA; RODRIGUES; NERIS, 2019) approach was applied, which supports the design of digital games by end users. The activities were carried out in 2019 at CAPS-AD in the city of São Carlos / SP - Brazil. In total, 21 CAPS-AD users participated in some of the activities carried out. As CAPS-AD is an open-door service, user turnover is a reality that needs to be taken into account in this study. The turnover of CAPS-AD users was a limitation, but the activities were adapted to minimize its effects. The case study was carried out to study the population in recovery from SUDs by carrying out design and development activities to identify demands. The results of the case study are presented in Chapter 3.

The demands identified in SM and the study with users supported the beginning of the construction of the framework. The framework was built considering a design process in the context of SUDs, a set of demands and rules for building an CA to guide the design process, and a web platform with an embedded CA to instantiate the design process. The results of these three steps are presented in Chapter 4, plus an assessment with experts in the field of SUDs.

In the last step of the research, with the completion of the development of the web platform, it was applied and evaluated in a second case study considering the same context. This case study was approved by the Research Ethics Committee of the Federal University of São Carlos (in São Carlos city, State of São Paulo in Brazil) under feedback report (named CAAE) number 66623823.4.0000.5504. This case study was applied to people in recovery from SUDs at CAPS-AD in the city of Passos / Minas Gerais (MG) - Brazil. In total, 25 CAPS-AD users participated in some of the activities carried out. Field diaries,

questionnaires, interviews, and artifacts generated during the design activities were used for data collection. For the analysis of the qualitative data collected in the field diaries and interviews, the thematic analysis method (CORBIN; STRAUSS, 2014; BERNARD; WUTICH; RYAN, 2016) was used. The results of the case study are presented in Chapter 5.

1.4 Synthesis of contributions and framework formalization

This doctoral research presents four main contributions to the scientific community. A synthesis of these contributions is described below. Scientific papers resulting from these contributions are presented in this thesis in Chapters from 2 to 5.

State-of-the-art study on computing to support the therapy of mental disorders. This research presents the results of a SM that was carried out to analyze scientific papers that involved therapy for people with mental disorders. In addition to the contributions generally presented from a SM, was also reported a set of guidelines for future research in the same domain (Chapter 2).

Lessons learned from applying a design process by people in recovery from SUDs in a real-life setting. To understand the specific needs and demands of this population with regard to actively applying a design process, a case study was carried out with users of CAPS-AD in the city of São Carlos / SP - Brazil. The case study brought contributions with regard to the carrying out of design activities by this population and the implementation of digital games with therapeutic potential. From this study, the lessons learned from the activities were also listed, bringing important insights for other researchers who wish to apply their research in the same domain (Chapter 3).

Construction and evaluation of a framework for the design of digital games with therapeutic potential by people in recovery from SUDs. The main contribution of this doctoral research consists of the creation and evaluation of this framework. The creation of the framework considered the results of the studies carried out and it is described in subsection 1.4.1.

Evaluation of the framework with end users in recovery from SUDs. To evaluate the framework, an evaluation of SemTh Web was carried out with health professionals from CAPS-AD in the city of Passos / MG - Brazil, and a case study with users of the service in the same institution. Chapter 4 presents details on the use of the framework to build the SemTh Web, the design decisions made, and the evaluation with health professionals. Chapter 5 presents the results of the case study with end users in recovery from SUDs.

1.4.1 Framework formalization

To build the framework proposed in this doctoral thesis were considered the results obtained in SM (Chapter 2) and the case study presented in Chapter 3. The framework is composed of three parts (see Figure 2), being them:

1. **Design Process.** Composed of three main stages (design, development, and evaluation), the design process for this context suggests the application of activities of enrichment of personas, interaction modeling, defining the game editor, implementation, and evaluation of gameplay. The entire process must be guided by a CA;

2. **Rules for creating CAs.** In this context of SUDs, it is expected that the CA has the skills to embrace users, explain and exemplify all activities, guide the entire design and development process, support the resumption of the train of thought, support collaboration between users and use a vocabulary adapted to the context;

3. **Web Platform.** The web platform, named SemTh Web, supports the suggested design process and adds a CA to guide users in the activities.

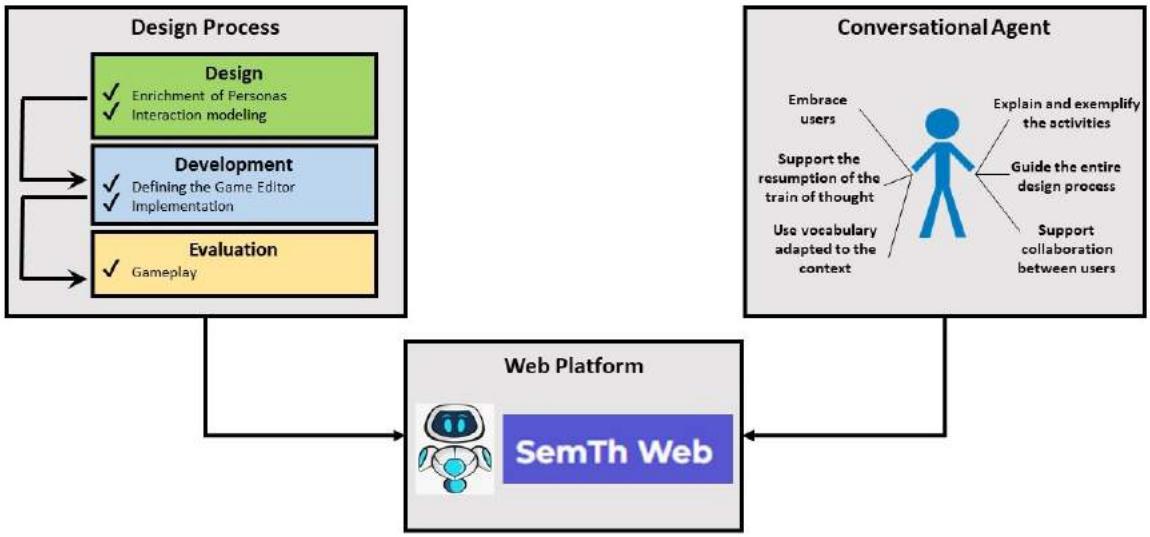


Figure 2 – Framework proposed in this doctoral research.

The construction of the framework was based on the results of studies carried out during the doctorate period. As a result of SM (Chapter 2) a set of guidelines for future authors was presented. Among the guidelines identified in SM, we brought to the framework the need to detail the design process, specify the pathology that will be addressed by the computational solution, involve healthcare professionals and patients and consider

characteristics of flexibility, accessibility, and diversity. Considering these recommendations, the framework was built to support SUDs therapy, including a design process that supports the participation of health professionals and their patients and adding some accessibility items (e.g. different forms of interaction).

In the case study detailed in Chapter 3 the SemTh approach (SOUZA; RODRIGUES; NERIS, 2019) and the Lepi game engine (GARCIA et al., 2019) were used. Lepi was chosen because it was evaluated in the context of SUDs. SemTh was chosen because it was developed to support end users in the design of therapeutic digital games. However, it had been used by healthcare professionals and this case study intended to identify how patients would apply the approach. SemTh has the stages of Clarification of the Design Problem, Interaction Modeling, Materializing Design, and Evaluation. Each stage has specific activities, and suggested design activities include: a brainstorming section, enrichment of personas, defining therapeutic requirements and objectives, and modeling interactions using a domain-specific modeling language (GARCIA; RODRIGUES; NERIS, 2016). Considering the ease and difficulties faced by patients when applying the design activities proposed by SemTh, the specific design process was defined for the context of SUDs. Based on the results of this case study, it was also possible to define the rules for creating an CA that would guide end users in the design process. It was observed which demands and doubts needed from computer professionals to be resolved during the implementation of SemTh activities. With this observation, we identified the steps and activities that would need to be supported by CA (e.g. support the resumption of the train of thought and exemplification of activities).

The web platform, named SemTh Web, was implemented considering the design process and rules for CA. Chapter 4 presents details of the implementation of the SemTh Web platform, as well as the design decisions that were made.

1.5 Text structure of this doctoral thesis

This doctoral thesis is composed of six chapters, in a paper collection format. Chapter 1 presents the introduction, context, motivation, problematic, objective, method, synthesis of contributions, and the structure of the text. Chapter 2 presents a paper with the results of a SM submitted to a scientific journal, in the process of review. Chapter 3 presents a paper with the results of a case study with the target public, published in a scientific journal. Chapter 4 presents a paper detailing the construction of the proposed web platform and an evaluation with health professionals, submitted to a scientific journal, in the process of review. Chapter 5 presents a paper with the results of a case study with the target public to evaluate the framework, published in a scientific event. Finally, Chapter 6 presents the conclusions of this doctoral research, its limitations, future work, and publications. Next, references and summaries are presented highlighting the contri-

butions of the papers:

[Chapter 2] Souza, Paula Maia; Junior, Clenio Batista Gonçalves; Neris, Vânia Paula de Almeida. Computing in Support of Mental Disorders Therapy: A Systematic Mapping. *Submitted to a scientific journal, in the process of review.*

The paper presents a SM on how computing is supporting therapy in the context of mental health focusing on how these technologies are been designed, developed, and evaluated and for whom. As a result of the complete analysis of 87 papers, it was possible to identify that the papers mainly addressed nine categories of mental disorders. Regarding the technological aspects, the authors omit several important data as the stakeholders and time of development and evaluation. Moreover, user diversity and software quality aspects such as accessibility and flexibility are not been investigated or reported. Finally, there are proposed guidelines for future research.

[Chapter 3] Souza, Paula Maia de; Neris, Vânia Paula de Almeida; Proença, Fernando Roberto; Garcia, Franco Eusébio. End-users in recovery from substance use disorders as designers of Personas and digital games with therapeutic potential. Journal on Interactive Systems, Porto Alegre, RS, v. 13, n. 1, p. 243–256, 2022. DOI: 10.5753/jis.2022.2539. Available in: https://sol.sbc.org.br/journals/index.php/jis/article/view/2539.

The paper investigates the co-creation of personas and digital games with therapeutic potential by patients recovering from SUDs. Twenty-one patients, one healthcare professional, and four computer science professionals took part in the workshops. In total, were created seven personas and four digital games with therapeutic potential. By conducting a qualitative analysis, we were able to determine eleven lessons learned from the process.

[Chapter 4] Souza, Paula Maia de; Alves, Bianca Alessandra de Souza; Santos, Vinícius Matheus Romualdo; Proença, Fernando Roberto; Borges, Vânia de Oliveira; Neris, Vânia Paula de Almeida. Development and evaluation of a web system for the design of digital games with therapeutic potential by end users. *Submitted to a scientific journal, in the process of review.*

The paper sought to investigate how to build a conversational interface for a web system that guides end users in recovery from SUDs in digital game design activities with therapeutic potential. We used the Design Science Research method to support the construction and evaluation of the solution. To evaluate the system, we conducted a usability test with health professionals from a psychosocial care center for people in recovery from SUDs. The emerging results suggest that healthcare professionals would use the system as an alternative therapy with their patients because the proposed solution can facilitate verbal expression, improve communication between patient and therapist, discuss how to deal with real situations in a playful way, and encourage interaction with technology.

[Chapter 5] Souza, Paula Maia de; Santos, Vinícius Matheus Romualdo; Alves, Bianca Alessandra de Souza; Proença, Fernando Roberto; Motti, Vivian Genaro; Rodrigues, Kamila Rios da Hora; Neris, Vânia Paula de Almeida. Case Study: End users in recovery from substance use disorders as designers and developers of digital games with therapeutic potential. In Extended Abstracts of the CHI Conference on Human Factors in Computing Systems (CHI EA '24), May 11–16, 2024, Honolulu, HI, USA. ACM, New York, NY, USA, 6 pages. Available in: https://doi.org/10.1145/3613905.3637114.

The paper proposes a design process and a web system to support the design and development of digital games with therapeutic potential by people in recovery from SUDs. The proposal aims to generate more autonomy for end users as a means of scaling game design for therapy. This case study aims to evaluate the design process and the web system. We also assessed the autonomy of end users (patients). We employ a case study, as a methodological approach, conducting six meetings with design activities and the development of digital games with patients in recovery from SUDs and their therapists. Research data were collected through field diaries, observation, questionnaires, and interviews. Results suggest that participants were more autonomous with the support of the web system. This paper also features a discussion of the authors' perception of the activities, design implications, and recommendations for future research in the same domain.

1.5.1 Another way to read this doctoral thesis

Composing a doctoral thesis following the format of a collection of papers allows the evolution of the work to be visualized, as it shows the preliminary results and highlights the sub-steps that led to these results. If this is your reading intention, it is recommended that the chapters be read in the sequence in which they were organized in this thesis. However, if you want to read this thesis along more traditional lines, Table 1 summarizes a possible structure considering the broad areas of scientific work in computing.

Table 1 – Large areas of scientific work in computing and sections of this thesis.

Areas of scientific work in computing	**Content covered in this thesis**	**Sections**
Bibliography and Theoretical Reference	Systematic mapping of computing and therapy for mental disorders	2
	Recovery from SUDs and support by computing	4.2.1
	Design and development of digital games with therapeutic potential	4.2.2
Contributions and framework formalization	Synthesis of contributions	1.4
	Framework formalization	1.4.1
	Lessons learned from end-users in recovery from SUDs as designers of Personas and digital games	3.5
	Problem identification, motivation, and definition of the objectives for a solution	4.4.1
	Design, development, and demonstration	4.4.2
Framework evaluation	Evaluation with health professionals	4.4.3
	Evaluation with end users in recovery from SUDs	5.3
Conclusions	Summary of conclusions, limitations, future work, publications and submissions	6

Chapter 2

Computing in Support of Mental Disorders Therapy: A Systematic Mapping

2.1 Introduction

The number of people with mental disorders continues to grow, generating significant impacts on the population's health. Among the main consequences, social and human rights and economic consequences stand out in all countries of the world. Mental disorders are usually characterized by a combination of abnormal thoughts, perceptions, emotions, and behavior, which can affect the individual and their interpersonal relationships (OMS, 2021). However, the WHO itself points out that it is a challenge to define mental disorders. This challenge is related to the fact that mental disorders are not a single condition but a group of disorders with points in common (WHO, 2005).

It is estimated that mental disorders affect 10% of the world's population. In the United States of America (USA), 1 in 5 adults experienced serious mental illness in 2019 (DUTRA, 2020). Disorders such as anxiety, substance use disorders, and depression affect millions of people. It is estimated that by 2030, mental illness will be the main burden of disease worldwide (WADLEY et al., 2018). However, the impact of mental disorders is often ignored and underestimated. It is considered important to develop solutions that support the treatment of pathologies related to mental health (DUTRA, 2020).

Computing has shown to be promising and willing to develop solutions in support of the health area, in an optimized and scalable way. Examples of existing technologies that have helped healthcare professionals and patients include management systems for

offices and hospitals (e.g. Kurniawan (2017), Tang et al. (2015)), systems for diagnosis and pathology's monitoring (e.g. Noguchi, Kamide e Tanaka (2020), Ćosić et al. (2020)), games that help in the rehabilitation and therapy of patients (e.g. Chu et al. (2020), Lin, Cheng e Chen (2020), Xu et al. (2020)).

The construction of computational solutions for mental health is a reality; however, more studies are needed to advance knowledge in the area and improve the development, evaluation, and reporting of these solutions (DRISSI et al., 2020). In this paper, we seek to map the solutions developed to support the therapy of patients with mental disorders, and we discuss guidelines for future researchers in this field. The term therapy is any treatment intended and expected to alleviate disease or disorder. Any recovery technique that may be medical, psychiatric or psychological is considered a therapeutic technique (MCGRAW; BURDETTE; CHADWICK, 2005). For the classification of mental disorders, it was considered for this paper the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) from the American Psychiatric Association. The DSM-5 classifies pathologies related to mental health into categories of mental disorders (e.g. depressive disorders, anxiety disorders, neurocognitive disorders) (JESTE et al., 2013).

2.1.1 Objective

This paper presents the results of a systematic mapping study about how computing has supported mental health therapy. Seven Mapping Questions (MQs) were addressed to conduct the analysis of 87 selected publications. The questions included: 1) associated mental disorder; 2) publication year; 3) technology used to build the solution; 4) solution type/research result (more focused on the development, design, or evaluation); 5) stakeholders who participated in the construction of the solution; 6) stakeholders who participated in the evaluation of the solution; and 7) if the paper considered users' diversity, and software quality aspects as accessibility and flexibility. We consider it important to leave in this paper a set of guidelines for future researchers. Our guidelines have the potential to support both researchers who wish to start studies in the area and those who wish to report their work already done.

2.2 Methods

This study used the systematic mapping research method to map the state of the art about computing in support of the therapy of patients with mental disorders. For this, we followed the steps of protocol definition, research of papers, reading titles and abstracts, reading full papers, data extraction, and data summarization.

2.2.1 Systematic Mapping Protocol

The defined protocol included the research topic "How computing has supported therapy for patients with mental disorders". We defined the research string as "computing and 'mental health' ". The searches were carried out in the bases ACM Digital Library, IEEE Xplore, and PubMed. The bases were chosen to index a wide range of papers in the computing and health areas. For the selection papers, we defined 1 inclusion criterion and 8 exclusion criteria. The inclusion criterion defined was "papers that present technology solutions (design, development or evaluation of computer systems) for the therapy of pathologies related to mental health". In addition, the 8 exclusion criteria were:

1. Analysis of the mental health of computing professionals;
2. Computational solutions that support administrative issues in mental health hospitals;
3. Computational solutions not related to mental health;
4. Computational solution for diagnosis or monitoring of pathologies;
5. Papers that do not address a computational solution;
6. Papers that are not in English, Portuguese, or Spanish;
7. Tutorials, reviews, and other texts not relevant to the research;
8. Incomplete work, not concluded, or those in which mental health is a secondary issue.

2.2.2 Research and Selection of Papers

The research was carried out looking for papers published from 2015 to 2020, aiming to map the results of computer support to mental health therapy before the COVID-19 pandemic period. The pre-pandemic period was defined because the pandemic had a greater impact on the mental health of the general population, which could influence the results. A total of 2953 papers were returned, of which 2057 were from ACM Digital Library, 338 were from IEEE Xplore and 558 were from PubMed.

To select the papers, the first two authors of this work read the titles and abstracts. Both read and analyze titles separately, applying the inclusion and exclusion criteria. Then, they performed consolidation of the titles and went on to read and analyze the abstracts. After reading the abstracts, they carried out another consolidation. Figure 3 shows a diagram summarizing the analysis process of the papers. Of the 2953 papers, 57 were duplicated and were excluded, leaving 2896 papers.

The first approach applying the exclusion criteria considering the titles, abstracts, and content overview resulted in 2708 exclusions. That left 188 papers to be fully read. To read the full papers, we performed an agreement analysis (PERROCA; GAIDZINSKI, 2003; SILVA; PAES., 2012). For the analysis, we separately read the same 38 initial papers. We made the annotation according to predefined grouping classes. Subsequently, we performed the agreement analysis, which resulted in a degree of agreement of 79.39%.

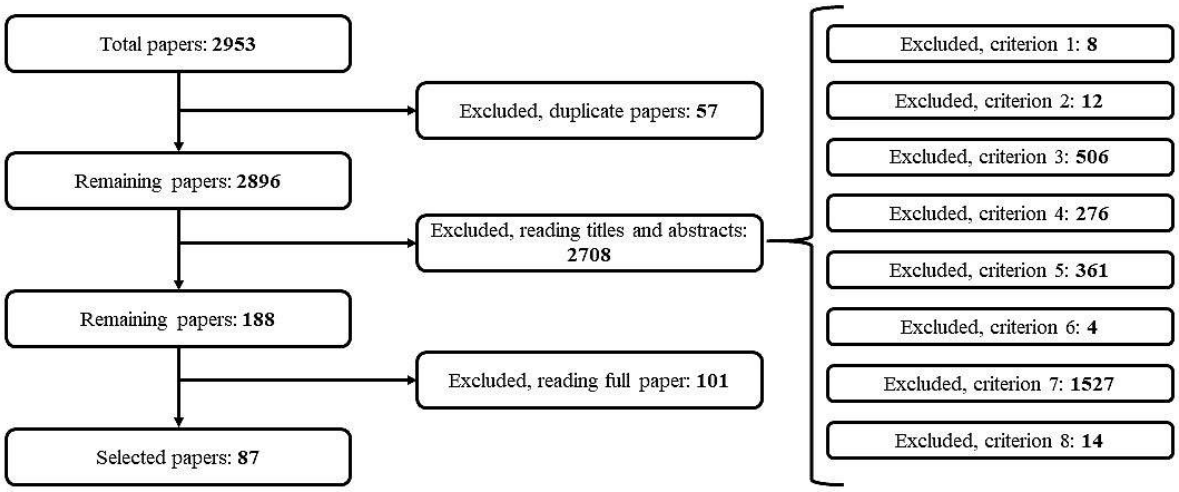


Figure 3 – Summary diagram of the analysis process of the papers.

With the degree of agreement result, we consider it possible to share the reading and analysis of the other papers. After reading the full papers, 101 more papers were excluded, resulting in 87 papers selected for this mapping. They are listed in Appendix A and are mentioned here, from now on, by the number listed in Appendix A.

2.3 Results

As a result of the research, data extracted from the 87 selected papers were analyzed. Six major grouping classes were identified to support data extraction: I) Mental Disorders; II) Solutions Built/Research Results (focused on design, development, or evaluation of computer systems); III) Technologies Used; IV) Evaluation of Solutions; V) Participants in the Construction of the Solution; and VI) Diversity, Accessibility, and Flexibility.

