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Departamento de Educação e Psicologia

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Psicologia da Saúde e Reabilitação Neuropsicológica, realizada sob a orientação científica da Doutora Sandra Cristina de Oliveira Soares, Professora Auxiliar do Departamento de Educação e Psicologia da Universidade de Aveiro e sob a coorientação do Doutor Samuel de Sousa Silva, Investigador do Instituto de Engenharia Eletrónica e Informática de Aveiro da Universidade de Aveiro.

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palavras-chave   ansiedade, stress, newcomers, qualidade de vida, m-health, universidade

resumo   Os problemas de saúde mental têm um impacto significativo na qualidade de vida. A prevalência epidemiológica de ansiedade entre estudantes universitários dificulta o tratamento por parte dos centros de saúde universitários. Portanto, subsiste a necessidade de explorar novas formas de prevenção, evitando assim a necessidade de recorrer a terapias. As tecnologias móveis de saúde (m-health) surgem como uma forma acessível e ubíqua de oferecer terapias psicológicas que apoiam os utilizadores na gestão das suas dificuldades e problemáticas relacionadas com a saúde, neste caso mental. No entanto, muitas das ferramentas disponíveis não fornecem suporte baseado na evidência relativamente à adequação e eficácia das técnicas utilizadas. Além disso, a maioria das ferramentas é projetada sem considerar as necessidades e as motivações dos usuários, resultando numa baixa adesão ou falta de motivação para o uso sistemático dessas mesmas ferramentas, comprometendo a eficácia das técnicas que utiliza. Tendo em vista a necessidade de considerar as motivações dos utilizadores-alvo, este estudo expõe os esforços de uma equipa multidisciplinar no desenvolvimento e no design de uma ferramenta para apoiar a gestão da ansiedade no campus académico, recorrendo a uma abordagem centrada no utilizador. Neste sentido, este trabalho apresenta a descrição da população-alvo, neste caso newcomers, a fim de desenvolver um sistema capaz de auxiliar estes alunos, de primeiro ano, nas dificuldades sentidas ao nível da gestão da ansiedade e do stress advindos dos vários contexto académicos.

keywords

abstract

Mental health problems have a significant impact on quality of life. The epidemiological prevalence of anxiety among college students hinders accurate treatment among universities health centers. Therefore, it subsists a need to explore new preventive ways, avoiding, the engagement in therapies. Mobile health (m-health) technologies emerge as an accessible and ubiquitous way to deliver psychological therapies that support users in the management of health-related problems, in this case mental health problems. However, many of the available tools do not provide evidence-based support of the adequateness and effectiveness of techniques used. Moreover, most tools are designed without considering the users' needs and motivations, resulting in poor adherence or lack of motivation for systematic use of these tools, hindering the efficacy of the techniques it uses. Bearing in mind the need to consider the motivations of the target users, this study exposes the efforts of a multidisciplinary team in developing and designing a tool to support anxiety management in the academic campus resorting to a user-centered approach. In this sense, this paper presents the description of the target population, in this case newcomers, in order to develop a system capable of assisting these first-year students in the difficulties experienced in the management of anxiety and stress arising from the various academic contexts.

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Introduction

University years present an important milestone in the academic career of each student. During their development, young adults are challenged with several factors that impact their mental health and well-being, making them susceptible to the development of mental health problems. If not addressed correctly, these young adults are at increased risk of developing psychological disorders when they reach adulthood (Abela & Hankin, 2008; Avenevoli, Swendsen, He, Burstein, & Merikangas, 2015). Considering these facts, alongside with quality of life, mental health needs to be addressed based on comprehensive models of subjective and multimodal health that include physical, psychological, mental, social and functional well-being (Gaspar et al., 2019). Considering these facts, anxiety emerges as an emotional condition considered normative, with adaptive value, inherent to the person´s state of alert, allowing him to manage abilities and strategies to face, or to avoid unpleasant situations (American Psychiatric Association [APA], 2013). According to the literature, anxiety arises from an adaptative response to a threatening stimulus comprising distinct symptoms dimensions that can be divided into somatic, cognitive and behavioral dimensions of anxiety (Clark & Watson, 1991; Himadi, Boice, & Barlow, 1985; Koksal, Power, & Sharp, 1991; Ree, French, MacLeod, & Locke, 2008). The somatic dimension incorporates hyperventilation, sweating, tachycardia, trembling, muscle tension/stiffness and palpitations, also known as self-reported symptoms. The cognitive dimension, on the other hand, is linked to thought processes, leading the individual to experience worry, intrusive thoughts and lack of concentration. Meanwhile, the behavior dimension is associated with the actions that individuals perform in order to avoid or to reduce their state of anxiety (Clark & Watson, 1991; Endler & Kocovski, 2001; Ree, French, MacLeod, & Locke, 2008; Kaplan & Sadock 1998 cited by Keeley & Storch, 2009). Nevertheless, as above mentioned, this condition may present itself as pathological, if inappropriate, excessive or poorly adaptive, making it a mental health problem (American Psychiatric Association, 2000). Bearing in mind the types of anxiety disorders, one that stands out among young adults is social anxiety or social phobia, a condition that predisposes the individual to avoid situations, as well as interactions that involve social contact, due to fear, or anxiety of being evaluated and observed (APA, 2013).