2.3.1 Mental Disorders

We identified 17 pathologies supported by the selected studies: anxiety, Autistic Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), cognitive impairments, dementia, dependency, depression, phobia, psychotic disorders, stress, suicidal behavior, panic disorder, self-injury, self-esteem, SUDs, emotional well being, and general

mental health. The identified pathologies were categorized based on DSM-5 (JESTE et al., 2013), resulting in nine categories of disorders: I) Neurodevelopmental Disorders (NDDs); II) Schizophrenia Spectrum and Other Psychotic Disorders (SSP); III) Depressive Disorders (DDs); IV) Anxiety Disorders (ADs); V) Trauma- and Stressor-Related Disorders (TSs); VI) Substance-Related and Addictive Disorders (SDs); VII) Neurocognitive Disorders (NDs); VIII) Suicidal Behavior Disorder and Self-injury (SS); and IX) General Mental Health (GMH). Figure 4 shows the graph relating the categories of disorders with the number of papers. The graph also considers the evolution of the amount of papers in the years 2015 to 2020.

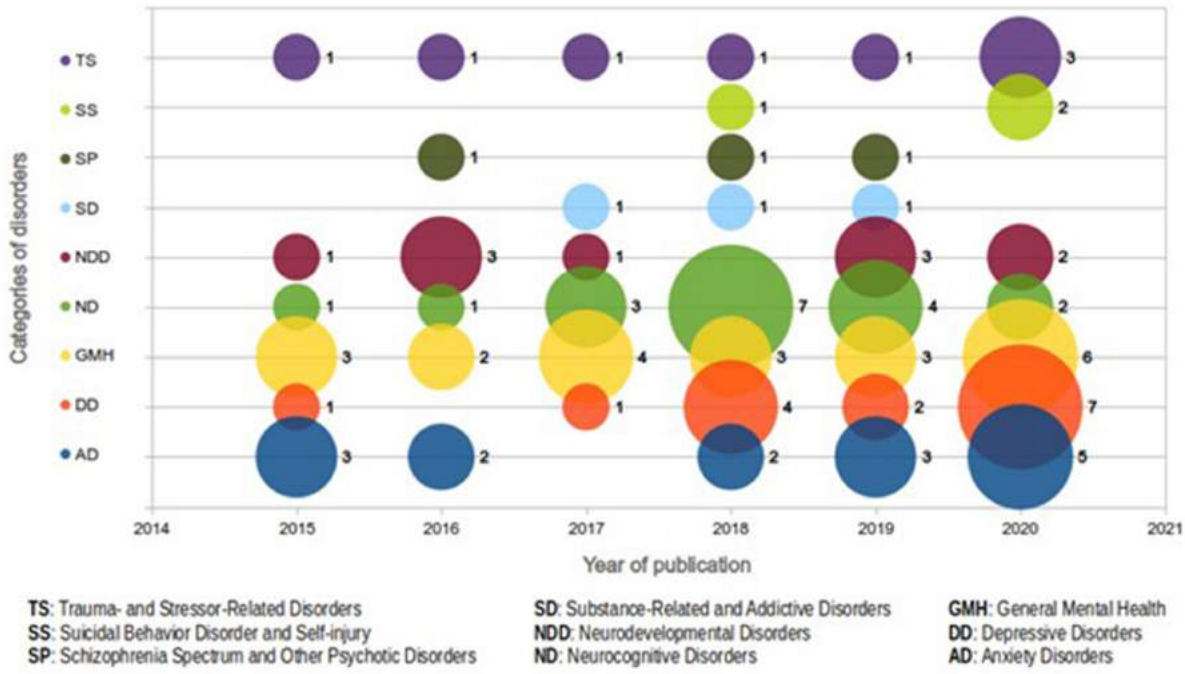


Figure 4 – Category of disorders and the number of related studies.

2.3.2 Solutions Built

When dealing with existing disorders, the studies presented solutions according to different phases of software development. In this review, to support further analysis, the studies were divided into 3 groups referring to the phases of software development most addressed in the selected articles, namely, i) design, when they formulated the conception of a technological process aimed at supporting mental health (e.g., 2, 15, 31, 57, 72); ii) development, when they manufactured a software artifact, created an algorithm, or produced an information system (e.g., 10, 21, 38, 49); and iii) evaluation when reporting on the use of an existing system, including quality assessment, stakeholder satisfaction, and software requirements (e.g., 6, 19, 47, 62).

Some works presented two types of solutions, such as design and evaluation (e.g., 56, 60), design and development (e.g., 23, 30 37), and development and evaluation (e.g., 10, 14, 15, 36, 65). In addition, studies were identified that presented three types of solutions (e.g., 26, 46, 49, 53, 66, 77, 86). Most of the solutions were applied to disorders ADs, DDs, GMH, and NDs among the disorders addressed.

Regarding the time taken to develop the solutions presented, only 15 works (17.24%) explicitly described it. These indicated durations from less than 1 month (e.g., 22) to more than 6 months (e.g., 44), and the work that reported the longest development time took 16 months (i.e., 65). The remaining 72 works (82.76%) did not indicate how much time the development process required.

2.3.3 Technologies Used

Among the solutions presented, the studies used 18 types of computational technologies. The growing use of technologies based on mobile devices (e.g., 8, 21, 37, 45, 60) and development for the web (e.g., 3, 23, 48, 57, 71) stands out. It is also possible to observe the constant use of technologies aimed at games (e.g., 5, 17, 36). In addition, the reduced use of assistive technologies (e.g., 15), frameworks (e.g., 13), and virtual agents (e.g., 85) can be seen.

2.3.4 Evaluation of Solutions

The solutions developed from the reviewed works went through evaluation processes, including feasibility studies. Except for the SD disorder, all of them presented a description based on the use of the developed solution. Examples of studies in which this has been done include papers 7 (19, 27, 29, 36, 57, 68, 69). Considering the solutions developed, 72.92% of these solutions were evaluated, and in 27.08% this did not occur.

2.3.5 Participants in the construction of the solution

While reading the full papers and data collection, we sought information about the development process of the solutions presented in the papers. For this, all categories of solutions were considered, be they design, development or evaluation. The intention was to identify who participated in the construction of the solution in addition to the authors of the paper. When analyzing the data collected, it was possible to identify that in 46 papers, those who participated in the construction of the solution were not described, which makes a total of 53% of the papers analyzed. In the remaining 41 papers, the participation of computer professionals, health professionals, education professionals, and patients in constructing solutions was identified. Figure 5 shows the graph that illustrates the participation of third parties other than the authors described in the studies.

Some of the studies explained techniques to support the participation of third parties in the development process. Co-design techniques were reported in 25, 34, 41, 56. Participatory design was highlighted by 41, 42, 46, 50, 62. In 18, the use of co-development techniques was reported, and in 37, the use of user-centered design was reported.

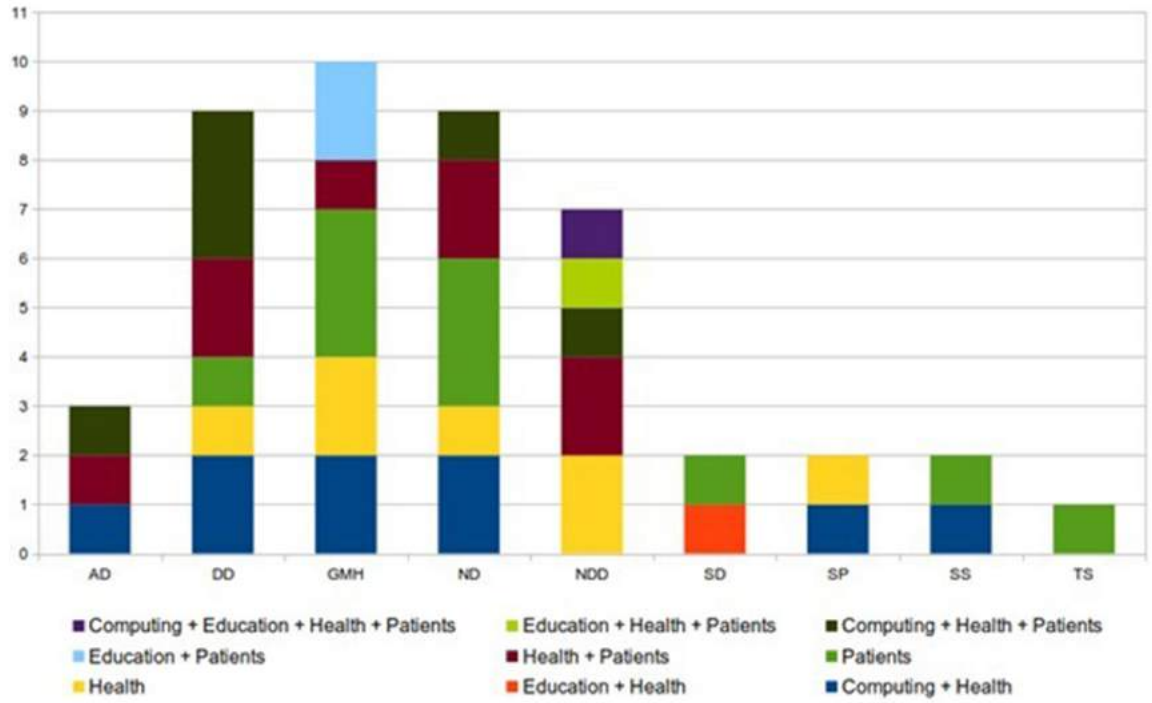


Figure 5 – Third parties described in the studies.

2.3.6 Diversity, Accessibility, and Flexibility

According to the perspective of human-computer interaction (HCI), the reviewed studies were evaluated with respect to the application of user diversity and software quality aspects such as accessibility and flexibility. Considering the totality of the disorders addressed, 24.14% of the studies applied one or more of the factors in question. In 22.99% of the studies, none of the factors were applied explicitly, and in 52.87% of the studies, there was no description of their use.

2.4 Discussion

Research involving computer solutions has been carried out in support of therapy for pathologies related to mental disorders. The mapping results point to research relevant to several disorders. With systematic mapping carried out, it became possible to identify that these studies have been increasing over the years. The largest leap took place from 2017 to 2018, going from 11 studies in 2017 to 20 studies selected in the following year.

The design and development of computational solutions for health differ from other development contexts because it is a complex domain. The parties most interested in the development of these solutions are patients, their families, and health professionals. Therefore, it is expected that the construction of these solutions will add multidisciplinary participation that involves not only computer professionals but also health professionals and patients themselves (SOUZA; RODRIGUES; NERIS, 2019; RODRIGUES et al., 2014; RODRIGUES et al., 2015).

However, it was observed that only 27 of the selected studies (31%) reported the participation of patients in the development process. Only 29 of the selected studies (33.3%) reported the participation of health professionals. A recommendation for future work is to provide ways to involve health professionals and patients more during the development process. Health professionals are experts in the field, patients are end-users, and their participation in development enhances the therapeutic results promoted by the computational solution. To support this participation can be considered the use of participatory design techniques (e.g. MULLER, HASLWANTER e DAYTON (1997), MULLER (2002), Carroll e Rosson (2007)), co-design (e.g. Walsh et al. (2010), Guha, Druin e Fails (2013)) and the use of semio-participatory approaches, such as SemTh Souza, Rodrigues e Neris (2019).

Another issue to be considered is how to describe participation in the development process. When reading an article that reports the development of computational solutions, it is understood that the authors participated in the process. However, it is unknown if there is a multidisciplinary among the authors unless this is described in the text. Only 41 selected studies (47%) detailed the development process and which stakeholders, in addition to the authors, contributed and participated in the process. The remaining 46 studies (56%) do not contain this information and do not even mention the authors' area of expertise in the text. Such information can be considered important since the development of therapeutic solutions requires the participation of specialists in the domain.

Another point to be considered in the reports of the works is related to the technology development time. In the studies analyzed, 72 (82.76%) did not explicitly describe the time spent developing the solution. This information could be useful to guide other researchers in creating the development protocol, especially when they add patients in the process. Of the 15 studies (17.24%) that described the time of development, 4 (26.67%) reported a duration of up to 1 month, 8 (53.33%) reported a duration of 1 to 6 months, and 3 (20%) reported duration of more than 6 months.

A longitudinal evaluation is considered necessary to analyze the therapeutic results that an intervention exerts on the patient. Monitoring over time is also considered pertinent to determine whether the therapeutic effect achieved is long-lasting or temporary. Other studies related to this also point out these issues, reinforcing the need for a more careful empirical evaluation and presenting clinical evidence of efficacy (e.g. Drissi et

al. (2020), Rojas et al. (2019). When reviewing the solutions developed by the studies, the results obtained indicate that a considerable percentage of studies (32.18%) did not evaluate the proposed solution for a specific disorder. In addition, among the studies that carried out the evaluation, 38.98% did not describe the time spent in this evaluation suggesting the need for a protocol to be followed.

The analysis of the selected papers also identified a lack of care related to flexibility, accessibility, and diversity. Only 21 (24.14%) of the studies described that the solutions considered any of the three questions. Patients suffering from mental disorders have several peculiarities, and there are also differences between the types of mental disorders. The construction of flexible, accessible systems that take into account the diversity of patients tends to have a greater potential to meet the demands of these patients. Thus, for future researchers in the area, it is suggested that these concepts be considered in developing solutions. Table 2 shows a summary of suggested guidelines for other authors in the same domain. For each guideline, there is also a brief explanation.

Table 2 – Guidelines for future authors.

Guideline	**Explanation**
Detail the supported pathology	Report which pathology you intend to attend and which a computational system can support clinical demands of this pathology.
Detail the team that participated in the project	Inform if the authors of the work form a multidisciplinary team, what their background and experiences are.
Detail the design and/or development process	Detail which process, method and/or approach were used, how they were used and what the results were.
Detail the development time	Inform and detail the duration of the project and each of its stages.
Involve patients and health care professionals	These are the main stakeholders in health care solutions and it is suggested that they be involved in design and development activities.
Detail the people involved and their contributions	Detail how people participated in the project, whether only as information providers or whether they actively participated. Detailing each case and what contributions.
Report the time and evaluation method	Present how the solution evaluation was carried out, which methods were used, how many people participated, which people's profiles, how long the evaluation took and what the results were.
Carry out and present the evaluation of therapeutic effects	Careful, longitudinal empirical evaluations that generate clinical evidence of efficacy are suggested.
Consider issues of flexibility, accessibility and diversity	Patients with mental disorders have peculiarities related to each disorder, so it is suggested that systems in this domain are flexible, accessible and meet the diversity of patients.

2.4.1 Limitations

One of the limitations of this systematic mapping is related to the search string used. Other terms could have been used to refine and direct the research further in the direction of therapy. However, it was decided to keep the search broader and filter the reading of the works. Another limitation of this paper is that only studies related to therapy were analyzed. Computing has also supported issues of diagnosis and prevention of mental disorders, which were not considered in this mapping.

Another limitation to be considered is related to the area of activity of the authors. The authors of this paper are from the computing area and have been working in computational solutions as a therapeutic intervention. However, if the mapping brought together more researchers who were specialists in mental health, it would have the potential to add more value to the results presented.

2.5 Conclusions

This paper presents a systematic mapping on computing in support of therapy for mental disorders. Given the main objective, the results of the analysis of the works selected in the mapping and a discussion with guidelines for future researchers were presented.

It was identified that there is an increase in research in this domain and that computing has demanded efforts in the construction of solutions with the potential to support the therapy of different categories of mental disorders. However, it was also observed that there is a lack of solutions available for effective use in therapy.

Our findings are in line with other studies Drissi et al. (2020), Rojas et al. (2019). The results of the mapping suggest the need for empirical longitudinal evaluations, which provide clinical evidence to evaluate the effectiveness of the therapeutic effects of the solutions that are developed. The results also suggest the need to demand attention in the insertion of health professionals and patients in the development process. They are demanding attention also to how this participation is reported in the papers.

Chapter 3

End-users in recovery from substance use disorders as designers of Personas and digital games with therapeutic potential

3.1 Introduction

SUDs are characterized by the inability of an individual to reduce the use of a substance (e.g., alcohol or illicit drugs) and affect 35 million people worldwide (HEYER et al., 2020; OLAFSSON; WALLACE; BICKMORE, 2020). The purpose of developing computational solutions for end-users is empowering them to create and modify their own digital artifacts to suit their needs (BARRICELLI B. R.; CASSANO; PICCINNO, 2019; LIEBERMAN H.; PATERNÒ; WULF, 2006). In the area of health, end-users are patients, health professionals, and other interested stakeholders who are enabled to make use of the solution, as well as the data collected. The active participation of end-users in the construction of digital solutions with therapeutic potential is important, because of the domain knowledge acquired and features such as the pathology itself. Moreover, the involvement of end-users, especially patients, in these practices may also bring therapeutic benefits (SOUZA, 2018; GARCIA et al., 2019).

Personas can be regarded as realistic and concrete representations of the potential users of a system. They may include a wide range of different characteristics, such as physical and psychological features, professional background, personality, family traits,

and daily routine (COOPER, 1999). The use of Personas in the design and development of computational solutions for healthcare has been extensively discussed in the literature. Although some studies involve end-users in the creation of personas, they usually assign healthcare professionals or patients the role of information providers and not co-creators or co-developers of the systems (RODRIGUES et al., 2015; WOODS et al., 2017; RODRIGUES; CONRADO; NERIS, 2018; HUH et al., 2016; HOLDEN et al., 2017; SOUZA; RODRIGUES; NERIS, 2019). More active participation is a desirable outcome to improve the design of digital systems for the healthcare domain.

Rodrigues et al. (2015) have outlined a method, aiming to add specific information to personas within the scope of therapeutic applications, which supports the active participation of health professionals. These authors (RODRIGUES; CONRADO; NERIS, 2018) describe an instance of this process with the active participation of health professionals in the construction of personas. In studies that described the participation of patients in the creation of personas (*e.g.* (HOLDEN et al., 2017; WOODS et al., 2017; HUH et al., 2016)), the patients only assisted in the creation as information providers (*e.g.* by taking part in interviews and focus groups). Thus, there is a lack of studies in the literature that investigate the active involvement of patients as the creators of personas.

The purpose of this paper is to discuss the creation and use of Personas for the construction of digital games with therapeutic potential. The process of creating the Personas, as well as the construction of the games, was carried out by end-users in recovery from SUDs.

The process of creating personas was carried out in a CAPS-AD. The personas creation activity was part of a project in which patients were invited and taught how to develop digital games with therapeutic potential. The project was approved by the ethics committee in 2018 and a cycle of activities took place at the CAPS-AD in the same year. This paper presents the results of a second cycle, which took place in 2019 at the same institution, but with different participants.

Therapeutic digital games have, among other benefits, the potential to increase patients' motivation and commitment to therapy (FUNABASHI et al., 2018). However, developing games that encourage positive, healthy behaviors is a challenge. The design of therapeutic digital games is in a critical context, which involves ethical and social responsibility (FERRARI et al., 2020). Bonacin, Reis e Baranauskas (2019) also point out challenges in development by end users. The authors point to examples of how to promote democracy and equality during the design process and how to promote the effective participation of end users (BONACIN; REIS; BARANAUSKAS, 2019).

Understanding the domain in which the game relates is fundamental, as is promoting ways to support participation and communication between different stakeholders. Therefore, for this project, the SemTh approach was adopted, which assists in the participation of different stakeholders during all stages of the development of therapeutic digital games

(SOUZA; RODRIGUES; NERIS, 2019).

An instance of the Personas Enrichment Method (RODRIGUES et al., 2014; RODRIGUES et al., 2015) is one of the initial activities of the approach (SOUZA; RODRIGUES; NERIS, 2019). In this project, the personas were created by the CAPS-AD patients themselves, with the support of health professionals and computer professionals.

Twenty-one patients and one health professional of CAPS-AD, as well as four computer science professionals, took part in the personas creation activity. The activities to instantiate the Personas Enrichment Process took place at the CAPS-AD Center in September 2019. Seven personas were created and these were used for the creation of therapeutic digital games by patients.

The process of creating the personas, the personas that were created, a brief description of the games, and the lessons learned are also presented in Souza et al. (2021). This paper is an extended and revised version of the paper by Souza et al. (2021), including a breakdown of the game implementation process by end users.

Activities to implement the games took place in November 2019. Lepi was used for implementation, a game editor software created by Garcia et al. (2019) that supports the development of digital games by end users (GARCIA et al., 2019).

The contribution made by this paper stems from the personas themselves, how they were used in the creation of therapeutic digital games by end users, and the lessons learned in a real research setting.

Personas are capable of being reused to assist in the creation of other computer systems for people recovering from SUDs. The process of creating games by end-users in recovery from SUDs has the potential to support other research in that domain. It is hoped that the lessons learned can encourage other researchers to adopt further co-design and co-development approaches in that field.

The remainder of this paper is structured as follows. Section 3.2 establishes the theoretical framework and conducts an analysis of related works in the literature. Section 3.3 describes the process of creating personas. Section 3.4 describes the therapeutic digital games created. Section 3.5 describes the lessons learned during the process. Section 3.6 summarizes the conclusions and makes suggestions for future work.

3.2 Background

This section establishes the theoretical framework adopted in this paper, based on Alan Cooper's (COOPER, 1999) Personas methodology and the Personas Enrichment Method (RODRIGUES et al., 2014; RODRIGUES et al., 2015). A summary of studies related to this paper is also provided.

3.2.1 The Theoretical Framework

Personas is a technique created by Alan Cooper (COOPER, 1999). It is widely used in the field of computer solutions design. When stakeholders employ the technique, the resulting Personas tend to assist the creation of a product that better suits the needs and requirements of the end-users (RODRIGUES et al., 2014).

According to Cooper (1999) (and corroborated by Pruitt e Adlin (2006)), Personas are concrete and realistic representations of potential users of a system. A persona can add features such as name, physical, biological, psychological, visual representations, and demographic data, among other information that is necessary for the desired design process (COOPER, 1999; PRUITT; ADLIN, 2006).

Personas have a defined life cycle, consisting of family planning, conception and pregnancy, birth, maturation, adulthood and retirement, death and/or reuse (COOPER, 1999; PRUITT; ADLIN, 2006). Family planning involves a) assembling a team to meet and create the personas, b) determining the problem that can be overcome by the solution that will be built and c) devising an action plan. The conception and gestation include an analysis of the data for the creation of the persona skeleton, which is born and validated, reaches maturity, and can then be used in adult life. After the persona has been used, it can retire, cease to be used, or be reused in another project (COOPER, 1999; PRUITT; ADLIN, 2006).

According to RODRIGUES et al. (2014), the Personas technique is, to some extent, suitable for the area of health. However, in such a complex scenario, there is a need for more granular Personas (for instance, more information is needed to better suit the domain). This level of detail can be achieved by involving stakeholders in the creation of personas (RODRIGUES et al., 2014; RODRIGUES et al., 2015). Williams et al. (2014) also point out that in the health domain, it is essential to involve a wide range of specialists, with the aim of basing design on the realities of health care provision.

A process that enables stakeholders to take part in the creation of personas was formalized by RODRIGUES et al. (2014), Rodrigues et al. (2015). This process was called the Personas Enrichment Process. It consists of four stages (see Figure 6): 1) identification of the stakeholders; 2) characterization of the users; 3) creation of the personas; and 4) presentation and validation of the personas.

The first stage of the process entails identifying the stakeholders and is illustrated by the Stakeholder Analysis Chart in Kolkman (1993), instantiated in Figure 8 and Figure 9 shows in the Section 3.3. In this stage, the artifact is used to identify stakeholders in the field of therapeutic applications. Its application can be carried out in a participatory way by designers, developers, professionals from other areas, and any other stakeholders that are interested in the solution, such as the family and the patients who are the intended audience of the solution (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

By following the chart, designers can benefit from obtaining a broader view of the

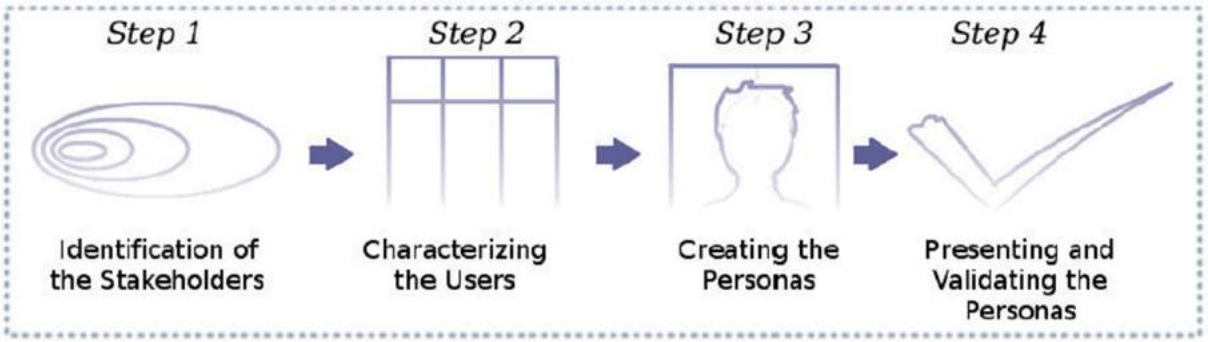


Figure 6 – Personas Enrichment Process (RODRIGUES et al., 2015).

stakeholders related to the solution. This view highlights the fact that stakeholders either exert an influence on the solution to be built or are themselves affected by it. The artifact represents the stakeholders in different layers and gives them different responsibilities. At the center of the chart is the Therapeutic Application, followed by the Contribution layer, in which the actors (users) and those responsible for building the application must appear. The next layer is the Source, in which it must be informed the stakeholders responsible for providing information that can lead to the construction of the application. The next layer is intended for the Market, where the potential partners and competitors must be informed. The last layer, which is farthest from the application, is called the Community, which should include spectators, legislators, and government agencies, among other stakeholders. The closer the layer is to the center, the more the application will influence (or be influenced by) the stakeholders of that layer (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

In the second stage of the Personas Enrichment Process, there is an instantiation of the artifact to characterize the users. The stakeholders previously identified as most interested in the application are regarded as potential users of the solution to be built. In the therapeutic domain, these users may be patients, health professionals, family members, or other people. It is necessary to create a chart (which is divided into four parts) to characterize each of the identified users (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

During the practice, a fictitious image of the patient should be provided together with a description of the ideal treatment and the influence of the stakeholders on the patient. It is also necessary to describe the clinical condition of the fictitious patient and to discuss possible problems that a therapeutic application may encounter when being used to assist this patient in the treatment (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

The data collected from these first two stages should be supplemented with data from the literature describing the profile of patients with the same pathology. The purpose of this is to obtain richer details (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

In comparison with the original Personas life-cycle devised by Cooper (1999), family planning is completed after stages one and two of the Personas Enrichment Process. The third stage of the process covers the conception, pregnancy, birth, and maturation of the Personas (RODRIGUES et al., 2014).

In the third stage of the process, an analysis is carried out of the collected data, the characterization of the user profiles, and the construction of the skeletons of the personas. A persona must be created for each characterization chart and instantiated in the previous stage. If the team deems it necessary, more personas can be created to represent the summarized information (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

The personas are then presented to the healthcare professionals for validation. The professionals must assess whether the personas created really represent the focus group and then fill out the Personas' evaluation sheet. The photos attached to the profiles, together with the descriptions in the clinical profiles, the family background, and the life history must also be evaluated, to ensure they are in accordance with the patients in the focus group (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

In the validation stage, the personas can be further refined, if necessary. When they reach adulthood, the personas can then be used for design decisions while creating the solution. Once the construction of the solution has been completed, the reflection of the personas in the created solution can be evaluated and they can be used to build other solutions within the domain (RODRIGUES et al., 2014; RODRIGUES et al., 2015).

The SemTh approach (SOUZA; RODRIGUES; NERIS, 2019) assists in the design of therapeutic digital games and recommends using the Personas Enrichment Process as one of its initial activities. SemTh is a semi-participatory approach to the design of therapeutic digital games. The flow of the SemTh approach (see Figure 7) consists of four stages: 1) Clarification of the Design Problem; 2) Interaction Modeling; 3) Materializing Design; and 4) Evaluation. In each of the stages, the SemTh approach: a) suggests activities that can assist design, b) facilitates communication between different stakeholders and c) encourages active participation by end-users (SOUZA; RODRIGUES; NERIS, 2019).

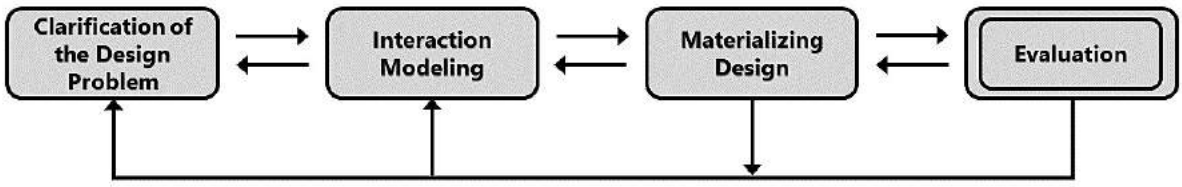


Figure 7 – Flowchart showing the stages of the SemTh approach (SOUZA; RODRIGUES; NERIS, 2019).

This paper covers the first and third stages of the SemTh approach. Describing the

instance of the Personas Enrichment Process defined by (RODRIGUES et al., 2014; RODRIGUES et al., 2015), which consists of one of the activities of the Clarification of the Design Problem stage. And describing the implementation of therapeutic digital games, the activity of the Materializing Design stage of SemTh.

3.2.2 Related Work

The Personas technique is used to support building systems in different situations. In this paper, research was carried out to find out how end-users took part in assisting the creation of personas in the area of health. It relied on the Google Scholar search engine and the search string "Personas by end-users to health" was also included. The period covered was 2015–2020. The identified results were classified in order of priority, and the titles with the best classification were analyzed. Five studies that examined the creation of personas within the field were selected.

Holden et al. (2017) attempted to create biopsychosocial personas for elderly patients with heart failure. The authors based their investigation on a quantitative analysis of data abstracted from the medical records of 32 elderly people suffering from this condition who had, recently been admitted to a hospital. The end-users (the patients) took part in the research as information providers. In addition to the data obtained from medical records, data from patients were collected through interviews and questionnaires. The study discusses the creation of personas, but it does not describe whether they were used to implement any system.

Personas created in the domain of Online Health Communities (OHC) are examined by Huh et al. (2016). In seeking to support the OHC, the authors created four personas that illustrate the requirements and needs of the users. They supplemented this information by conducting interviews with 16 users and OHC administrators and applying an online questionnaire, which received 184 responses. As in the case of Holden et al. (2017), Huh et al. (2016) are only concerned with the creation of personas, and they do not describe how they were used.

A mHealth application (WOODS et al., 2017) was carried out with the aim of assisting patients suffering from heart failure. The term mHealth is used to refer to health practices that are supported by mobile devices, such as smartphones and tablets. The project was carried out through a co-design and with the participation of seven patients, four family members, and multidisciplinary professionals. The Personas technique was applied to form the profiles of the potential users of the system. The end-users took part in building the personas, though they have had an informational role. Ethnographic interviews conducted with eleven self-selected patients and family members provided an in-depth understanding of how their daily lives had been affected by heart failure. The interviews lasted about an hour and were conducted on the campus of a hospital. An "Empathy Map" was completed after each interview to obtain both subjective and objective qualitative data.

Similar themes were merged, which resulted in the formation of four profiles. Fictitious sociodemographic information was added to make the personas realistic and relatable while maintaining the anonymity of the interviewed participants.

A workshop was held with the design and development team to introduce the personas. Posters were designed that included the personas, with the aim of representing the needs, ideas, patterns of behavior, and anxieties of possible end-users of the mHealth application. An "Idea Matrix" was designed which included several post-its on a large whiteboard divided into a grid of four columns (representing each persona) and three lines (representing each design criterion). The design team members were asked to find solutions for each design criterion based on the needs of each persona (WOODS et al., 2017).

Rodrigues, Conrado e Neris (2018) and Rodrigues et al. (2015) examined the active participation of end-users (health professionals) in the construction of the personas. Rodrigues, Conrado e Neris (2018) created personas as a part of a system to provide assistance in the treatment of children with cancer. Rodrigues et al. (2015) used the creation of personas as a means of finding solutions to help patients with chemical dependency and depression.

The goal of Rodrigues, Conrado e Neris (2018) was to devise a digital game to assist in the treatment and well-being of children with cancer in a hospital. A team formed of computer and health professionals used the Personas Enrichment Process (RODRIGUES et al., 2014) to create three personas within the domain. After the necessary data had been collected, the personas were enriched with data from the literature on childhood cancer to assist in the development of prototypes for a digital game.

Subsequently, the project was resumed in the course of a research project on the design of therapeutic digital games (SOUZA; RODRIGUES; NERIS, 2019). The aim of this research by Souza, Rodrigues e Neris (2019) was to formalize an approach within this category of digital games. When evaluating the approach adopted here, the project for devising games for children with cancer by Rodrigues, Conrado e Neris (2018) was resumed, and the personas that had been previously created were used. The three personas were validated by the new team and three others were created. The team for this project also comprised computer and health professionals, some of whom also took part in the creation of the first personas. On the basis of the existing personas, a platform was built that added a web system and a mobile game to assist children with cancer and their families (SOUZA; RODRIGUES; NERIS, 2019).

In the area of mental health, we took note of the study by Rodrigues et al. (2015) in which the authors attempted to build a computational solution to assist young patients in a hospital with illicit drug dependence and suffering from depression. The work examines the application of the Personas Enrichment Process (RODRIGUES et al., 2014; RODRIGUES et al., 2015). The process was instantiated with the participation of health

professional end-users, but there was no patient participation. In total, six personas were created that aggregate information about the patient's clinical profiles and their relationships with stakeholders and technology. Two game prototypes were developed on the basis of these personas, one related to drug dependency and the other related to depression.

Table 3 provides a summary of the related works. On the basis of these studies, a gap can be detected in the literature with regard to creating personas with the active support of patients, who are the key beneficiaries of digital therapeutic solutions.

Table 3 – Summary of related works.

Study / Domain in health	**End-user participation**	**Were the personas used?**
(HOLDEN et al., 2017) / Cardiac insufficiency (heart failure)	End-users (patients) as providers of information, through interviews and a questionnaire.	No.
(HUH et al., 2016) / Online health communities (OHC)	End-users as providers of information, through interviews and questionnaire.	No.
(WOODS et al., 2017) / Cardiac insufficiency (heart failure)	End-users (patients) as providers of information, through interviews.	Yes.
(RODRIGUES; CONRADO; NERIS, 2018) / Support for the treatment of children with cancer.	Health professionals actively participating.	Yes, later.
(RODRIGUES et al., 2015) / Mental health (chemical addiction and depression)	Health professionals actively participating.	Yes.
This paper / Substance abuse rehabilitation	Health professionals and patients actively participating.	Yes.

In the final line of Table 3, data are included from this paper to establish how it relates to the other studies. In that line, it can be seen that this paper emphasizes the active participation of health professionals and patients, which was not found to be the case in the other studies.

3.3 The Personas Creation Process

The personas creation process outlined in this paper was conducted as a part of a larger project aimed at enabling end-users in an alcohol and drugs abusive rehabilitation center to devise therapeutic digital games. The study took place in a CAPS-AD. This section examines the research setting, and the persona creation process while also conducting an analysis of the generated artifacts.

3.3.1 The Research Setting

Psychosocial Care Centers (CAPS), with their different modalities, are institutions designed to provide open healthcare and support services for the local community. Their

teams are made up of multidisciplinary professionals who work in an interdisciplinary way and give priority to patients with mental disorders. CAPS-AD is a CAPS that specializes in disorders caused by alcohol and drugs (SAúDE, 2017).

In this paper, professionals from a CAPS-AD (in partnership with computer professionals) embarked on a project to design therapeutic digital games at the center. The project sought to provide CAPS-AD with the means to allow patients to create digital games with therapeutic potential. The SemTh (SOUZA; RODRIGUES; NERIS, 2019) approach was employed to encourage the active participation of multidisciplinary teams to design of these games. The project was carried out in ten meetings held between August and November 2019, every 15 days at CAPS-AD.

When the meetings at CAPS-AD were planned, it was decided that SemTh would start to be applied in the second meeting. The number of meetings was defined according to the availability of the CAPS-AD. The activities were explained and exemplified at each meeting. Computer professionals were present helping the patients and the psychologist. The four computer professionals involved had already worked on user studies and had experience with the proposed activities. The computing professionals had the role of explaining, exemplifying, and supporting the filling in of the artifacts.

The first meeting would be used to explain the project to the participants (patients and health professionals), as well as the Informed Consent forms, and give the patients training on the basic functions of the computer. At the first meeting, computer professionals introduced the project to the participants and showed the patients the basic functions of the computer. The patients also played games created by computer professionals. For some patients, this was their first contact with the computer.

Data to identify patient profiles were collected. 21 patients (19 men and 2 women) aged between 27 and 55 years participated in the personas creation activities. Of these, 6 patients completed high school, 2 had not completed high school and 13 patients had not completed elementary school. Of the 21 patients, 9 reported that they had never used a computer. Only 4 patients had attended the CAPS-AD for over a year. Motor skills, cognitive, and general characteristics of patients who attend the institution are evaluated by the health professionals of the institution and considered confidential information.

A brainstorming session was held in the second meeting when the SemTh approach was first adopted. The purpose of this was to find out the patients' ideas and expectations about the project and what they wanted to create. The activity planned for this meeting was carried out by dividing the patients into two groups of five patients each, and the main ideas raised were documented. The separation of the working groups was carried out by the psychologist. She has knowledge of the interpersonal characteristics of patients and, not knowing in detail the activities that would be performed, she had the autonomy to separate patients into work groups, not generating bias with regard to the application of activities by them.

The third and fourth meetings were aimed at instantiating the Personas Enrichment Process, which is outlined in this paper. The details of the activities carried out, as well as the description of the patients of each group and the results of the personas created, are set out in Subsection 3.3.2.

3.3.2 Describing the creation of the Personas

As shown in Subsection 3.3.1, the creation of the personas took place in the third and fourth meetings at CAPS-AD. CAPS-AD is an open-door service, in which everyone who arrives is free to take part in all the activities held on any given day. The activities of the Personas Enrichment Process are sequential and the turnover of the participants was a challenge. In an attempt to overcome this, at each new meeting, the researchers reviewed the objectives of the activities and what had been done in the previous meetings.

The third meeting at CAPS-AD was attended by three computer professionals, the psychologist at CAPS-AD, and thirteen patients who wanted to participate in the project. The professionals explained the project as a whole again and defined what personas are, as well as the enrichment method that would be applied at that meeting. The psychologist divided the patients into two new groups, hereafter called Group 1 and Group 2. When selecting them for the groups, she took account of the real circumstances of the patients' lives and their backgrounds. One of the key factors noted by the psychologist in making the division was with regard to patients who were (or had been) in homeless. Group 1 consisted of patients who had never been on the street and Group 2 was allocated to those who were or had already been in that situation. Each group met in a different room to carry out the activities and was accompanied by a computer professional.

When the students were engaged in the planned activity, the Stakeholders' Chart, the User Characterization Chart, and skeleton structure sheets were used for the personas. The artifacts used were printed on A4 paper. There were also post-its and printed images representing people, together with public domain images, which can be freely accessed on the Internet.

Regarding the Personas Enrichment Process (RODRIGUES et al., 2014; RODRIGUES et al., 2015), the first stage was to fill out the Stakeholder Chart. Groups 1 and 2 completed the task, accompanied by the professionals (see Figure 8 and Figure 9).

At the beginning of the planned activities, the patients had difficulty in understanding what should be done. The professionals helped them by giving examples of people and institutions that might be interested in the game that would be developed. After the professionals had given some examples, the patients were able to complete the Stakeholder Chart.

The members of Group 1 defined patients, family, and health professionals as the main stakeholders, and referred to them as Contributors (in Portuguese, *Contribuição*). In the case of the members of Group 2, the principal stakeholders were the CAPS-AD staff, the

Figure 8 – Stakeholders' Chart - instantiated by Group 1.

staff of the temporary house (shelter), friends, and schools. In the Sources of Information (in Portuguese, *Fonte*), Group 1 included professionals, friends, patients, family members, and literature as sources of information for the solution that they would create. Group 2 chose the participants and professionals of the CAPS-AD as the only sources. In the Market layer (in Portuguese, *Mercado*), Group 1 cited other CAPS, clinics, therapeutic communities, schools, and religious institutions as possible beneficiaries of the solution. Group 2 cited other CAPS-AD and the Family Health Unit as beneficiaries. Finally, in the Community layer (in Portuguese, *Comunidade*), Group 1 cited hostels for the homeless, the Health Secretariat, community centers, foster homes for minors, the Brazilian Bar Association, the Association of Parents and Friends of Exceptional Children and the Government, as stakeholders for the solution. Group 2 included CAPS, the Pop Center, the Afro-Center, the Street Population Forum, the Sports Center, the Basic Health Unit, the Department of Transport, the Department of Health, and the Department of Housing.

The computer professionals noted the absence of the 'family' stakeholders in the Group 2 chart and questioned the psychologist. She stated that patients who have been homeless have less family support, which is the reason why Group 2 did not even consider the family as an interested party since they believed the family they had was the CAPS-AD staff.

Figure 9 – Stakeholders' Chart - instantiated by Group 2.

After completing the stakeholder chart, the groups started to fill in the Persona Characterization Chart. A little confusion arose with the term 'personas'. As the project was carried out in Brazil, in Portuguese 'personas' sounds very similar to '*personagens*' (which in English means characters). Sometimes the patients had to be reminded that the personas being created were potential players for the games and not the actual characters of the game. At the end of the third meeting, the groups ended the instantiation of the stakeholder chart, filled out the characterization charts, and started creating the persona skeleton.

The fourth meeting was attended by three computer professionals, the CAPS-AD psychologist, and fifteen patients. The purpose of this fourth meeting was to finalize the creation of personas and validate them. This activity was in a sequence that followed the activity of the previous meeting. Of the fifteen patients present, only seven were at the previous meeting.

The psychologist once again divided the patients into two groups, and this time the inclusion of new participants in a particular group depended on their real-life circumstances and affinities. In this fourth meeting, the groups finished filling out the boxes for the characterization of personas and created the skeletons of the personas. Figure 10

shows the characterization chart of one of the created personas, the Andrew.

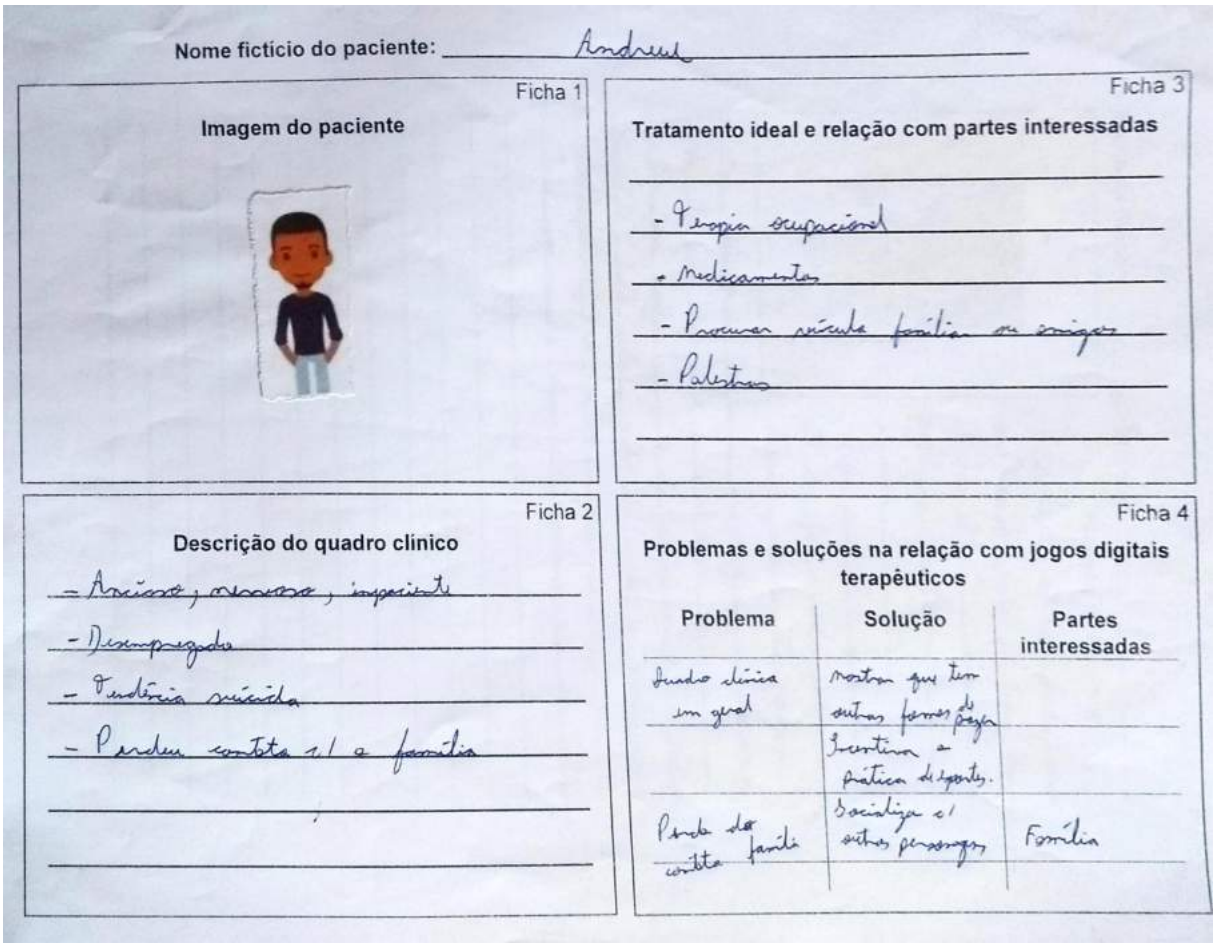


Figure 10 – Characterization Chart of the Persona Andrew.