Addressing these issues in other strands is upmost relevant due to the high psychosocial costs inherent to their treatments and the constraints that may arise from conventional therapies, not only for students but also for their universities (Reiss et al., 2019). Nevertheless, conventional treatments, namely psychopharmacology, psychotherapy and a combination of both, still play an important role in tackling these issues (Reiss et al., 2019). One of the most reliable psychotherapies applied in the treatment of

anxiety disorders is Cognitive-Behavioral Therapy (CBT). In this sense, among all techniques inherent to CBT, namely mindfulness, progressive muscle relaxation, diaphragmatic breathing, among others, the ones that focus on breathing control are arguably the most efficient when it comes to reducing high levels of stress and anxiety (Everly & Lating, 2013).

Nowadays there is a growing concern regarding evidence that point out that university students are more vulnerable to develop mental health problems, particularly anxiety, point to the fact that studies show alarming risks of this problematic, namely showing a prevalence of approximately 75% of students with moderate risk and 9% with elevated risk of developing an anxiety disorder (Ameida & Soares, 2004; Bayram & Bilgel, 2008; Luz, Castro, Couto, Santos, & Pereira, 2009; Tavolacci et al., 2013; Vaez & Laflamme, 2008). In 2016, Portugal had 6.06% of patients with anxiety disorders (Programa Nacional para a Saúde Mental, 2017), a percentage above the world average, with registrations of around 3.6% (World Health Organization, 2017). The academic context exposes a set of factors auspicious at the development of mental health problems, being that, nowadays, it is noticeable an alarming percentage of young adults susceptible to this problematic, worldwide (Bayram & Bilgel, 2008; Luz et al., 2009; Tavolacci et al., 2013). It is worth mentioning that, Luz et al, (2009) found out, from a sample of 660 Portuguese students, of several courses and years of the University of Aveiro, that a percentage of 26,2% of this students showed high levels of anxiety and stress, particularly first-year students (newcomers), which were the ones that evidenced increased risk, when compared with their peers of the following years.

The first contact with academic education represents a particular source of anxiety and stress, especially for newcomers, once the first contact with the academic life brings about new challenges and difficulties that test this students' capabilities through this new stage of their lives. In this way, the academic environment exposes a set of factors that increase the prevalence of mental health problems among the university students, mainly newcomers, when compared with the population in general (Cooke, Bewick, Barkham, Bradley, & Audin, 2007; Patel, Clarke, Eltareb, Macciomei, & Wickham, 2016). This disparity can be explained given the presence of high rates of anxiety when students experience or face moments of evaluation, social anxiety, greater autonomy, reduced self-confidence, socioeconomic complexities and also when facing peer and group pressure, difficulties with time management, indecision regarding career choices, changes in sleeping and eating habits, distress related to distance from home, among others (Gaspar et al., 2019; Stewart-Brown et al., 2000). For instance, students that deal with social phobia have higher prevalence of dropping out from school and experience lower levels of well-being, work productivity, social economic status and quality of life (APA, 2013). It must be borne in mind that newcomers sphere also include students from foreign countries who sought

to choose another country to pursue their academic careers, which, in addition to the above-mentioned factors, also face difficulties related with the traveling to an unknown country with different languages, cultures, economic disparities, lack of support from friends and family among other problems and difficulties (Green, 2008; Patel et al., 2016).

Technological evolution accustomed the human being to the familiar presence of mobile devices on a daily basis, such as smartphones and tablets, allowing a greater openness regarding the emergence of assistive systems (Cooper, Reimann, & Cronin, 2007; Silva, Felgueiras, & Oliveira, 2018). Thus, when considering the transmission of health knowledge using technological devices, we are confronted with the concept of mobile health (m-health), which has gained ground in the treatment and management of general health problems (Bakker, Kazantzis, Rickwood, & Rickard, 2016; Neary & Schueller, 2018). Access to treatments for pathological anxiety, which subsists as one of the most prevailing causes of disability, is limited to the access of most individuals (Zetsche & Margraf, 2007, cited by Sucala et al., 2017). Moreover, waiting lists to get a psychology consultation, in universities health centers are long, reaching up to three-month waiting time (Reiss et al., 2019). Therefore, the use of m-health applications proves to be essential as a preventive solution avoiding the development of pathologies which in turn liberates universities psychology consultation services. The individual thus benefits from the availability of exercises, as well as guided and self-help techniques, information on mental health care, and the possibility of change in real-time and asynchronous with a mental health specialists (Sucala et al., 2017). In this sense, we aim to approach and contact potential end-users, in the various moments of data gathering, throughout the product development (Bazzano, Martin, Hicks, Faughnan, & Murphy, 2017; Chammas, Quaresma, & Mont'Alvão, 2015).

Considering the systematic review elaborated by Sucala and collaborators, we have a better ease to access mental health care due to a wide range of applications aimed at reducing anxiety symptomatology (Sucala et al., 2017). However, these applications have serious shortcomings that undermine their effectiveness, particularly the lack of validation, the lack of information regarding their effectiveness and the interventions they use, the lack of user involvement in establishing the requirements (Neary & Schueller, 2018), the lack of adherence and user engagement (Morgan et al., 2017), as well as the absence of empirical evidence on techniques, interventions, and content, as well as long term assessment (Cooper et al., 2007; Sarkar et al., 2016). In this sense, the evaluation of these tools presents a crucial step in the development of these applications, bringing forth several challenges. Baring this in mind, laboratory preliminary evaluations are essential to avoid the complexity of the ecological scenarios (Cooper et al., 2007). As such, several authors came up with ways to replicate the real world in controlled laboratory settings allowing the management of uncontrollable real context variables (Allen et al., 2017;

Kirschbaum, Pirke, & Hellhammer, 1993). One example of these protocols was adapted and described in this study.

To develop a product that satisfies the various users, it is essential to develop a product based on human specificity, considering its specific needs, since, when considering the individuals as a whole, it gives rise to a cluster of general functionalities, an increase of the cognitive load, navigation by all the possible users, as well as the disregarding of each person likings (Cooper et al., 2007). Thus, to develop an effective approach, it is essential to be aware of the target audience for which the product is intended, based on the selection of those individuals whose needs are better suited by the product. Besides, it is essential to prioritize the needs and objectives of these potential users, avoiding compromising the potential of the product in meeting the needs of possible secondary users, who may also benefit from the use of the product (Cooper et al., 2007). To face the challenge of best tailoring the needs and motivations of potential users when confronted with situations and contexts that trigger anxiety symptoms, as well as the lack of adherence to m-health applications, given the incompatibility to fulfill the user´s needs, its essential to use an iterative user-centered approach (Cooper et al., 2007). When designing a product, personas play a fundamental role, since they contribute to the definition and characterization of target users, from the observation of real people. Personas comprise fictitious characters with a name, age, sex, socioeconomic occupation, interests, life histories and motivations, being employed in the representation of the potential target users, as well as the relations they present with the context and the problem. In addition, personas resemble the final representation of the potential user, fostering empathy with their goals and needs (Cooper et al., 2007). There various types of personas namely primary, secondary, supplemented, costumer, served and negative, however, due to the nature of this work, only the primary and served persona will be used and described (Cooper et al., 2007). The primary persona is the main target to which the product is developed to, being the one that directly benefits from it. On the other hand, served personas do not use the product, although, they are impacted by the product usage (Cooper et al., 2007). In addition, the information used to describe personas is obtained by the implementation of ethnographic interviews as well as the observation of the context of the potential product user. This information can be complemented using literature, subject matter experts, as well as previous studies (Cooper et al., 2007). By narrating a persona using simple and universal language it enables the various professionals to better understand each other allowing user centered focus throughout the development process. In addition of being a communication facilitator, personas also offer benefits in terms of promoting consensus and commitment among different professionals, determining the behavior and function of the product, as well as contributing to the development of future related products at the level plan, sales, and marketing (Cooper et al., 2007; Queirós et al., 2013).