Andrew's profile described him as nervous, anxious, and impatient; he also had suicidal tendencies. He was unemployed and had lost contact with his family. The ideal treatment for him was medication, occupational therapy, attendance of lectures, and enabling him to bond with a family. Other possible solutions were to show him that he could have other forms of pleasure and also to encourage the practice of sports and encourage socialization. The characteristics pointed out in the chart are reflected in the persona created and, later, in the game that was developed.

Groups 1 and 2 created a total of five personas which were evaluated by the psychologist. As a result of the evaluation, it was observed that three of the personas did not have the characteristics of an alcoholic and drug addict; one of them was characterized as a CAPS-AD professional. Not in all personas there was explicit information about substance abuse, but they had some pathology from substance abuse (e.g. aggressiveness, depression, suicidal thoughts). Therefore, none were discarded from the study.

The professionals then became aware of the need to create more personas to follow the project, with data from the literature related (CAPISTRANO et al., 2013; FERNANDES

et al., 2018; ANGELI, 2015) to people recovering from SUDs. As a result, two new personas were created by the computer professionals and validated by the psychologist. The psychologist agreed in her report that the photos associated with the profiles, the descriptions of the life history and the family background, and the descriptions of the clinical pictures corresponded with the patients in the focus group.

The persona creation activities resulted in five personas (Andrew, Carlos, José Largatixa [*sic*][1], Lauany and Marcos) that were created by the patients who took part in the project, with the support of professionals, and two personas (Gabi and Pablo) created by computer professionals based on their experiences and data from the literature. Figure 11 shows the descriptions and representative images of the created 7 personas. The personas were originally created in Portuguese and translated for this paper.

Andrew

Andrew likes sports, but he injured his knee and was traumatized. He is 28 years old and started having family problems since childhood. His parents are separated, causing a lot of pain in Andrew, who was raised by his grandparents. He fell in love with a girl who only made his life worse, only took it to the bottom. He plays the guitar and likes to talk to people. Andrew is humble, intelligent and likes to help others. He is participatory and has many friends. He is looking for help to improve his internal pain.

Carlos

Carlos is a very stressed person, has no family support and feels very alone. Carlos is 30 years old, he is convinced and proud. He always tries to solve everything himself, but he can't do it. Because of Carlos' way, people started to move away from him. He started doing volunteer work with children and the elderly to try to improve. He liked the volunteer work with children so much and he started study pedagogy in college. With the college he got a paid internship, which slightly improved his financial condition. His dream is to finish the college to work on projects with children.

José Largatixa

José Largatixa is 40 years old and suffers from alcoholism due to family alcohol history. He came from a sexist family who claimed that an adult man had to drink. If the other men in the family drank, he had to drink too. In addition to alcohol, José has also been a smoker since he was 10 - 11 years old. When he goes to "darkness" (train track) he is physically worn out (clothes, cleaning, looks, weight loss).

Marcos

Marcos is 20 years old and went through his parents' separation. He lives with bad company. He fought with his girlfriend due to betrayal. He was studying, but he stopped studying. The place where he lives makes him vulnerable to the use of other drugs. He doesn't believe he can get out of the situation he finds himself in.

Lauany

Lauany is sentimental, she is a recent graduate in psychology and she is 23 years old. Even with her problems, she dedicates herself to work at CAPS-AD. She is doing yoga to relieve her stress. She was betrayed by her fiancé, went into depression and she is away from the service for treatment with a psychologist. In addition, she recently lost her mother. She has been meditating, doing yoga, ballroom dancing, going to the psychologist. She likes to read and write poems. With all this, she is improving her quality of life.

Pablo

Pablo is 25 years old, he is divorced and has a 3 years old daughter. In his life divided between moments of instability and mental and emotional stability, he managed to finish high school and, in his good times, he managed to work and live well with his daughter. Pablo is an alcoholic, having been introduced to alcohol by his father at the age of 5. He developed a mood disorder due to alcohol use. Today, after breaking up and barely being able to see his daughter, he started undergoing treatment to try to stop drinking and to control his mood. Pablo has had severe withdrawal crises and his shaking is already constant and hinders him when making certain movements, such as writing, cooking and using the computer.

Gabi

Gabi is 20 years old and has been using substances since she was 15, when her parents separated. She says she started using it as an escape from her parents' constant fights. Gabi left school, left home, and went to live with her "friends" in an alley in the city. She went through situations that she didn't even know existed, used all kinds of substances, suffered abuse. At the age of 17 she was removed from the streets (from "hell" as she says) by the tutelary council and went to a shelter. When her parents finally met her again and she moved in with her mother. Gabi suffers from depression and had her self-esteem destroyed by the times she lived on the street. She has tried to stop substance use, but sometimes relapses. She cannot forgive her parents, saying that they are to blame for everything. Although she lives with her mother for 3 years, their relationship is not good. Gabi is undergoing psychological treatment in order to overcome her traumas and abandon substance use.

Figure 11 – Descriptions of the created personas.

[1] "Lagartixa" means gecko/lizard in Portuguese. The name for the persona has been misspelled as "Largatixa".

3.4 Implementation of Digital Games with Therapeutic Potential

To implement the games, the patients were divided into three groups. Each group could choose the personas whom they wished to design their games for. The group 1 chose the personas Andrew, Gabi and Carlos. The group 2 chose Pablo, Gabi and José Largatixa. And the group 3 chose Carlos and Marcos. Table 4 shows a summary of the games created and the personas used in each game. The therapeutic features of the games, their scenarios, storytelling and scoring criteria are also briefly referred to in the table.

Table 4 – Summary of the games created and the personas used.

Games / Personas Used	**Therapeutic Content of the Game**	**Scenarios**	**Storytelling and Score**
Game 1 / Andrew, Carlos, Gabi	Practicing sports and collective activities. Encouraging non-use of alcohol. Living with family, friends and using CAPS-AD.	CAPS-AD, soccer field, pool, party, square.	Playing sports: Deciding to play a sport – the character wins points and the family appears to cheer him. If the character decides not to play a sport, he/she loses points Party: If the character decides to drink alcohol, he loses points.
Game 2 / Gabi, José Largatixa, Pablo	Encouragement to seek help at CAPS-AD. Encouraging non-use of alcohol and other substances. Family support. Given an incentive to study.	CAPS-AD, square, grandparents' house.	Grandparents encourage their grandson to go to CAPS-AD for help. If the grandson goes to CAPS-AD he recovers, goes back to school and wins points. If the grandson does not go to CAPS-AD he goes to the square, where he meets colleagues who offer him alcohol and drugs. If he accepts them he loses points.
Game 3 / Carlos, Marcos	Encouraging social interaction. Practice of sport and music. Encouraging non-abuse of substances.	Court, square, music school.	The character is invited to play basketball; if he agrees, he gets points and manages to help a friend by encouraging him to start music lessons. If the character decides not to play and stays in the square, he is invited to use drugs. If he takes them he loses points.
Game 4 / Carlos, Marcos	Encouraging social interaction and to practice sport. Encouraging non-abuse of substances.	Court, square, street alley.	The drug user character can decide either to stay on drugs and thus lose points, or try to recover. To try to get over the problem, he can seek to practice sports.

The games had to be developed to support the treatment of patients with the profiles of the chosen personas. The goal of the patients in the creation activities was to design

games that could help the chosen personas. Four meetings were held at the CAPS-AD for the creation of the games. Altogether 21 patients contributed to the activities of the games development meetings. Four therapeutic digital games were created.

The groups started the process of creating the game, by listing the requirements of the game, the settings, characters and its history. The personas were very important in this process. When patients were confused about how to perform an activity, the professionals reminded them that the goal was to create a game to help personas.

The Lepi tool was used to implement the games created. Lepi is a desktop tool for game development by and for everyone. In other words, Lepi is designed to provide the means to allow anyone to create digital games that others can play (GARCIA, 2019). Figures 12a, 12b and 12c shows the creation of game scenes in Lepi, patients building the game and patients playing the created games.

(a) Construction of one of the scenes in the game created by Group 1.

(b) Patient constructing scenes from the Group 2 game.

(c) Patients playing one of the games created by Group 3.

Figure 12 – Patients building and playing the created games.

In all games the intention of the stories was for the players to think about better decisions and reflect on the consequences of their decisions. With this, we seek to encourage them to make more positive decisions in a real case. In the subsections 3.4.1, 3.4.2 and

3.4.3 present the games created by each of the groups.

After the creation of the games, there was a meeting in which the patients could play the games created by other colleagues. More details about this round of games are presented in subsection 3.4.4.

3.4.1 Details of the game created by Group 1

The game created by group 1 was based on the practice of sports. The group defined that the game's story would revolve around characters who attended CAPS-AD and were deciding which sport they were going to practice. The group also defined that the family should appear in the game. Figure 13 shows the first scene of the game and the scene in which the player must choose which sport to practice. The player also has the option of not playing any sport.

Figure 13 – Screenshot of the first scenes of the group 1 game.

The requirement to involve sports came from the characteristics of the Andrew persona. Andrew likes sports, has many friends and family problems, was raised by his grandparents after his parents split up.

With the practice of sports, the group also sought to encourage socialization, considering the characteristics of the Carlos persona. Carlos has difficulties in relating to people,

he is very proud and convinced but he feels very alone.

Family and friends also appear in the game created by group 1. In the scenes in which the characters are playing sports, these people appear cheering them on (see Figure 14). In addition to the Andrew persona, Gabi also shows family-related characteristics. Gabi has family problems and blames her parents who are separated for her problems, has low self-esteem, depression and has lived on the street. The game's story ends according to the player's choices. The scene in Figure 14 has a positive outcome, meaning that the player made good choices and made good decisions throughout the game. The game has a negative outcome if the player chooses not to play sports.

Figure 14 – Screenshot of the group 1 game: Family and friends cheering for the characters.

Figure 15 shows a scene when the player chooses not to play a sport with his colleagues. In the scene the character appears in a square, feeling alone and soon after someone appears offering drugs for him.

Figure 15 – Screenshot of the group 1 game: Scene after the player chooses the option of not playing a sport with his teammates.

3.4.2 Details of the game created by Group 2

Group 2 chose the personas José Largatixa, Gabi and Pablo. The three chosen personas had family problems. José Lagartixa and Pablo had problems with alcoholism. Gabi had problems with false friends that led her to the drug path. The story in the game covered issues such as family, alcohol abuse and drugs abuse, traits that relate to the personas chosen by the group. Thus, the results of the game suggest that the patients used the personas, as intended, in the construction of the game.

The group defined, as requirements, that the game should include the family, education, therapeutic activities, encouraging behavior change and attendance at CAPS-AD. The story of the game created by group 2 begins with a conversation between a young man and his grandparents. The young man says that he is not well and that he is using alcohol and drugs as an escape mechanism for his problems. Figure 16 shows the screen where grandparents offer help asking if their grandchild has already sought treatment and the screen where the player can choose an answer option.

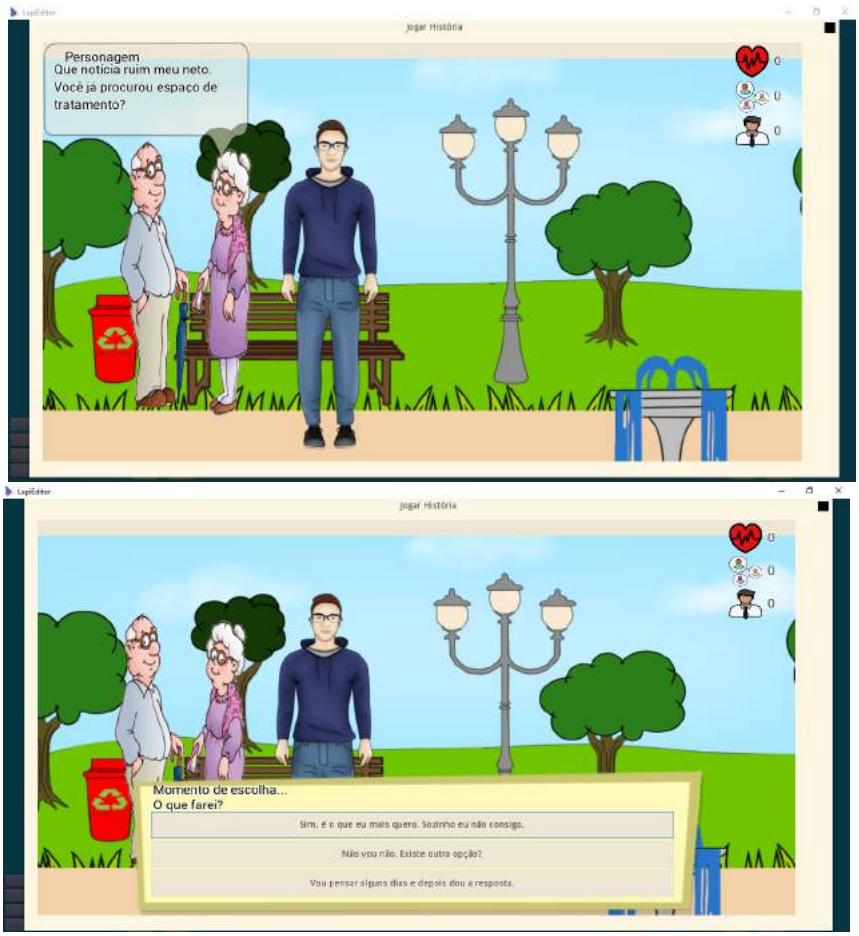


Figure 16 – Screenshot of the scenes of the group 2 game.

Among the options presented in Figure 16, if the player makes the decision to go to CAPS-AD the story continues in the CAPS-AD scenario (see Figure 17). In the game's story, after the character goes to CAPS, he decreases substance use, and goes through

withdrawal crises, but continues with treatment. At the end of the story, the character manages to recover, which is the positive outcome of the game.

Figure 17 – Screenshot of the character arriving at CAPS-AD.

If the player decides not to accept the help, the story goes to its negative outcome. In this case, the character meets friends (see Figure 18) who make him drink. However, the story of the game does not end like that, with this negative outcome. Even if the player does not choose to go to CAPS-AD at first, the story continues until the character remembers the grandparents' advice and decides to be treated.

Figure 18 – Screenshot of the character in the square with friends offering alcoholic drink.

3.4.3 Details of the games created by Group 3

Group 3 chose the personas Carlos and Marcos. Carlos' traits include feeling very alone, not having family support, and being proud. He does volunteer work and is trying to finish college. Marcos, on the other hand, stopped his studies after his parents divorced. With the bad company he was with, he entered the world of drugs. Considering the chosen personas, group 3 created 2 therapeutic digital games.

The requirements, specified by the group, for both games were to encourage making good friends, avoiding bad company, and looking for a church or some form of spirituality. The group also defined that questions involving family and scenarios such as court, square, street, alley, and graffiti should appear in the game.

The first game was about social interaction as a way to combat substance abuse. This game added questions about sports and music.

Figure 19 shows the scene of one of the positive outcomes of the game when the characters decide to take a music class. With music, they made good friendships, which motivated them for good actions. This game contains more scenes and a story that presents more decision options for the player. The story goes through decisions to play a sport or not, use drugs or not, and take music lessons or not, among others.

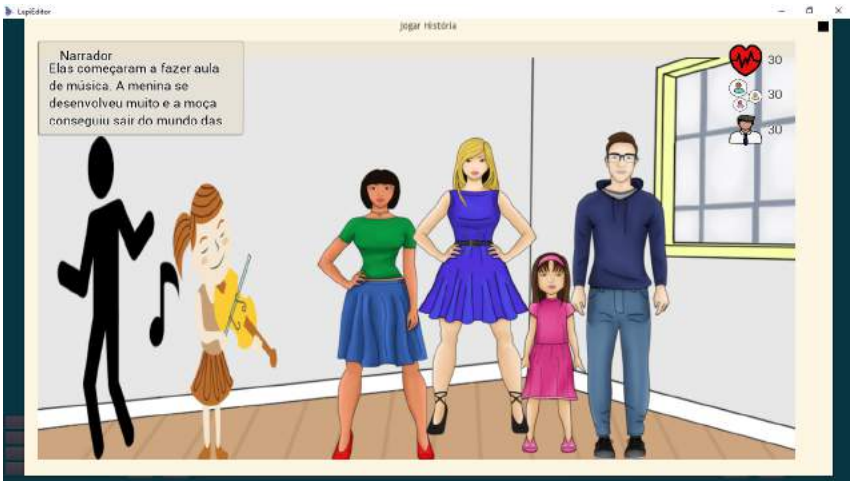


Figure 19 – Screenshot of the scene from one of the positive outcomes of game 1 of group 3.

One of the negative outcomes of the game is shown in Figure 20. In the scene, the player's decisions lead the characters to an alley where they are using drugs. They are approached by police officers and taken to the police station.

The second game created by group 3 starts with one character offering drugs to another. The player has the option to choose to use it or not. If the player chooses not to use drugs, the game goes to scenes where the character is playing sports with his friends (see Figure 21).

If the player's first decision is to accept the drug, in the next scene the character appears asking God for help in thought. At that moment the player has more options to choose (see Figure 22), continue in the drug world, go to the Church, or look for a graffiti workshop.

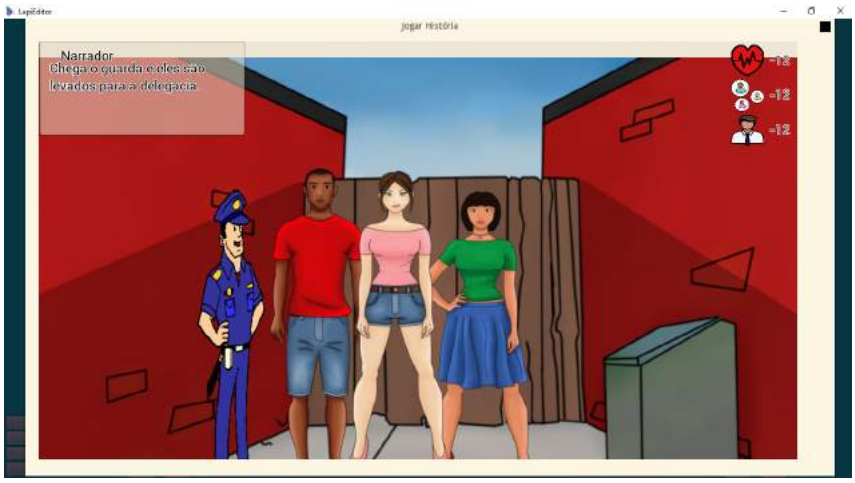


Figure 20 – Screenshot of the scene from one of the negative outcomes of game 1 of group 3.

Figure 21 – Screenshot of the scene of the character doing sport.

Figure 22 – Screenshot of one of the scenes with decision options.

3.4.4 Playing the games created by peers

After the creation of the games by the work groups, a meeting was held so that the patients could play the games created by peers. The purpose of the meeting was to provide interaction between patients and evaluate patients' emotional response after playing the games. All participants could play the games they created and the games created by their peers.

Figure 23 shows two pictures of patients playing the games. It was observed that they felt proud to show the games they made to their peers. Only one patient, still resistant to computer use, did not want to play the games.

Figure 23 – Patients playing the games created by peers.

After the patients played the games, we applied the Self-Assessment Manikin (SAM) (BRADLEY; LANG, 1994) to analyze their emotional responses. SAM is a non-verbal assessment technique that directly measures happy, excited, and controlled associated with a person's affective reaction to a stimulus.

Thirteen patients wanted to respond to the SAM. Figure 24 shows the graph generated from the responses. Regarding happy, 12 indicated they had a high level of happy and 1 left the SAM line related to happy blank. In relation to excited, 9 responded being highly

excited, 1 responded being medium to high excited and 3 responded being low excited. As for controlled, 1 indicated feeling low controlled, 1 indicated being neutral, 2 indicated feeling medium to high controlled, 8 indicated feeling high controlled and 1 left the SAM line related to controlled blank.

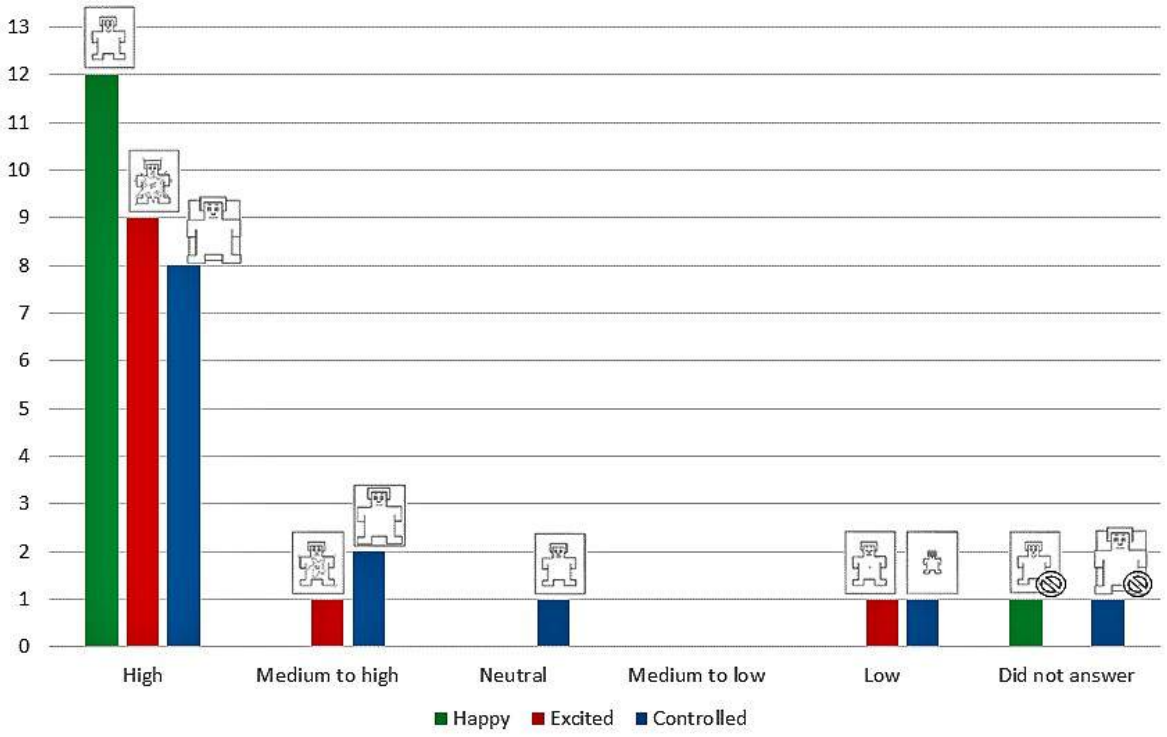


Figure 24 – Graph of SAM application results.

After analyzing the SAM responses, the results suggest that when playing the games, patients in general had a good emotional response. Most of them reported having a high rate of happy, excited and controlled.

It was also possible to verify, through observation, that they were happy and proud to show the games to their peers. And the patients also left suggestions for improvement for the games. For example, they suggested putting in every game a last screen with the character recovered by following the 'good path' proposed in the games.

3.5 Lessons Learned

After conducting an analysis of the entire persona creation process carried out in this project, we were able to determine eleven lessons that had been learned. The persona creation activities carried out by end-users and patients of CAPS-AD were examined to find out these lessons. Account was also taken of how the personas created, were reflected in the therapeutic digital games that were developed. These lessons are the result of

analyzing the generated artifacts and observing the work of the computer professionals (researchers) and the health professional who accompanied the activities.

The lessons learned were grouped into 3 categories, namely: Lessons on care when dealing with vulnerable people in this area; Lessons on patients as creators of personas; Lessons about the work team and their roles. Each of the 11 lessons is described below.

3.5.1 Care when dealing with vulnerable populations in this area:

(1) The cognitive and physical condition of the patients may be compromised. Patients who attend CAPS-AD tend to have cognitive and sometimes physical deficits, caused by their addiction to substance abuse throughout their lives. The psychologist who accompanied the activities highlighted this fact. In her view, people who usually go through CAPS-AD without experiencing any cognitive and/or physical deficits, are able to enter the labor market and society again. As a result, they do not identify with CAPS-AD activities and do not attend its meetings. Some of the patients also had a low level of literacy and difficulty with written activities. They were assisted by professionals and colleagues during the activities that depended on reading and/or writing. Thus, it is necessary to take note of the activities being carried out and adapt them to the conditions of the patients.

(2) It is important to listen to patients and care about them. The time allocated to activities should include a period for welcoming patients, understanding their own motivations and assessing their willingness to speak and participate. Several patients want to speak, tell their own stories, and be part of the group. Thus, it is essential to listen to them in this situation. The CAPS-AD psychologist who followed the activities reported that many researchers go to CAPS-AD with the aim of just studying the patients, but this research was designed to give them something useful - the games created. It is necessary to care about the patients and not just be concerned with the results of the research.

(3) It is also important to know what vocabulary is appropriate to the domain. The language that is used by professionals and researchers must be carefully chosen within the context of the research. It is also necessary to pay attention to the behavior and attitudes of the participants. Professionals should also pay attention to how they behave themselves and how they communicate with patients. With regard to this question, researchers must be relaxed, and speak calmly, slowly and confidently to avoid making patients agitated and apprehensive. The adopted language should avoid terms that might seem to belittle the self-esteem of the patients. In the activities carried out at CAPS-AD, some new terms often employed by computer professionals were learned, such as: i) substance abuse - i.e. the problem with the context is not use, but abuse;

ii) substance users - the psychologist hardly ever referred to patients as alcohol and drug users, she referred to substance users; iii) disorganized - when patients are unable to avoid abuse, or are not working, or have problems at home. That is, when they are out of control, the psychologist referred to the expression “they are disorganized”; and iv) “in situation of street”, in English homelessness - to refer to patients who are homeless.

(4) Practical examples should be given for each activity. The creation of personas is something new for patients and should be explained in a way that comes close to the language they understand. One possible way to explain how the activities and artifacts should be generated is through practical examples. It is thus deemed necessary to adopt a process of creating personas that are already instantiated, by showing examples of what they should do and what the expected results are.

(5) There is a large turnover of patients. When applying a sequential process in an open-door institution, such as CAPS-AD, it is necessary to learn how to deal with the question of “patient turnover”. To get around this situation, it should be remembered, during each activity, that the objective of the project as a whole, is to show what has already been achieved and provide guidance on what can be expected from the following activities.

3.5.2 Patients as creators of personas:

(6) Patients are interested in technology. Most of the patients who took part in the project, were very interested in technology and in learning more about it. This is despite that fact that they previously had little knowledge of the use of technology. Before the computer could be used for carrying out activities, there was a need for previous training on its correct use. By using the computer, it was possible to determine how motivated the patients were and the learning made them feel more socially included.

(7) End-users (patients) are able to create personas. The studied patients managed to create personas that represent the domain for the rehabilitation of patients from substance abuse. With the support of the computer and health professionals, CAPS-AD patients were able to go through the Personas Enrichment Process (RODRIGUES et al., 2014).

(8) Patients tend to create personas based on their real circumstances. In the analysis of the generated artifacts, it was possible to determine that the patients created the personas based on their own life experiences, and not only by summarizing data. It should be mentioned that this is indeed the goal of creating personas - to represent the users of a system in the most realistic way possible. Here are some examples:

1. In the activity of filling out the list of interested stakeholders, one of the groups put the family as an interested party, while the other group did not want to do this since they maintained that the CAPS-AD staff was their family. According to

the psychologist, this difference could be attributed to the life experiences of the patients in both groups. The group that did not want to include the family had patients who were homeless;

2. While the group that had street patients portrayed their personas as still being in search of improvement or lacking optimism about their prospects of improvement, the other group created personas with optimistic situations, in which they had already recovered from their addictions;

3. The features of substance abuse were also more explicit in the group that had homeless patients;

4. Other questions that motivated this lesson learned were patients who wanted to name their children after the personas, or patients who stated that the persona created looked like a colleague from CAPS-AD, as well as patients who included stories of their lives or family members in the personas.

(9) The patients are able to identify with and feel affection for the personas created. When they were choosing the personas that they would use to create their games, the patients tended to select the personas created by themselves. The patients were divided into three groups to create the games. Each group could choose which personas they would use. The patients who took part in the creation of the personas wanted to use the personas they had created themselves rather than those created by other participants. Decisions made in games that have the potential to assist the treatment of personas (and based on their characteristics) appeared more often in games created by groups that had more members and who also took part in the creation of the personas. One of the personas created by the patients was not chosen – precisely the persona who was named after the daughter of one of the patients who helped to create it, but was not included in the game development activities.

3.5.3 The work team and their roles:

(10) The participation of health professionals is required. Health professionals have the theoretical and practical knowledge that is needed to deal with situations in the domain, which computer professionals are not trained to handle. It is health professionals who know the reality of the lives and history of the patients. They know the most appropriate language to use and are able to give patients guidance on how to carry out activities. With regard to the creation of personas and game development, the group which was most assisted by the psychologist added more real data related to the chosen domain. Thus, it is advisable that the number of health professionals should be chosen in accordance with the needs of the groups. Each group must contain at least one health professional and one computer professional.

(11) The participation of professionals in the field of computing is recommended. The activities carried out and the artifacts used to create the personas are far from the real world of the patients and outside the domain of the study of health professionals. In addition, several patients have little or no knowledge of technology, especially with computers, and it is necessary to train them on how to use the computer before carrying out the activities. Thus, computer professionals are needed to monitor the activities.

3.6 Conclusion and Suggestions for Future Work

This paper makes three key contributions, namely, the personas created by end-users, the games implemented by end-users based on personas, and the lessons learned from the process of creation. The process of creating personas and implementing of the games took place in the midst of a real environment for the rehabilitation of patients suffering from substance abuse, and involved the patients themselves actively participating in the creation process.

The persona creation activities were a part of a larger project, which aimed at designing therapeutic digital games for end users. The patients created the personas and later used the personas created to develop their own therapeutic digital games. Altogether 7 personas were created and 4 digital therapeutic games were built.

The personas created by the patients and outlined in this paper, have the potential to assist in the creation of other computer systems for similar domains to the one explored here. Moreover, as a result of the process carried out, the professionals identified 11 lessons that can serve as a guide for other researchers.

It should be emphasized that it was only possible to identify these lessons because the researchers (professionals in computing) had direct contact with the studied public. The activities were carried out in the patients' own environment (at CAPS-AD) and different results could be expected if the activities were carried out in a controlled environment (at the University, for example).

Among the lessons learned, the patients' ability to create personas stands out. Even though they had no knowledge of the techniques needed for creating personas and suffered from cognitive impairments, the patients managed to create personas after being given a brief explanation. In the case of other projects involving a similar audience, it should also be underlined that it is important to be familiar with the terms appropriate to the domain. There is also a need to know how to listen to patients and have at least one health professional and a computer professional for each group of patients.

The greatest limitation found from the researchers' standpoint was the high turnover of patients during the activities. As the Personas Enrichment Method requires sequential activities and owing to the format of the activities in CAPS-AD, it was not possible to

structure the teams in a way that allowed all the members to take part in all the stages of the process on an ongoing basis.

A second limitation that has been identified is the lack of any evaluation of the therapeutic effects of the activities carried out. Only an observational analysis was conducted by the psychologist who accompanied the project, but there was no evaluation based on scientific methods.

In future works, it is recommended that a comparative analysis between personas created by patients and personas should be conducted by professionals. Another potentially valuable future study would be assessing the therapeutic potential of games created by patients with the personas. A third future work would be to apply the Personas Enrichment Process to other patients, either in the same domain or in domains concerned with assisting other pathologies.

Chapter 4

Development and evaluation of a web system for the design of digital games with therapeutic potential by end users

4.1 Introduction

Demands related to mental disorders are large all over the world, but current resources are still insufficient. In 2017, it was estimated that 271 million people in the world, between 15 and 64 years old, had used drugs in the previous year (DRUGS; CRIME, 2019). Self-isolation, social distancing, and other public health measures adopted during the Covid-19 pandemic have intensified the use of alcohol and other drugs and disrupted the provision of specialist treatment services (LUNDAHL; CANNOY, 2021; MONARQUE; SABETTI; FERRARI, 2023). Mental disorders, such as SUDs, bring individual and societal challenges that are considered complex because there is no single solution. In the quest to alleviate these challenges, collaborative practices involving health professionals and patients can be used to build creative and relevant solutions to support the treatment of people with SUDs (ÅKERBLOM; NESS, 2023).

Solutions using digital interventions tend to demonstrate effectiveness and can be engaging, less stigmatizing, and more accessible (MONARQUE; SABETTI; FERRARI, 2023). However, for the development of digital solutions in this context, there must be the active participation of a multidisciplinary team. The expectation is that this team includes

computer professionals, health professionals who are specialists in the pathology to be addressed, patients, and caregivers (SCHMITT; YAROSH, 2018; SOUZA; RODRIGUES; NERIS, 2019).

Therapeutic digital games, for example, have the potential to be well employed in the SUDs context. Game design can also contribute to the recovery process, complementing traditional treatments (HEYER et al., 2020), enabling users to express their opinions in the first person, and building computational systems that can help them better adhere to the prescribed treatment. It can also improve their self-esteem (GARCIA; RODRIGUES; NERIS, 2016).

By allowing them to actively participate in design and development, design decisions are expected to be more aligned with their specific needs. In addition, personalized content dedicated to supporting their recovery facilitates the rehabilitation process. Nevertheless, several design considerations are necessary to take into account their specific conditions and reduce any risks. (BEURS et al., 2017). Thus, involving people in recovery from SUDs in the design process can be complex and it is not fully investigated. It is an emergent research theme.

The first stage of this research was carried out in order to investigate the involvement of people in recovery from SUDs in the design of digital games with therapeutic potential. Design activities based on the SemTh approach (SOUZA; RODRIGUES; NERIS, 2019) were applied with patients at a psychosocial care center. The activities carried out were brainstorming, the definition of interested parties, enrichment of personas, the definition of therapeutic objectives and requirements, modeling of interactions, implementation, and evaluation of games. The previous implementation was carried out with a game editor software called Lepi (GARCIA et al., 2019). Our intention was to study how those people would go through a design process, identify facilities and difficulties they would have, and list specific demands to build a solution that supports game design by this population.

In that first approach to people in SUDs rehabilitation, it was possible to identify that they were engaged in the proposed activities. With the support of the health professional who accompanied the activities, the participants were able to discuss harmful and protective actions associated with SUDs. They also thought about the impact of these actions on the changes in the game score and, mainly, on their lives. In addition to the reflections that emerged, another important therapeutic aspect was related to self-esteem. Participants were proud of what they had created, which is known to be beneficial in the context of SUDs recovery.

However, some challenges were also observed. The participants needed support at all times from the computing professionals who were involved in the activities. Some activities had to be adapted, as the participants had difficulty understanding parts of the process, especially parts that involved greater abstraction. Another challenge was the need to explain, exemplify, and remember what had been done in previous activities and

what needed to be done next. The rotation of the participants was also a challenge and the lack of knowledge in the use of the computer.

Considering the challenges encountered, this research presents the construction of a web system that supports the design of digital games with therapeutic potential by people in recovery from SUDs. The emerging results of this research aim to contribute to the research of a doctoral project that seeks to promote a way for end users recovering from SUDs to design digital games with therapeutic potential, in a scalable and autonomous way. This seeks to reduce dependence on a computer professional to carry out activities, providing more autonomy to health professionals and their patients in recovery from SUDs. Therefore, the objective of this paper was to design a conversational interface for a web system that guides end users recovering from SUDs in carrying out digital game design activities with therapeutic potential.

The research method used was Design Science Research (DSR), detailed in Section 4.3. The conversational interface was implemented by the authors using tools for web development. As the system is in the health context, it is important that it undergoes an evaluation with health professionals, who are also end users, before being made available to patients. Therefore, for evaluation, the system was made available to four health professionals from a psychosocial care center for people recovering from SUDs. The professionals participated in a usability test. They were invited to use the system and then answered two questionnaires. The results suggest that the system is apt to be used by patients recovering from SUDs and professionals are willing to use the system in support of therapy with their patients. The results of the implementation and evaluation, as well as a discussion of the results, are detailed in Section 4.4.

4.2 Background

This section presents the background of this paper. In Subsection 4.2.1 is presented an overview of computing in support of recovering from SUDs. The Subsection 4.2.2 presents an overview of the design of digital games with therapeutic potential.

4.2.1 Recovery from Substance Use Disorders and Support by Computing

The abusive consumption of psychoactive substances, such as alcohol and drugs, can lead a person to individual vulnerability, social and community. The growth of abusive consumption of these substances has demanded public policies with the intention of minimizing the aggravated consequences to the health of individuals (BRASIL, 2015). The recovery of people with SUDs is related to inclusion initiatives through social, cooperative, productive, and income-generating activities. Social inclusion is also important in

the context, aiming at exercising citizenship and developing autonomy (SANCHES; VECCHIA, 2018). The concepts of psychosocial rehabilitation and social reinsertion are also used in the literature on SUDs. All terms used are related to the creation of conditions for people in recovery from SUDs to be able to maintain their social, family, and community relationships, participate in society, and have their rights guaranteed with the maximum possible autonomy (SANCHES; VECCHIA, 2018).

Digital inclusion is also seen as important for people recovering from SUDs, including as a means of supporting social relationships and contributing to job opportunities. Research is being carried out on the experience of SUDs users in the use and design of technologies to support therapy. However, previous work on the experience of end-users with an SUDs background has been limited due to several factors (WOELFER, 2014). Not only is it complex to reach and recruit such individuals (MAESTRE et al., 2018), but they may also be hesitant to share their perspectives, feeling uncomfortable being actively involved in research and design activities due to past negative experiences involving judgment, stigma, trauma, among others (WOELFER, 2014). Furthermore, traditional HCI approaches to user-centered design have not been validated with vulnerable groups, thus we argue that a range of adjustments is needed to ensure that data collection truly reflects the views of end users.

Given the challenges mentioned above, previous works involving end-users with a history of SUDs have primarily focused on predictive analytical to support recovery from substance addiction (FISCHMAN, 2018), mobile apps to assist patients in recovery (YOU et al., 2016), virtual agents for motivational interviewing (OLAFSSON; WALLACE; BICKMORE, 2020) and pairs support for online communities (RUBYA; YAROSH, 2017). Methods employed include questionnaires, interviews, model development, participatory design, and experiments (YOU et al., 2016; RUBYA; YAROSH, 2017; FISCHMAN, 2018; SCHMITT; YAROSH, 2018). As far as we know, the active participation of people with SUDs in the design and development of therapeutic solutions involving technology has not yet been properly investigated, being considered an innovative and challenging field of research.

4.2.2 Design and Development of Digital Games with Therapeutic Potential

The application of knowledge in computing to support other areas of knowledge is a reality on the world stage. Systems are developed seeking to improve people's lives, individually and collectively (CARRO; WAGNER, 2016; TIBES C. M. D. S.; DIAS; ZEMMASCARENHAS, 2014). In the health area, technological development has changed several practices, including activities such as clarifying pathologies, education, management, diagnosis, and therapy (NUNES F. L. S.; COSTA; MORAES, 2011). It has been

developed from application programs that support health professionals in their offices (e.g. spreadsheets, software for financial and patient control, etc.), hospital care systems, diagnostic support systems (e.g. medical image processing), therapy support systems, and also digital games created to directly assist in the treatment of patients (SOUZA; JUNIOR; NERIS, 2023).

Digital games have increasingly become part of people's daily lives. Therapeutic games are a subset of serious digital games designed to complement rehabilitation therapies. MADER, LEVIEUX e NATKIN (2016) define therapeutic digital games as being digital games that produce a direct, expected, and intended therapeutic effect on the patients who play them. This therapeutic effect can alleviate, improve, or cure the specific condition of the patients. Game design is the process by which a game designer creates a game. One of the goals of successful game design, perhaps the most important one, is learning how to create great game experiences for players (TEKINBAS; ZIMMERMAN, 2003).

The design of therapeutic digital games differs from the others due to the need for the participation of specialists in the field of therapy to be attended. The creation of therapeutic digital games should be considered the participation of computer professionals, health professionals, and patients themselves (SOUZA; RODRIGUES; NERIS, 2019).

SemTh is an approach to therapeutic digital game design that supports the participation of multidisciplinary teams throughout the design process (SOUZA; RODRIGUES; NERIS, 2019). The approach consists of four steps, namely:

1. Clarification of the Design Problem - This step aims to understand the domain in which the game will be applied and includes brainstorming activities, enrichment of personas, a survey of therapeutic objectives, a survey of requirements, and a definition of design elements;

2. Interaction Modeling - This step consists of creating scenarios and modeling game interactions;

3. Materializing Design - This step consists of implementing the game. The approach suggests using the Lepi game editor;

4. Evaluation - This step consists of evaluating the games created. The approach suggests the assessment of compliance with requirements by computing professionals, usability assessment by users (patients), and assessment of therapeutic effects by health professionals.

Garcia et al. (2019) developed a framework that allows the implementation of digital games by end users, not computer specialists. The framework is composed of a software architecture, a collaboration model, and the game editor Lepi. Lepi allows users to implement games by dragging and dropping elements to create scenarios, insert characters,

and create dialogues and interactions. Lepi was not created in a health context, but it was applied in this context and proved to be useful in the scenario of therapeutic digital games implementation (GARCIA et al., 2019).

4.3 Method

The research method used in this study was DSR. Initially proposed by Hevner et al. (2004), the DSR method has been evolving over time (PEFFERS et al., 2007; HEVNER; CHATTERJEE, 2010; PEFFERS et al., 2012). For this study, we followed the DSR method detailed in the work of Peffers et al. (2007). The DSR grew out of efforts to formalize Design Science in Information Systems research. The method provides researchers with a framework to produce and present high-quality, rigorous, and publishable research in research outlets (PEFFERS et al., 2007).

The DSR process includes six steps, being them: i) problem identification and motivation; ii) definition of the objectives for a solution; iii) design and development; iv) demonstration; v) evaluation; and vi) communication (PEFFERS et al., 2007).

The identification of the problem and motivation, as well as the objectives and requirements for this study, emerged from a doctoral project in progress and are detailed in subsection 4.4.1. The project investigates the design and development of digital games with therapeutic potential by end users recovering from SUDs. One of the products of the doctoral research in progress is a system to support the investigation process. The study presented in this paper consisted of the development and initial evaluation of the proposed system.

The design, development, and demonstration of the system are detailed in Subsection 4.4.2. The valuation method applied is detailed in Subsection 4.3.1 and the results of the evaluation are detailed in Subsection 4.4.3. Finalizing the DSR process, in Section 4.5, the authors present a discussion of the results and their implications for future research.