Context scenarios are usually associated with personas, as they describe how the proposed system assists end-users with the problems they face. These typically describes a specific context and period, aiming at exposing the increase in the performance of the end-users towards the fulfillment of their motivations resorting to the use of the product (Cooper et al., 2007). Context scenarios also need to be narrated using a simple language, avoiding technical details, to provide a universal understanding by the different professionals involved. These scenarios must be elaborated in conjunction with usability experts, under permanent contact with potential users and creators of the product. Furthermore, they need to comprise the technological requirements, essential to the performance of the product, situations that impact the personas, the surrounding contexts, the functional requirements, which the product should be able to perform, as well as the interaction requirements (Cooper et al., 2007).
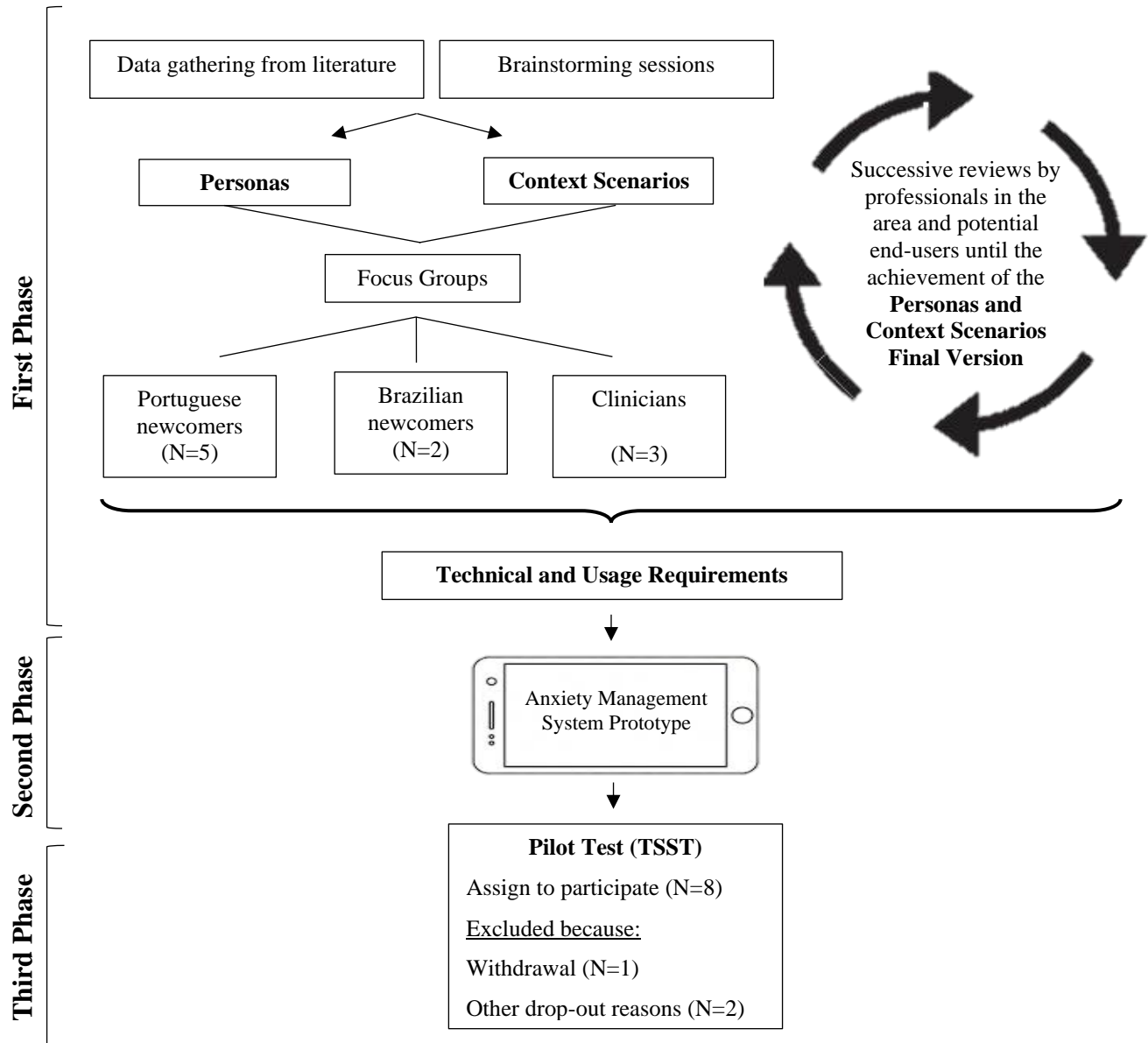
Based on the theoretical review, this paper aims to expose the work done in designing and developing an innovative strategy to assist the academic community in the management of the various body signs resulting from anxiety symptomatology, using a smartphone platform system focused at reducing symptoms, preventing pathology and promoting a healthy living. This work intends to characterize and define the potential users of the anxiety management system (AMS), considering their characteristics, needs, motivations, expectations, and behaviors, especially in newcomers and college health center clinicians. Besides, we intend to specify the context scenarios in detail, define the usage requirements and propose techniques suitable to this population, relying on psychologists expertise and knowledge. Finally, we delineated a prototype of the AMS and elaborated a protocol capable of testing the efficacy and efficiency of the tools it uses.