4.3.1 Evaluation Method

We conducted a usability evaluation with healthcare professionals who will later use the system with their patients recovering from SUDs. Usability evaluation is a way to ensure that interactive systems are adapted to users, and their tasks and that there are no negative results from their use (BASTIEN, 2010). Moreover, usability is one of the key factors in successfully implementing health digital applications (MARAMBA; CHATTERJEE; NEWMAN, 2019).

Maramba, Chatterjee e Newman (2019) reports that the most used methods for usability testing are questionnaires, interviews, focus groups, task completion, 'Think-Aloud', and heuristic testing. Usually works use one or two methods together (MARAMBA; CHATTERJEE; NEWMAN, 2019).

For the evaluation carried out in this study, we applied a usability test with four health professionals from a psychosocial care center for people in recovery from SUDs. The system was made available to health professionals, and after using the system, they answered two questionnaires.

The purpose of the first questionnaire was to identify perceived ease of use. According to Davis (1989) perceived ease of use is the degree to which a person believes that using a system will be free of effort. Questionnaire questions were based on the Technology Acceptance Questionnaire (TAQ) (DAVIS, 1989). The TAQ is a research instrument that measures user acceptance of a given technology. It is widely used in information and communication technology research to assess the acceptance of a new technology or system. The TAQ is composed of two main dimensions: Perception of Usefulness and Perception of Ease of Use (DAVIS, 1989). This study considered the Perception of Ease of Use.

In addition, another questionnaire was applied to collect the profile of the health professionals and obtain feedback with qualitative data on which specific points of the system could be improved. We also sought to identify the health professionals' perception of demands to make the system available to their patients. For data collection, in addition to the questionnaires, we used direct observation and a field diary.

For the analysis of the qualitative data collected, the thematic analysis method (CORBIN; STRAUSS, 2014; BERNARD; WUTICH; RYAN, 2016) was used. According to Corbin e Strauss (2014) the thematic analysis method is a systematic technique for the analysis of qualitative data that involves the identification and categorization of patterns in the data. The basic steps of thematic analysis are:

1. **Data preparation:** Before starting the thematic analysis, the qualitative data must be reviewed and organized. Data can be transcribed and edited to ensure it is easily readable and understandable.

2. **Identification of themes:** Identifying themes involves carefully and repeatedly reading qualitative data to identify ideas, concepts, or words that repeatedly crop up in various parts of the data. Topics should be identified openly and without bias to ensure that relevant information is not lost.

3. **Categorization of theme:** Identified themes are grouped into broad categories based on their similarities and relationships. Categories can be created from themes or can be identified during data analysis. Categories are often used as labels to help organize data.

4. **Pattern analysis:** Pattern analysis involves a careful review of categories to identify relationships and patterns that emerge between them. Researchers can use diagrams, maps, or other techniques to visualize relationships between categories.

5. **Validation of results:** Validation of results involves review and confirmation of analysis results by other researchers or study participants. This helps ensure the reliability and validity of the results.

6. **Report of results:** Analysis results are reported clearly and objectively, often with examples of data that support the conclusions. Reporting the results should include a detailed description of the themes and categories identified, as well as an analysis of the patterns that emerge among them.

Thematic analysis can be performed manually or using some software for qualitative data analysis (BERNARD; WUTICH; RYAN, 2016). For the analysis carried out in this study, we used the ATLAS.ti [1]. The evaluation results are described in subsection 4.4.3.

4.4 Results

In this section, we present the results of this research following the steps of the DSR. In Subsection 4.4.1 are presented the results of the steps i) problem identification and motivation; and ii) definition of the objectives for a solution. In Subsection 4.4.2 are presented the results of the steps iii) design and development; and iv) demonstration. In Subsection 4.4.3 are presented the results of step v) evaluation. In Section 4.5 we finish with step vi) communication of the DSR through a discussion of the results and their implications for future design research in the SUDs domain.

4.4.1 Problem identification, motivation, and definition of the objectives for a solution

The problem and motivation of this research are related to an ongoing doctoral project that seeks to investigate ways to support the design and development of digital games with therapeutic potential by people in recovery from SUDs. Our motivation is to make these people more autonomous, feel empowered in the creation of therapeutic digital games, and be able to express themselves through the design and stories created for the games.

Seeking to investigate this population in a real-life scenario, design and development activities for therapeutic digital games were carried out in a specialized institution. With this first step, it became possible to identify some demands that supported the definition of the proposed objectives and requirements for the system presented in this paper.

The activities provided discussions on harmful and protective actions in SUDs, providing an opportunity for patients to express themselves. However, cognitive limitations and those related to low literacy demanded adaptation to the activities. With this, it was considered that alternative forms of interaction would be necessary for the system.

[1] https://atlasti.com

Already in this first step, it was also noticed the difficulty of patients in activities that demanded greater abstraction. Therefore, for the construction of scenes and modeling of interactions, for example, we provide the system images of scenarios and real contexts. Collaboration between patients during activities was also observed, which is why we seek to support, encourage, and take advantage of this collaboration for the outcome of the games.

Another identified demand is related to the exemplification of the proposed activities and the return to the train of thought. In activities that require sequence, like in a design process, it is necessary to support patients in resuming their train of thought. The design process as a whole should also be guided by reminding patients about the activities that have already been done and the goals of the next activities.

Finally, it was observed that the patients needed support at all times from the computing professionals who were involved in the activities. Patient turnover and lack of knowledge of computer use was also a challenge.

Considering the observed demands, the authors of this paper listed the necessary requirements for the system. The main listed requirements are presented in Table 5. In addition to the requirements presented, it was defined that the system should support patients throughout the creation process, from planning to implementation of the game. For this, it is important that the interface offers tutorials and support resources, in addition to allowing collaboration between patients and the health professionals who accompany them.

4.4.2 Design, development, and demonstration

Once the requirements had been defined, prototypes (wireframes) were built, which were soon implemented by the development team. The first version of the system was made available for evaluation by a group of three specialists in HCI. For evaluation, a heuristic usability evaluation. Heuristic evaluation was used to validate the interface design and ensure that it is in line with usability best practices. After evaluation by HCI specialists, the interface was refined until it reached the current version.

The main task to be carried out in the system is the design of a digital game with therapeutic potential. The system user will be instructed to carry out design activities for the creation of a storytelling game, building scenarios, and characters, and creating stories with reflections on everyday life. Each set of activities for creating a game must be linked to a project. The project must be created by the health professional who will be accompanying their patients in the activities.

The system can be used by two user profiles, health professionals and patients. Health professionals can register, log in to the system, and manage projects. Patients use the

Table 5 – Main requirements listed for the system.

Requirement ID	Requirement description
R1	The system should have an interface-based icon/image, more visual activities, and interaction based on click, and drag-drop.
R2	The system should guide the user with explanations and examples of the activities so that he knows the steps he must take to reach the final objective.
R3	The system should allow interaction with the guide using text, voice, audio, and click.
R4	The system should verify and confirm with the user before he performs an action within the activities.
R5	The system should have a timeline to follow the project steps and allow previous steps to be accessed.
R6	The system should suggest answers for all activities within the project in order to exemplify them.
R7	The system should have some kind of guidance in case the user does not understand the proposed activity.
R8	The system should have potential stakeholder activity for users to identify players, community, and information sources.
R9	The system should have a player characterization activity for users to characterize the players, such as name, image, clinical symptoms, a form of treatment, and description.
R10	The system should have the activity to draw the scenes and characters of the game.

system without the need to register, and there is no need to save data from these users.

When entering the system, the health professional will be able to create new projects. To register a project (see Figure 25a) the health professional must inform a name for the project, which therapeutic topic he wants to address with that project, and which patients will participate in the project. Then, the system generates an automatic and unique code for that project. On the projects screen (see Figure 25b) the professional will be able to get the generated code. It is with this code that patients will be able to access the project (see Figure 25c) to carry out game design activities.

As soon as the patient enters the system with the code informed by the health professional, the system will start the activities and present the patient with a CA explaining the first activity (see Figure 26a). The patient will be able to perform all activities being guided by the CA. The CA shows the patient a step-by-step explanation and example of each activity (see Figure 26b). The CA interacts via text, audio, click, and explanatory videos if the patient has difficulties understanding the activities to be performed. If the

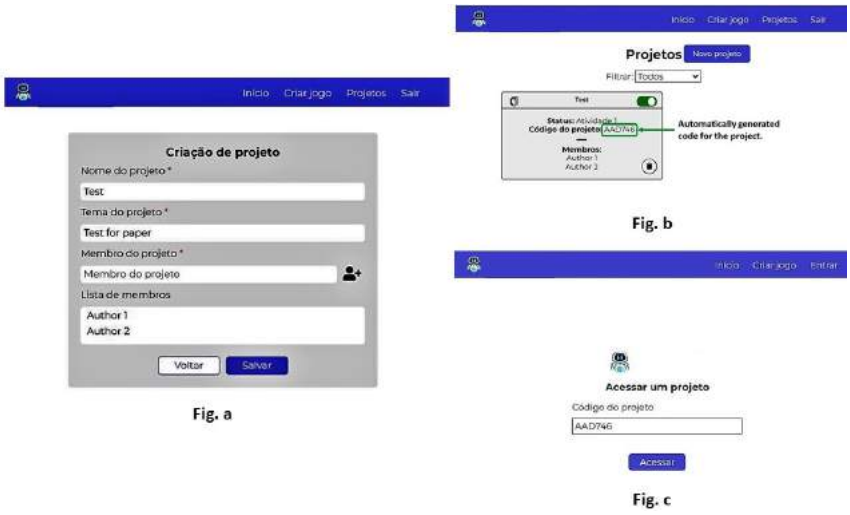


Figure 25 – a) Project register screen. b) Projects screen. c) Screen for patients to access activities.

patient wants, he also has the option of closing the CA and carrying out the activities. In this case, the CA is "waiting" (see Figure 26c), and if the patient needs it, s/he will be able to request the help of the CA again.

Figure 26 – a) CA explaining the first activity. b) CA guiding the activity step by step. c) CA "closed", waiting for the patient to ask for help if necessary.

The system supports four design activities: i) definition of interested parties; ii) enrichment of personas; iii) modeling of interactions; and iv) implementation. Each activity was adapted according to the demands identified for the SUDs rehabilitation population. We seek to reduce the need for technical knowledge and abstraction in understanding and carrying out activities. In activities i and ii there is a board with predefined suggestions to help patients think of examples and complete the activities.

The definition of interested parties was called in the system of *"possíveis interessados no jogo"* (see Figure 27). In this activity, patients are instructed to identify potential players for the game and think about sources of information and institutions in the com-

munity in general that could contribute and/or be impacted by the therapeutic game they will build.

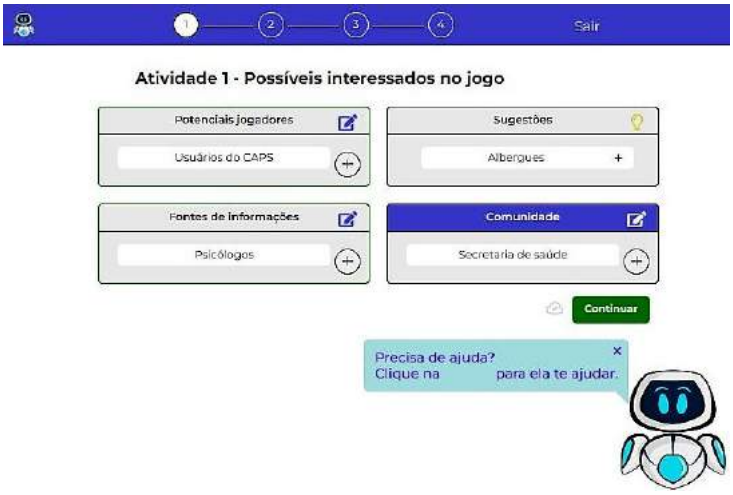


Figure 27 – Screen with all the steps of Activity 1 - Defining potential stakeholders in the game.

Enrichment of personas was called in the system of *"caracterização dos jogadores"* (see Figure 28). The term *"jogadores"* (players) makes it easier for patients to understand. In this activity, patients were instructed to think about who the game they are going to build will be for, and think about who will play the game. Patients then define a name, an image, clinical symptoms, treatment that can be addressed in the game to help the player improve their clinical symptoms, and a description for the player.

Figure 28 – Screen with all the steps of Activity 2 - Characterization of the players.

The modeling was presented in the system through the construction of scenes (see Figure 29), using images close to reality, reducing the need for abstraction. In this activity, the patient is instructed to think about the story of the game, choosing the scenes and characters in the story. The CA shows instructions, always remembering that the game's

story must be thought of considering the player profile that was defined in the previous activity. The patient needs to create at least two scenes, and there is no upper limit to the number of scenes. Later, the constructed scenes can be downloaded from the web system and imported into the Lepi game editor.

Figure 29 – Screen with all the steps of Activity 3 - Designing the scenes.

For the implementation activity, the system shows instructions in the format of four videos (see Figure 30). The videos cover explanations on how to use the Lepi game editor software, how to download created scenes, and how to import them into Lepi.

Figure 30 – Screen with all the steps of Activity 4 - Instructions for implementing the game.

Table 6 presents the design decisions that were taken to meet the listed requirements. All decisions taken were thought by the development team considering the demands identified and presented in the subsection 4.4.1.

In addition to the design decisions presented in Table 6, a design decision that encompassed all activities and requirements was to simplify the technical terms. For example,

Table 6 – Design decisions and relationship with requirements.

Requirement ID	**Design decision**
R1	We implemented the system in such a way that all activities can be performed via click.
R2	We implemented a CA in the system that explains and guides patients during all activities.
R3	The CA's interaction with the user can be carried out by text, audio, and/or videos. And the user's interaction with the CA is by click.
R4	We implemented the activities in such a way that for the user to move on to the next activity, he needs to confirm that he wants to do that action. When trying to close the system, the user is also asked to confirm the action, being informed that he may lose information that has not yet been saved.
R5	We implemented a well-marked flow of activities in the system, with a timeline indicating which activity the user is in and how many still remain to be performed. Through the timeline, the user can also go back to previous activities if he wants to.
R6	We implemented a suggestion board in the system. The board was thought to give suggestions to the users and also to allow interaction through click, and drag-drop of R1.
R7	We implemented the system in such a way that through the AC the user can access explanatory videos if he does not understand the proposed activity.
R8	In the first activity of the system, we implemented the definition of interested parties, so that users can identify players, community, and sources of information.
R9	We implemented that in the second activity of the system, users must think about the name, image, clinical symptoms, form of treatment, and description of the player.
R10	In the third activity of the system, we implemented that the user must build the game scenes through images with scenarios and characters that refer to the real world.

when talking about personas, the participants in the first stage of the study understood that they were the characters in the game. At the time, it was difficult for them to understand that, in fact, personas were player profiles. That's why in the system we don't use the term personas, but players. The same occurred with the terms "stakeholders" and "interaction modeling".

4.4.3 Evaluation

To carry out the system evaluation, we contacted an institution specialized in psychosocial care for people recovering from SUDs. Our intention was to propose a project to evaluate the system with professionals and their patients. We invited all the institution's professionals, 4 of whom were interested in evaluating the system and subsequently applying it to their patients.

We held three meetings with professionals. Each meeting lasted approximately one hour. At the first meeting, we presented the project and invited health professionals, henceforth called P1, P2, P3, and P4. In the second meeting, they were able to use the system to design a digital game with therapeutic potential. They carried out the design activities proposed in the system, identified potential stakeholders in the game, characterized the players, and designed the scenes. Finally, in the third meeting, they answered the questionnaires to evaluate the system.

The health professionals were two psychologists, a social worker, and an arts monitor. They have between 2 to 9 years of experience working in the institution. On a 5-point scale related to experience with technology, P1 considered having 2 experience points, P2 considered having 3 experience points, P3 and P4 considered having 4 experience points. None of the reviewers had previously participated in digital game design activities. And none of the health professionals had previously used digital systems to support the therapy of their patients.

The first questionnaire answered by the health professionals was based on the TAQ. The objective was to identify the perception of ease of use of the system. Nine items were presented to the health professionals who could respond on a scale of 1 to 7, where 1 was strongly disagree and 7 strongly agreed. Table 7 shows the items covered in the questionnaire and the average of the health professionals' answers. As can be seen in Table 7 all items had an average score above 4.5 points, indicating good results in the perception of ease of use of the system.

The second questionnaire contained questions about the health professionals' profiles and closed and open questions about their general perspectives when using the system. At this stage, a semi-structured interview was to be carried out, however, due to the health professionals' limited time, the questions were adapted and applied in a questionnaire format. Table 8 presents the results of the quantitative part of the second questionnaire and Figure 31 presents the results with the themes analyzed in the qualitative part of the second questionnaire.

The closed questions of the second questionnaire were answered on a 5-point Likert scale. In general, the health professionals reported that they felt interest, autonomy, and satisfaction when using the system, with an average of 4 points or more for these questions. Health professionals also showed interest in using the system as an alternative therapy with their patients. The only question that had an average score lower than 4

Table 7 – Result of the questionnaire for perception of ease of use of the system.

Item	Mean
I learned to use this technology quickly.	5.75
It is easy to use this technology.	6
It is easy to learn how to use this technology.	5.5
Using this technology requires little mental effort.	4.75
It is easy to remember how to use this technology.	6
Interact with this technology is clear and understandable.	5.75
This technology is easy to use without outside help.	5.5
I feel confident in using this technology.	6
I feel comfortable using this technology.	6.25

was related to the health professionals' perception of the patients finding the system easy to use. The health professionals were not sure how easy the patients would find it to use the system since each patient has their own specific conditions. However, although the health professionals are not sure about ease of use, they found that patients would be interested in using the system.

Table 8 – Result of the questionnaire about the general perspective of the health professionals when using the system. Quantitative part.

Item	Mean
On a scale of 1 to 5, where 1 is no interest and 5 is very interesting. How interested in using the system?	4
On a scale of 1 to 5, where 1 is no autonomy and 5 is a lot of autonomy. How much did you feel autonomy to use the system?	4
On a scale of 1 to 5, where 1 is not satisfied and 5 is very satisfied. How much did you feel pleased to use the system?	4.25
Answer the following statement on a scale of 1 to 5, where 1 totally disagrees and 5 fully agrees. "I would use the system as an alternative form of therapy with my patients."	4.5
Now answer thinking about your patients. On a scale of 1 to 5, where 1 is not easy and 5 is very easy. How much do you believe your patients will find it easy to use the system?	2.5
Now answer thinking about your patients. On a scale of 1 to 5, where 1 is no interest and 5 is very interesting. How much do you believe your patients will be interested in using the system?	4

For the analysis of the qualitative part of the second questionnaire, it was used the thematic analysis method. First, the data preparation step was performed, and the

questionnaire with responses from the health professionals was transcribed for ATLAS.ti. By reading the responses, we identified themes and included them in the ATLAS.ti coding. The identified themes were categorized into themes about the system, health professionals (therapists), patients, and about the therapist-patient relationship. The answers were analyzed and coded according to the themes. One author of this paper performed the coding and later two other authors validated the results. Figure 31 shows a diagram generated in ATLAS.ti with a list of themes and how many times they were identified in the health professionals' responses.

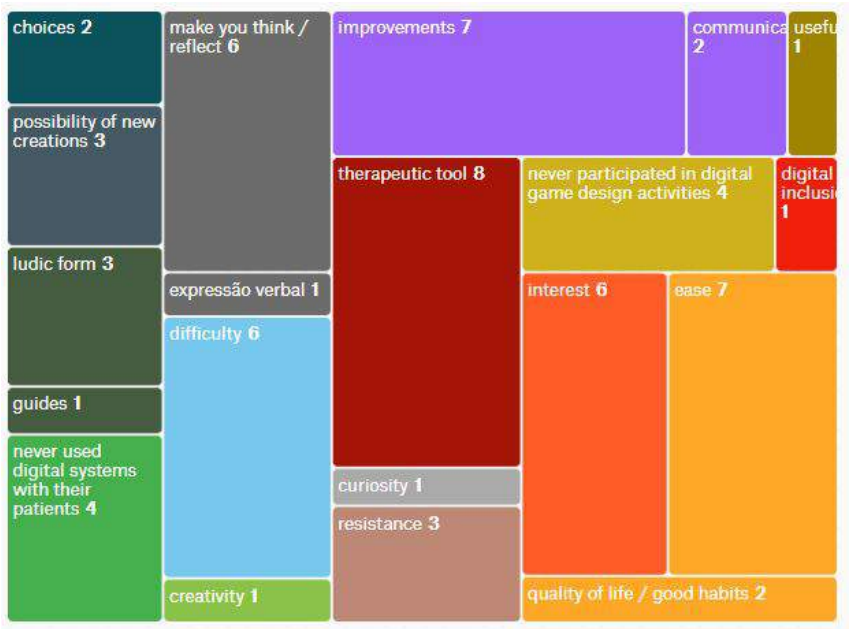


Figure 31 – Result of the questionnaire about the general perspective of the health professionals when using the system. Qualitative part.

The theme that stood out the most (8 occurrences) was the potential of the system to be used as a therapeutic tool. All health professionals reported believing that the system can help in the therapy of their patients. P3 reported that the system is "a good therapeutic tool, facilitating communication between therapist and patient". P4 reported that by raising relevant themes in the creation of game design, it is possible that the system can help as one of the therapeutic tools.

In second place (7 occurrences), the themes that appeared the most were about the ease of using the system and about improvements to be made. The health professionals reported that there was not much difficulty in using the system. Although in the closed questionnaire the lowest score was about ease, in the open questionnaire they reported that they did not see many difficulties for patients. P2 reported that "the system is easy to work with because it guides you on what to do". About improvements, P4 reported the need to have an "experience of playing before creating the games" and an "illustrative video of a game created by the tool". They also indicated more specific improvements.

P4 reported on the possibility of more image options for creating scenes, allowing you to include more than 3 characters in the scene and having the possibility of enriching scenes with more objects. P1 spoke about the need to facilitate the explanation for the next step. P3 reported on the need for audio description but later observed that the system already had this functionality.

In third place (6 occurrences), the themes that appeared the most were about the potential of the activities in the system to make patients think and reflect on real-life decisions, interests, and some points identified as difficulties. P3 reported that "at first, there may be resistance from some patients, as they are not familiar with digitalis, but I believe that later it will awaken interest". P4 reported that the creation of the games "promotes the player's identification with the situations and characters", "can facilitate the representation of everyday choices", and "represent real situations of choices". The difficulties encountered are related to the use of the system itself. P1 reported that the "difficulty was understanding that it is necessary to click on continue". P3 found it difficult to return to the previous stages and to confirm to proceed. P4 reported as difficulty "familiarizing yourself with dialog boxes", and "understanding what they ask for in defining the steps", however, he also reported that he believes "that was a difficulty from the first contact".

P3 reported that "the most playful way can arouse interest". P4 also reported that "the tool is a playful way of representing real situations of choice, promoting good habits for a better quality of life".

4.5 Discussion

Based on these emerging results, our discussion seeks to bring new insights to the scientific community to inspire design research involving populations in recovery from SUDs. To do this, we discuss our findings on 5 aspects relevant to the HCI community.

Approximation of the population. Design professionals and HCI already know the need to get closer to end users to ensure technology solutions are adapted to the context. However, this need is even greater when it comes to vulnerable populations and little studied by the computing literature. We observed that by inserting ourselves into a real scenario of SUDs rehabilitation, we had the opportunity to identify the specific demands of that population. For example, low literacy, lack of knowledge in basic computer use, difficulty with abstraction, difficulty following a line of thought, and difficulty remembering previous activities. We also observed that this population is interested in digital games, they can think of stories and create games with the support of computing and health professionals.

Data collection methods. The number of healthcare systems that publish their usability assessment results remains just a small fraction. Quantitative questionnaires

are the most prevalent evaluation method, which provides an overall measure of usability but does not identify issues that need to be resolved. Qualitative methods may be more useful in this regard (MARAMBA; CHATTERJEE; NEWMAN, 2019). Diverging from what was reported by Maramba, Chatterjee e Newman (2019), we noted that quantitative questionnaires can be used, but observation and qualitative data can add richness to assessments in the context of SUDs. We only identified the demands for observing the population in a real scenario and the qualitative responses of health professionals who evaluated the system brought more useful information to identify difficulties and improvements for the system.

Design implications. When designing digital solutions in the context of SUDs, it is necessary to guide the activities that the patient will perform, guiding what should be done. In activities and processes that require sequentially, it is necessary to support them in resuming the train of thought. It was also observed the importance of more visual activities and interaction based on clicking, dragging, and dropping. Other alternative forms of interaction should also be considered in an SUDs context, such as text, audio, and video interaction. Technical terms should be avoided, and the need for abstraction should be minimized. The use of the ludic was also pointed out by health professionals as a good way to arouse the interest of patients.

Interest of health professionals. The use of computer systems in the context of SUDs rehabilitation did not seem to us to be very common. However, we observed that health professionals were very interested in using technology as an alternative form of therapy with their patients. They reported that the evaluated system can help in collaboration between patients and therapist-patient communication. We believe that this engagement of professionals is fundamental for the success of therapeutic systems and that they are willing to collaborate with computing in the construction of these systems.

Therapeutic instrument. Both in the first approximation of the population and in the evaluation of the system with health professionals, it was possible to observe that game design activities tend to have a therapeutic effect on patients. In the first step of the research, we observed an improvement in self-esteem; the feeling of being inserted and learning something different; they felt proud of themselves; were able to express themselves through the stories created for the games; and discussed ways of protection and harm reduction. In evaluating the system, health professionals considered that the system has the potential to be used as a therapeutic tool and showed interest in using the system as an alternative form of therapy with their patients.

4.6 Final Remarks

This research presents the design, development, and evaluation of a web system for the creation of digital games with therapeutic potential by end users. We used the DSR method and presented the results according to the steps proposed by the method. The objective of this paper was therefore to design a conversational interface for a web system that guides end users in SUDs recovery in carrying out digital game design activities with therapeutic potential.

In the first contact with the studied population, we identified demands for the construction of the system. The system was developed and an evaluation was carried out with four health professionals from a psychosocial care center for people in recovery from SUDs. The results suggest that the system can be applied to patients in an alternative SUDs therapy context. The professionals who evaluated it showed interest in using the system with their patients.

The system has not yet been directly evaluated with patients in recovery from SUDs, which can be considered a limitation of the work. However, future work is already being structured to apply the system with patients recovering from SUDs.

The emerging results of this paper aim to contribute to the research of a doctoral project that seeks to promote a way for end users recovering from SUDs to design digital games with therapeutic potential, in a scalable and autonomous.

Chapter 5

Case Study: End users in recovery from substance use disorders as designers and developers of digital games with therapeutic potential

5.1 Introduction

SUDs affect 35 million people worldwide and cause more than 500,000 deaths yearly (OLAFSSON; WALLACE; BICKMORE, 2020; TERRA, 2021). The WHO predicts that by 2030, mental illnesses will be the leading disease burden worldwide. Given this projection, technological advances create opportunities for close collaboration between computing and mental health researchers (WADLEY et al., 2018). Computing has made efforts to develop systems to support the therapy of people with SUDs. Among these systems are therapeutic digital games, potentially engaging patients in the therapeutic process. The design and development of games in this domain requires an active multidisciplinary team, which includes computer and health professionals with experience in the pathology that will be treated. The active participation of end users, patients, and caregivers is also desired (SOUZA; RODRIGUES; NERIS, 2019; SOUZA et al., 2022). However, little is known in the literature about people in recovery from SUDs as designers and developers of therapeutic digital games (SOUZA; JUNIOR; NERIS, 2023; SOUZA et al., 2022).

Based on this context, an ongoing Ph.D. research seeks to investigate ways to support the design and development of digital games with therapeutic potential by people

in recovery from SUDs so that they have more autonomy, feel empowered in the creation of digital games with therapeutic potential, and can express themselves through the design and stories created for the games, without depending on the direct intervention of computing professionals. For this, the Ph.D. research proposed the construction of a framework that supports design and development activities by this population, providing more autonomy for end users. More autonomy in this context is considered the ability of end users to apply activities with the least possible intervention from computing professionals.

The framework is being built with the following composition: i) a design process considering the SUDs context; ii) a set of rules to create CA that support and guide end users in SUDs rehabilitation in the design and development process of digital games with therapeutic potential; and iii) a Web platform where end users in SUDs recovery can apply the design process (see Figure 32), guided by a CA.

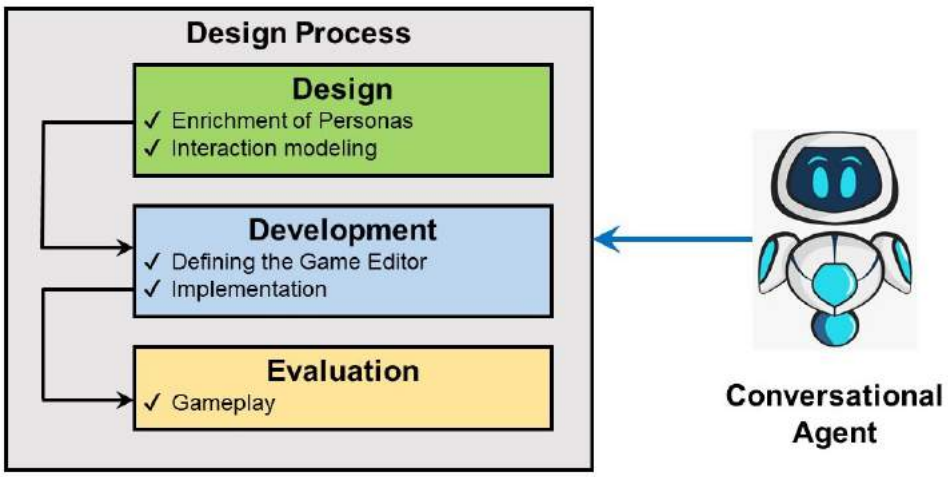


Figure 32 – Suggested design process for SUDs context.

The Web platform proposed in the framework, henceforth SemTh Web (SOUZA et al., 2023), is in the evaluation phase. Therefore, this case study aimed to make SemTh Web available to professionals of a CAPS-AD to use with their patients. This case study aims to verify how much end users (patients) can use the system and evaluate the autonomy of these end users in designing digital games with therapeutic potential. The research hypothesis is that using the SemTh Web will give end users (patients in recovery from SUDs) more autonomy in designing digital games with therapeutic potential. This case study was approved by the Research Ethics Committee of the Federal University of São Carlos (in São Carlos city, State of São Paulo in Brazil) under feedback report (named CAAE) number 66623823.4.0000.5504.

5.2 Method

This research is characterized as an empirical case study, part qualitative and part quantitative. The case study has 6 stages, namely: plan, design, preparation, collection, analysis, and sharing (YIN, 2015).

5.2.1 Plan, design, and preparation of the study

The case study was chosen as a research method because it is a research that does not allow the control of behavioral events, seeks to answer questions about how participants would apply the proposed activities, and focuses on a contemporary event. The case study also allows the collection of data from multiple methods, such as interviews, questionnaires, observation, and artifact analysis (YIN, 2015).

In the planning of the study, it was defined that it would be carried out in six meetings, which are detailed in Table 9. The number used as an identifier in the "ID" column of Table 9 refers to the number of meetings. In each meeting, participants carried out participatory activities to design digital games with therapeutic potential. For the activities, the steps proposed in the design process suggested for the SUDs context were followed (see Figure 32).

Table 9 – Activities planned for the study.

ID	Activity	Purpose	Data Collection Instruments
1	Presentation of the Project	Present the project to the participants; Signing of consent forms; Familiarize participants with the computer.	Field diary and observation.
2	Persona Enrichment Process	Identify, characterize, and profile potential players.	Field diary, observation, and content created.
3	Interaction modeling	Designing game scenes using predefined images.	Field diary, observation, and content created.
4	Game implementation - Part 1.	Creation of a first prototype of a digital game; Creation of scenarios, inclusion of game mechanics.	Field diary, observation, and content created.
5	Game implementation - Part 2.	Finalize the digital game; Creation of scenarios, inclusion of game mechanics.	Field diary, observation, and content created.
6	Evaluate of the games	Evaluate the gameplay.	Field diary, observation, and interview.

Research activities were carried out in spaces made available by CAPS-AD in Passos City, State of Minas Gerais in Brazil. The CAPS-AD is an open-door and daily care service aimed at the treatment and service users' family, social, and community reintegration (LACERDA; FUENTES-ROJAS, 2016). CAPS-AD provides daily care and therapeutic to people in recovery from SUDs. The service has the participation of multidisciplinary

teams composed of social workers, psychiatrists, psychologists, occupational therapists, nurses, and nursing assistants, among others (ROCHA, 2017).

The target audience for this research consists of people in recovery from SUDs, participants in rehabilitation activities at CAPS-AD, and their respective therapists. A therapist is considered to be any CAPS-AD health professional who participates in the therapeutic process of service users.

The project was presented to CAPS-AD health professionals, and all who wished to participate were welcome. Health professionals who wanted to participate in the project were responsible for recruiting their patients. All CAPS-AD users interested in the study were welcome, and the inclusion criteria for research participants were:

- ❏ The participant was undergoing a therapeutic rehabilitation process for SUDs at the CAPS-AD in Passos City;
- ❏ The participant was invited and supervised by a CAPS-AD health professional;
- ❏ The participant was interested in participating in the study;
- ❏ The participant agreed to participate by signing the free and informed Consent Form.

5.2.2 Collection, analysis and sharing data

Field diaries, questionnaires, interviews, and artifacts generated during the design activities were used for data collection. The health and computing professionals who followed the activities kept field diaries of all six meetings. The participants (patients) initially answered a profile questionnaire and, at the end of the activities, answered the System Usability Scale (SUS) (BROOKE, 2013) questionnaire and an interview to evaluate the process.

The SUS is a standardized questionnaire for evaluating the usability of systems or products. The mean SUS score (68 points) was calculated to analyze the quantitative data obtained through the SUS questionnaire.

For the analysis of the qualitative data collected in the field diaries and interviews, the thematic analysis method (CORBIN; STRAUSS, 2014; BERNARD; WUTICH; RYAN, 2016) was used. According to Corbin e Strauss (2014), the thematic analysis method is a systematic technique for analyzing qualitative data that involves identifying and categorizing patterns in the data. The basic steps of thematic analysis are:

1. **Data preparation:** Before starting the thematic analysis, the qualitative data must be reviewed and organized. Data can be transcribed and edited to ensure it is easily readable and understandable;

2. **Identification of themes:** Identifying themes involves carefully and repeatedly reading qualitative data to identify ideas, concepts, or words that repeatedly crop up in various parts of the data. Topics should be identified openly and without bias to ensure that relevant information is not lost;

3. **Categorization of theme:** Identified themes are grouped into broad categories based on their similarities and relationships. Categories can be created from themes or can be identified during data analysis. Categories are often used as labels to help organize data;

4. **Pattern analysis:** Pattern analysis involves a careful review of categories to identify relationships and patterns that emerge between them. Researchers can use diagrams, maps, or other techniques to visualize relationships between categories;

5. **Validation of results:** Validation of results involves review and confirmation of analysis results by other researchers or study participants. This helps ensure the reliability and validity of the results;

6. **Report of results:** Analysis results are reported clearly and objectively, often with examples of data that support the conclusions. Reporting the results should include a detailed description of the themes and categories identified, as well as an analysis of the patterns that emerge among them.

Thematic analysis can be carried out manually or using some software for qualitative data analysis (BERNARD; WUTICH; RYAN, 2016). For the analysis carried out in this study, we used the ATLAS.ti [1]. The evaluation results are described in Subsection 5.3.3.

With the end of the analysis of the data collected in the case study, we now have the opportunity to share the results obtained through this scientific paper. We therefore hope to contribute to the academic community and to future research in the same domain.

5.3 Results

In this section, we present the details of the results of the case study. A computer researcher and two CAPS-AD health professionals participated in the six meetings held at the institution, which took place in April and May 2023. They invited their patients to participate in the activities. All who wanted to participate were instructed to sign the consent form and answer a profile questionnaire. A total of 25 patients participated in the activities. The profile of the participants is described in the Subsection 5.3.1.

The participants were divided into two groups (G1 and G2). Each health professional accompanied a group. G1 used the SemTh approach with paper artifacts for game design. G2 used the SemTh Web system. One of the objectives was to assess how much

[1] https://atlasti.com

more autonomous G2 was and how much less intervention was needed by the computer researcher who accompanied the activities. Details of the six meetings are described in the Subsection 5.3.2.

In all meetings, the computer researcher and the health professionals kept field diaries. In the last meeting, participants were instructed to answer the SUS questionnaire, and an interview was conducted about the activities carried out. The results of the analysis of the collected data are presented in Subsection 5.3.3.

5.3.1 Profile of participants

Of the 25 participants in the study, 22 participants (88%) identified themselves as men and three as women (12%). Age ranged from 18 to 60 years. In relation to the participants' education, the results of the profile questionnaire showed a variation from participants who did not complete basic education to participants with a complete technical level. Some participants attended CAPS-AD for less than a month (44%), and participants who attended for more than two years (24%).

Regarding the experience with computers, 12 participants (48%) reported having no experience and only 2 participants (8%) reported having a lot of experience. 23 participants (92%) said they had never participated in digital game creation activities and the same percentage also stated that they had never used any digital system to support their therapeutic process.

5.3.2 Activities carried out at CAPS-AD

In the first meeting, there were ten patients. The professionals presented the project to the patients and invited them to participate. All accepted and completed the consent term and the profile questionnaire. The first meeting aimed to present the project and provide participants with computers and digital games. The computer researcher took two laptops with two games developed in her research group. A game to teach the use of the mouse and another developed to encourage the self-esteem of people with depression. Some participants had the opportunity to use a computer for the first time at this meeting.

In the second meeting, the design activities began. Eight participants were divided into two groups (G1 and G2). In this meeting, both groups carried out the Persona creation activity. In this context, to facilitate understanding by the population, the activity was called defining the profiles of players. They defined the stakeholders and created the profiles and stories of potential players.

G1, accompanied by a health professional and a computer researcher, started the design using SemTh artifacts on paper. G2 went to another room accompanied by a health professional and created the design activities using the SemTh Web. Figure 33a shows a photo of G1 participants performing the activities and one artifact completed

by G1. Figure 33b shows a photo of G2 participants performing the activities and one artifact completed by G2.

a. Photos and artifacts - G1. b. Photos and artifacts - G2.

Figure 33 – Second meeting - Photos and artifacts - G1 and G2.

In the third meeting, there were 14 participants. Participants who were not at the previous meeting were divided between G1 and G2. G1 continued doing the activities on paper and G2 using the SemTh Web. In this meeting, they were encouraged to carry out the interaction modeling activity. Within the context, the activity was applied in the format of providing a set of images of the real world for participants to create the game scenes (see Figure 34). Participants were reminded that game scenes and stories should always reflect a way to help the player profiles defined in the previous meeting.

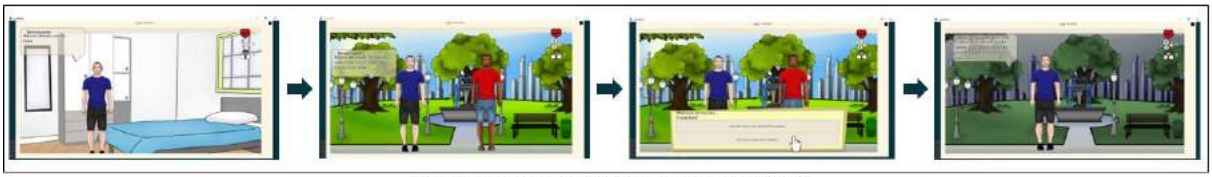
a. Photos and artifacts - G1. b. Photos and artifacts - G2.

Figure 34 – Third meeting - Photos and artifacts - G1 and G2.

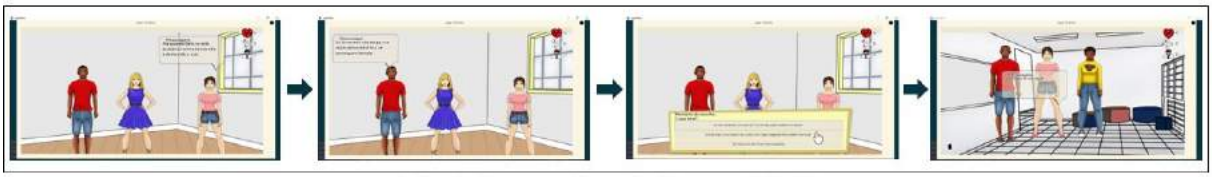
To implement the games, a game engine called Lepi was used. Lepi supports the implementation of digital games by end users, not computer specialists (GARCIA et al., 2019). The participants started using Lepi to implement the games in the fourth and fifth meetings. They remained divided into groups and were instructed to implement the scenes created in the third meeting, complementing them with dialogues, decisions, and punctuation. In the fourth meeting, there were 15 participants in the fifth meeting there were 13 participants.

G1 implemented 7 scenes in total. Figure 35a shows a sequence of scenes from the game created by G1. In this story, the character decides to leave home, meets a friend, and is thinking about going to play ball. The player can then decide whether to play ball or drink alcohol. If he chooses to play ball that choice would lead to a positive consequence, when he chooses to go drinking the choice leads to a scene with a negative consequence.

G2 implemented 10 scenes in total. Figure 35b shows a sequence of scenes from the game created by G2. In this story, the main character's sister and girlfriend are angry with him for spending the night on the street and ruining his and their lives. The character says that he is fine and that they care a lot. The player can then make a choice between saying they are better off alone, continuing their life the same way, or accepting help. Each choice leads to other scenes with possible consequences.



a. Example of a sequence of scenes from the game created by G1.



b. Example of a sequence of scenes from the game created by G2.

Figure 35 – Examples of a sequence of scenes from the games created by G1 and G2.

In the sixth meeting, with the groups together, the participants were invited to play the game their colleagues had created. After the round of games, they were asked to respond to the SUS questionnaire and an interview to evaluate the activities. There were 5 participants in this meeting.

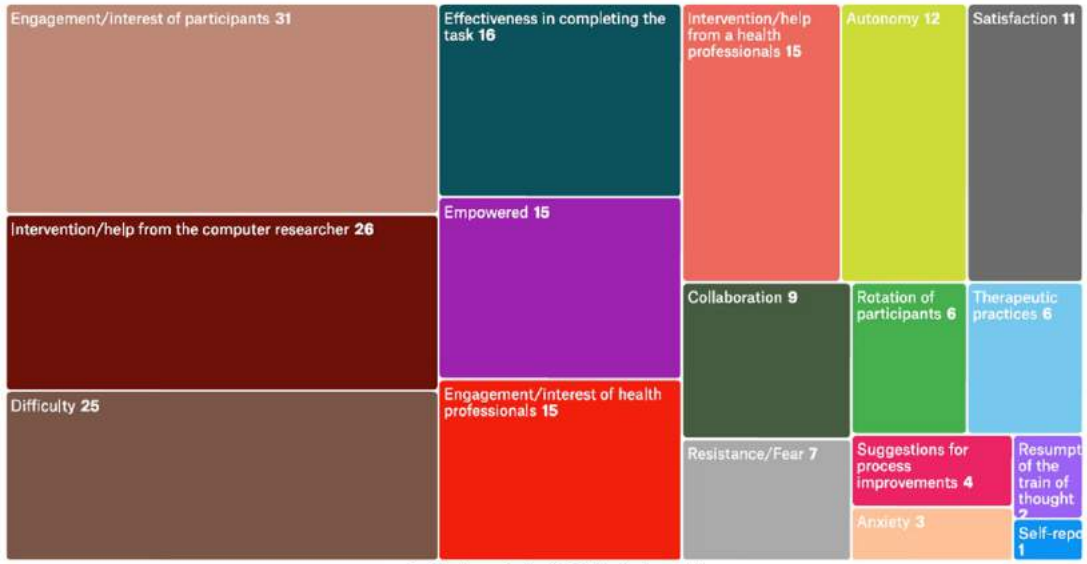
5.3.3 Data analysis

The result of the SUS questionnaire indicated a result of 69.5 points. This suggests that, according to the method, the evaluated design process had good usability acceptance by the research participants. Among the SUS results, in general, participants indicated that they felt confident and found it easy to use the process. They also pointed out that they would need support to use the process, but that they would learn quickly. They also indicated that they would like to use the process frequently.

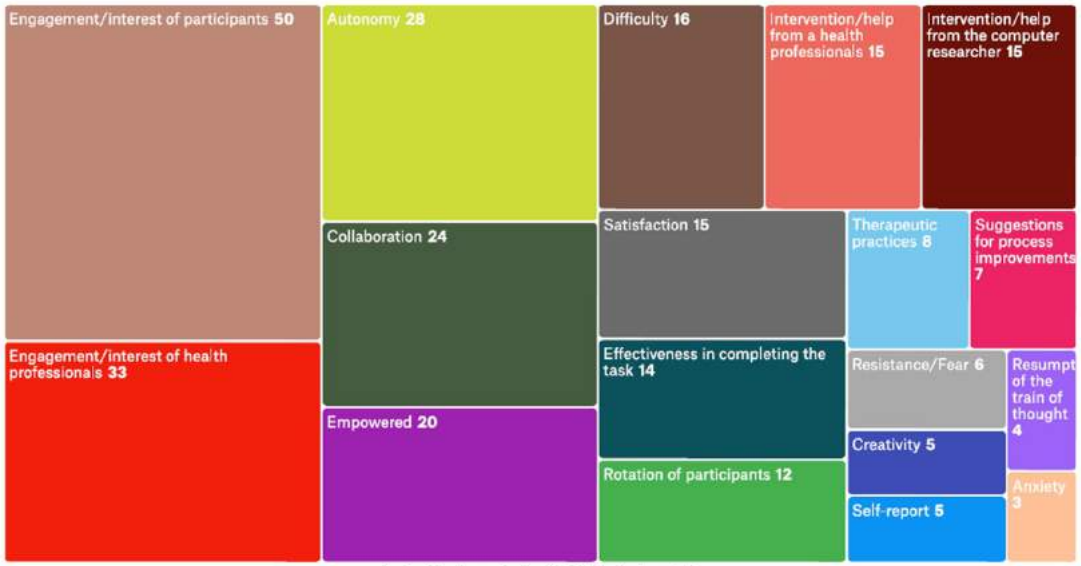
To analyze the field diaries, the thematic analysis method was used. Firstly, the data preparation stage was carried out, in which the field diaries were transcribed into the ATLAS.ti. By reading the diaries, we identified themes and included them in the coding

of the ATLAS.ti. The themes identified were grouped into 18 categories, being them: 1) Anxiety; 2) Autonomy; 3) Collaboration; 4) Creativity; 5) Difficulty; 6) Effectiveness in completing the task; 7) Empowered; 8) Engagement/interest of health professionals; 9) Engagement/interest of participants; 10) Intervention/help from health professionals; 11) Intervention/help from the computer researcher; 12) Satisfaction; 13) Resistance/Fear; 14) Resumption of the train of thought; 15) Rotation of participants; 16) Self-report; 17) Suggestions for process improvements; and 18) Therapeutic practices. The texts from the field diaries were analyzed and coded according to the theme categories.

Figure 36a shows the graph generated in ATLAS.ti after the qualitative analysis carried out in the field diaries in relation to G1. Figure 36b presents the graph generated in ATLAS.ti after the qualitative analysis carried out in the field diaries in relation to G2.



a. Qualitative analysis of field diaries from G1.



b. Qualitative analysis of field diaries from G2.

Figure 36 – Graphics of qualitative analysis of field diaries from G1 and G2.

Observing the results of the data analysis in both groups, it was possible to identify that the participants and the health professional in G2, who used the SemTh Web, were more engaged in the activities. In the results, there were 31 occurrences of the theme "engagement/interest of participants" in G1, versus 50 occurrences of the same theme in G2. The theme "engagement/interest of health professionals" appeared in 15 occurrences in G1, versus 33 occurrences in G2.

Analyzing the results, it is also possible to observe that there was a difference in autonomy between the two groups. There were found 12 occurrences of the theme "autonomy" in G1 data, versus 28 occurrences in G2 data. G1 needed the researcher's intervention 26 times, while G2 needed the researcher only 15 times. In the field diary of the health professional who accompanied G2 in meeting 4, the first meeting using SemTh Web, the professional reported that "*the help of the computer researcher was not necessary*".

Another relevant difference is the collaboration between participants. In G1 there were 9 occurrences of the theme "collaboration", while in G2 there were 24 occurrences of the same theme. According to the field diary of the health professional who accompanied G2 "*the group climate was creative, promoted identification, projection and reflection, collaborative, welcoming and sometimes relaxed postures even in the case of complex scenes*".

In the G2 field diaries there were also more occurrences of the themes "creativity", "empowered", "satisfaction", "self-report" and "therapeutic practices". In contrast, in G2 there were fewer occurrences of the theme "difficulty".

Two other themes considered very relevant in studies with people recovering from SUDs are the need to remember and help resumption the train of thought in sequential processes and the difficulty encountered in relating to turnover. In G1 there were 2 occurrences of the theme "resumption of the train of thought" and in G2 there were 4 occurrences of the same theme. This result may be related to the rotation of participants in the activities, appearing in G1 6 occurrences of the theme "rotation of participants" versus 12 occurrences in G2.

Only one mention of CA appeared in the field diaries. The health professional who accompanied G2 reported that "*P11 quickly understood that for each action he had to click on the 'little robot' SemTh*". The 'little robot' mentioned referred to the avatar of SemTh Web's CA. As only this mention appeared, it was not possible to evaluate how much the CA support helped G2.

In line with the other data analyzed, the interviews indicated that the participants enjoyed carrying out the activities. P22 reported that "*the experience was cool, I would like to repeat the meetings*". In general, they reported that what they liked most was the interaction with their group colleagues and the fact that they could use the computer.

All participants who responded to the interview also agreed that the activities carried out helped in the therapeutic process. P16 reported that the activities "*encouraged me to use the computer, helped my head, got rid of bad thoughts and calmed me down a lot*".

P20 reported that "*it helped a lot because you interact with people, make new friends*".

5.4 Discussion

The design process presented to research participants brings together activities with characteristics adapted to the context. The process includes digital game design activities with therapeutic potential in the storytelling format, in which participants can express their opinions in the construction of stories for the games, reflecting on decisions related to real life. This game construction format makes participants reflect on their own daily choices, helping with rehabilitation, therapy and harm reduction related to SUDs. This section features a discussion of the authors' perception of the activities, design implications, and recommendations for future research in the same domain.

Engagement and autonomy. Before we started the activities, health professionals mentioned that CAPS-AD users did not engage in activities for more than 40 minutes. However, all project meetings lasted between 1 hour and 15 minutes to 1 hour and 30 minutes. Furthermore, G2 participants only stopped activities because they were at lunchtime or were interrupted by health professionals because they had some other important activity. This result already indicates the adherence and engagement of participants in the activities.

Our hypothesis that the use of SemTh Web would give end users (patients in recovery from SUDs) more autonomy in designing digital games with therapeutic potential was accepted by the results obtained. Data analysis suggests that participants who used the SemTh Web system were more engaged in activities, had more autonomy, and needed less help from the computer researcher. The health professional who accompanied G2, who used SemTh Web, also seemed more engaged in the activities. He said in his final field diary that he "*would like to thank us for opening and delivering the meetings and reiterate the invitation for future partnerships with the academy*".

Collaboration. The health professional who accompanied G1 reported that she observed collaboration between the participants and that they helped and encouraged each other to participate. In G2's field diaries, it was observed that everyone created the stories together, respecting each person's profile and knowledge, and what the group decided was implemented. The health professional who accompanied G2 highlighted the collaborative and welcoming attitudes. And the participants themselves reported in the interviews aspects of interaction with colleagues and the possibility of new friendship ties.

In both working groups, collaboration between participants was observed. However, it was observed in the data analysis that in G2 there was more collaboration than in G1. Therefore, the results suggest that the use of the SemTh Web system supported collaboration between participants.

Therapeutic practices. The activities carried out and the resources used provided

inspiration for health professionals. They pointed out that the creation of stories can be used in therapeutic groups. The activities carried out provoked reflection on the use of technology in the therapeutic process, to elaborate on existential, family, and relationship issues with drugs. According to health professionals, it was very rich the possibility for users to express their characteristic vocabulary, their slang, compare the virtual situation with the real one, and project the consequences of their choices. Activities and encouragement to use the computer were also considered relevant for social reintegration, from the use of social networks to reintegration into the job market.

Design implications. The results of the study suggest that the design process adopted and the design decisions made in the development of the SemTh Web (SOUZA et al., 2023) were satisfactory in terms of generating engagement and promoting autonomy in participants. More accessibility features should be explored in future work. Health professionals were concerned about ensuring that the process was accessible to users with different levels of impairment (psychic organization, difficulties in cognition, drowsiness effects of the medication, lack of glasses). Some of these issues have already been considered at SemTh Web, but others have been addressed externally, with the support of health professionals and computer researcher.

Recommendations for future research. We believe that the main recommendation for future research in the field of SUDs is the need to approach the population in a real-life scenario. All the learning and results of this study were only possible due to the researchers' engagement in meeting this population in a real SUDs rehabilitation scenario.

When working with this population it is also necessary to take into account the rotation of participants. Research must have the flexibility to be adapted to the rotation without losing scientific rigor. A limitation of this study was the final evaluation by the participants. The rotation of participants limited the evaluation. Only 1 participant from G2 was present at all meetings that used SemTh Web and only he responded to the SemTh Web ease of use perception questionnaire, limiting this part of the evaluation. Of the 25 participants who attended the meetings, only 5 were at the last evaluation meeting. For these reasons, for future research, the authors suggest that evaluations be conducted per meeting, minimizing the effects of the rotation of participants.

Chapter 6

Conclusions

Digital game development activities carried out by (GARCIA et al., 2019) with end users (people in recovery from SUDs) showed a potential therapeutic effect, such as increased self-esteem, empowerment, and gain of autonomy. At that time, end users needed full support from computer professionals and there was a lack of a design process for therapeutic digital games that considered the specific demands of this population. Therefore, this doctoral research began with the motivation to scale the construction of therapeutic digital games by people recovering from SUDs, reducing the need for interventions from computer professionals and increasing the autonomy of these end users.

Since then, a path has been followed, starting with research to understand the state-of-the-art in this context and identify the specific demands of this population. The SM carried out (Chapter 2) confirmed a lack of works actively involving this population in digital game design activities with therapeutic potential. Furthermore, with the design activities carried out at CAPS-AD in the city of São Carlos / SP - Brazil (Chapter 3), it was possible to identify the specific demands of this population for this scenario. Based on these two studies, we identified the need to formalize a specific design process for people in recovery from SUDs, build a platform to support these activities and incorporate into this platform a way to guide these people throughout the design process.

Considering this context, the objective of this doctoral research was to build a framework to collaborate with the design and development activities of this population, consisting of a design process, a web platform, and a CA incorporated into this web platform. The hypothesis was that delivering this framework to this population would reduce the need for interventions from computer professionals and increase the autonomy and empowerment of end users (health professionals and their patients recovering from SUDs). The results presented in Chapters 4 and 5 suggest that the objective of this doctoral

research was achieved and the hypothesis accepted.

After all the studies carried out, the results suggest that with the proposed framework the studied population carried out design and development activities in a more autonomous way. The results of the evaluation (Chapter 5) with CAPS-AD users from the city of Passos / MG - Brazil showed that the group that used SemTh Web showed more interest, engagement, autonomy and empowerment when compared to the control group. The health professional who accompanied the group that used SemTh Web was also more engaged compared to the health professional who accompanied the control group.

As a product of this doctoral research, we delivered to the scientific community an intuitive and simplified design process that facilitates application by end users. A web platform with an embedded CA capable of guiding end users through the design process. In addition, we deliver state-of-the-art advances in computing to support therapy for people recovering from SUDs, lessons learned, and directions for future researchers in this field. Most of the results of this research were only possible because we were in partnership with healthcare professionals and patients in real-life scenarios and situations in these people's routines.

6.1 Limitations

Some limitations can be found in relation to the evaluation of SemTh Web. Participant turnover is a difficulty in studies with people recovering from SUDs. The evaluation could have been richer if all participants in the evaluation research were present in all activities carried out in CAPS-AD. However, this is a characteristic of the population, and future researchers in the same domain should consider this characteristic.

Another limitation regarding the evaluation is the fact that the framework was evaluated with people who attend CAPS-AD and was not evaluated with other audiences or with people diagnosed with other mental disorders. As a result, the evaluation of the solution was restricted to SUDs, but nothing prevents it from being evaluated later in scenarios involving people with different mental disorders.

Still in relation to the evaluation, a specific evaluation of the CA incorporated into SemTh Web was not carried out. The research participants used the CA together with SemTh Web and the process as a whole was evaluated, not obtaining such evident data of a detailed assessment of the CA.

A final limitation identified is the lack of a more simplified integration of SemTh Web with the Lepi game engine to implement games. Such integration would require a reconstruction of Lepi within SemTh Web, which was not feasible within the scope of this doctoral research, which focused on the design process.

6.2 Future works

In future work, we aim to generalize the design process and the framework as a whole to be used in different mental health contexts. To this end, we propose that the framework be evaluated with healthcare professionals and their patients affected by other mental disorders. Such an evaluation tends to validate the framework in other mental health contexts, as well as propose improvements to achieve the intention of collaborating in these other contexts.

As a second future work, there is a demand to integrate the Lepi game engine with SemTh Web. This integration has the potential to facilitate the dynamics of construction activities for therapeutic digital games.

Finally, an important future work consists of making SemTh Web available to CAPS-AD in other cities. As one of the initial intentions of this doctoral research was to scale the solution, contact with other CAPS-AD is important so that they can use SemTh Web with their patients.

6.3 Publications and submissions

- Souza, Paula M.; Rodrigues, Kamila R. H.; Neris, Vânia P. A. Semth: an approach to the design of therapeutic digital games. In: Proceedings of the 18th Brazilian Symposium on Human Factors in Computing Systems. Vitória, ES, Brazil. 2019. doi.org/10.1145/3357155.3358440

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- ❏ Souza, Paula Maia; Motti, Vivian Genaro; Neris, Vânia Paula de Almeida; Rodrigues, Kamila Rios da Hora. Critical Lens on End User Development in Alcohol and Drugs Abuse Rehabilitation. *Submitted to a scientific journal, in the process of review.*

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Appendix

APPENDIX A

List of papers selected for mapping.

1. "Energy is a Finite Resource": Designing Technology to Support Individuals across Fluctuating Symptoms of Depression.
2. "I Hear You, I Feel You": Encouraging Deep Self-disclosure through a Chatbot.
3. "Suddenly, we got to become therapists for each other": Designing Peer Support Chats for Mental Health.
4. A Conversational Robotic Approach to Dementia Symptoms: Measuring Its Effect on Older Adults.
5. A Gamification Engine Architecture for Enhancing Behavioral Change Support Systems.
6. A Mental Health Chatbot for Regulating Emotions (SERMO) - Concept and Usability Test.
7. A Mental Health Database Creation Method with 2-Phase Correlation Computing.
8. A mobile application for campus-based psychosocial wellness program.
9. A Mobile Phone App to Improve the Mental Health of Taxi Drivers: Single-Arm Feasibility Trial.
10. A multimodal adaptive dialogue manager for depressive and anxiety disorder screening: a Wizard-of-Oz experiment.
11. A multi-modal human robot interaction framework based on cognitive behavioral therapy model.

12. A Service-Oriented Architecture for Web Applications in e-Mental Health: Two Case Studies.

13. A usability study with healthcare professionals of a customizable framework for reminiscence and music based cognitive activities for people with dementia.

14. Alexa as Coach: Leveraging Smart Speakers to Build Social Agents that Reduce Public Speaking Anxiety.

15. An assistive technology design framework for ADHD.

16. An Enhanced Social Networking Intervention for Young People with Active Suicidal Ideation: Safety, Feasibility and Acceptability Outcomes.

17. An Interactive Game to aid with Anxiety Management.

18. Anxiety and Autism: Towards Personalized Digital Health.

19. AR-IoMT Mental Health Rehabilitation Applications for Smart Cities.

20. Artificial Intelligence-Assisted Online Social Therapy for Youth Mental Health.

21. Behavioral and cognitive intervention strategies delivered via coached apps for depression: Pilot trial.

22. Bring the Outside In: Providing Accessible Experiences Through VR for People with Dementia in Locked Psychiatric Hospitals.

23. Building a web based cognitive restructuring program for promoting resilience in a college campus.

24. Changing Family Practices with Assistive Technology: MOBERO Improves Morning and Bedtime Routines for Children with ADHD.

25. Co-Design Beyond Words: 'Moments of Interaction' with Minimally-Verbal Children on the Autism Spectrum.

26. Co-designing ambient-assisted interventions using digital interlocutors for people with dementia.

27. Computer-assisted therapy.

28. Conceptual knowledge and sensitization on Asperger's syndrome based on the constructivist approach through virtual reality.

29. Conversational Agents and Mental Health: Theory-Informed Assessment of Language and Affect.

30. Conversational Agents to Provide Couple Therapy for Patients with PTSD.
31. Design and Evaluation of a Touch-Centered Calming Interaction with a Social Robot.
32. Design Opportunities for Mental Health Peer Support Technologies.
33. Designing a Chatbot as a Mediator for Promoting Deep Self-Disclosure to a Real Mental Health Professional.
34. Designing Mental Health Technologies that Support the Social Ecosystem of College Students.
35. Developing design considerations for mobile and wearable technology.
36. Development and User Satisfaction of Plan-It Commander, a Serious Game for Children with ADHD.
37. Development of a Mobile Clinical Prediction Tool to Estimate Future Depression Severity and Guide Treatment in Primary Care: User-Centered Design.
38. Development of an App to Support Self-monitoring Smartphone Usage and Healthcare Behaviors in Daily Life.
39. Emotional Self-Regulation of Individuals with Autism Spectrum Disorders: Smartwatches for Monitoring and Interaction.
40. Engaging Older Adults with Depression as Co-Designers of Assistive In-Home Robots.
41. Engaging Teenagers in Asynchronous Online Groups to Design for Stress Management.
42. Enhancing social functioning in young people at Ultra High Risk (UHR) for psychosis: A pilot study of a novel strengths and mindfulness-based online social therapy.
43. Evaluating the Impact of a Mobile Neurofeedback App for Young Children at School and Home.
44. Exploring the Potential of Exergames to affect the Social and Daily Life of People with Dementia and their Caregivers.
45. Exploring User Learnability and Learning Performance in an App for Depression: Usability Study.
46. Facilitating Collaboration and Social Experiences with Videogames in Dementia: Results and Implications from a Participatory Design Study.

47. Finding the Adaptive Sweet Spot: Balancing Compliance and Achievement in Automated Stress Reduction.

48. Gamification of cognitive training: a crowdsourcing-inspired approach for older adults.

49. Happy bits: interactive technologies helping young adults with low self-esteem.

50. Healing spaces: feasibility of a multisensory experience for older adults with advanced dementia and their caregivers.

51. How can social robots spark collaboration and engagement among people with intellectual disability?

52. In Helping a Vulnerable Bot, You Help Yourself: Designing a Social Bot as a Care-Receiver to Promote Mental Health and Reduce Stigma.

53. Integrating the Digital and the Traditional to Deliver Therapy for Depression: Lessons from a Pragmatic Study.

54. Lessons from Practice: Designing Tools to Facilitate Individualized Support for Quitting Smoking.

55. Leveraging the social network for treatment of social anxiety: Pilot study of a youth-specific digital intervention with a focus on engagement of young men.

56. ManneqKit Cards: A Kinesthetic Empathic Design Tool Communicating Depression Experiences.

57. Moderated online social therapy for carers of young people recovering from first-episode psychosis: study protocol for a randomised controlled trial.

58. Moderated Online Social Therapy: A Model for Reducing Stress in Carers of Young People Diagnosed with Mental Health Disorders.

59. Moderated Online Social Therapy: Viewpoint on the Ethics and Design Principles of a Web-Based Therapy System.

60. MUBS: A Personalized Recommender System for Behavioral Activation in Mental Health.

61. Opening up the Design Space of Neurofeedback Brain–Computer Interfaces for Children.

62. Participatory Design of Technologies to Support Recovery from Substance Use Disorders.

63. Personalizing Mental Health: A Feasibility Study of a Mobile Behavioral Activation Tool for Depressed Patients.

64. Plant-based Games for Anxiety Reduction.

65. Playful Multimodal Training for Persons with Dementia with Executive Function based Decision Support.

66. Pocket Skills: A Conversational Mobile Web App To Support Dialectical Behavioral Therapy.

67. Printer Pals: Experience-Centered Design to Support Agency for People with Dementia.

68. Promoting Personal Recovery in People with Persisting Psychotic Disorders: Development and Pilot Study of a Novel Digital Intervention.

69. Recommending Activities for Mental Health and Well-being: Insights from Two User Studies.

70. SCAARF: a subtle conditioning approach for anxiety relief facilitation.

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78. Supporting Self-Injury Recovery: The Potential for Virtual Reality Intervention.

79. Technological solution for the identification and reduction of stress level using wearables.

80. Think+ Using Virtual Reality Therapy Game Mobile Application for Treating Phobia.

81. Towards a mobile and wearable system for predicting panic attacks.

82. Two examples of online eHealth platforms for supporting people living with cognitive impairments and their caregivers.

83. Unified Health Gamification can significantly improve well-being in corporate environments.

84. Use of virtual reality games in people with depression and anxiety.

85. Users requirements in the design of a virtual agent for patients with dementia and their caregivers.

86. Using a Serious Game to Reduce Stress and Anxiety in Children with Autism Spectrum Disorder.

87. Virtual Reality-Based Musical Therapy for Mental Health Management.