Materials and Methods

This study was approved by the Ethics Committee of University of Aveiro, Portugal and the guidelines of the Declaration of Helsinki. Moreover, we followed the standards of the American Psychological Association. Participation as subjects in the experiment was based on written informed consent including the right to abort participation at any time. Participants did not benefit from any sort of reward as a motivation to participate in this study.

To better understand the work done, this study was structured in three phases (graphic 1). In the first phase, we resorted to the information gathered from the literature and focus groups to elaborate personas and context scenarios, essential to the extraction of technical and usage requirements. These requirements played an imperative role in the development of the AMS prototype. Meanwhile, following the development of the AMS prototype, we devised a protocol where we induced stress responses while

trying to understand if one of the AMS relaxation techniques was successful in lowering the stress and anxiety exhibited by the potential end-users.

Figure 1: Flow of the study, representing all three stages of work.

Participants

In a first stage, with the purpose of selecting a sample of newcomers and clinicians, we have resorted to a non-probability convenience sampling method (Fortin, 1999). It is worth mentioning that our sample comprises clinicians as they are influenced by the AMS, making them served personas. In

this sense, our sample was composed of newcomer students, from both sexes, of different scientific areas and departments of University of Aveiro, aging over 18 years old as well as clinicians from the Aveiro University health center. For this matter, when gathering information to develop the personas and the context scenarios, we hold three focus groups with 10 potential end-users, being five Portuguese newcomers (M=19.8, SD=1.30), two Brazilian newcomers (M=28, SD=4.24) and three clinicians, (M=26.33, SD=2.51). In every focus group held we had four psychologists and two informatic engineers, which, accordingly to Lynn (1986), is the ideal number, between five and 10 specialists, that an appropriate panel should include. Regarding the participants, a minimum of six potential users is required to perform a focus group (Lynn, 1986).

In a third stage, after the development of the prototype version of the AMS, we devised a protocol to evaluate the efficacy of one of the anxiety reduction techniques. For this purpose, we recruited potential newcomers' end-users, mainly Portuguese and Brazilian first-year students, from various degrees of the University of Aveiro. In this study, two female students and three male students from the University of Aveiro took part, with ages ranging from 18 to 21 years (M=19.20, SD=1.304).

Equipment and Materials

In the first phase, to formalize the participants voluntary involvement in the focus groups, we provided an informed consent to all participants (annex A). During the third phase, two informed consents were provided comprising a brief written explanation about the aim of the study, the procedure, the duration, the confidentiality, the possibility of dropout as well as the possible associated risks. It is worth noting that the first informed consent (annex B) did not provide the real aim of the present study for the purpose of not compromising the data gathering. Instead, it had a convincing cover story previously elaborated to gather potential participants. This cover story was planned to recruit first-year students to take part in a study to ascertain the difficulties of public communication in the academic community, in order to understand, on the one hand, the main difficulties encountered in the presentations, and, on the other hand, to assist in the development of useful tools that improve students' speaking skills. Identical to the first one, the second informed consent (annex B) displayed the real reason of the study, plus the requisition to use the data gathered for research proposes.

Aiming at conducting the procedure to evaluate the AMS prototype efficacy, we applied several instruments and tools, namely a sociodemographic questionnaire, the State -Trait Inventory for Cognitive and Somatic Anxiety (STICSA), as well as the Vital Jacket and Vitals Recorder System.

The sociodemographic questionnaire (annex C) was developed in order to gather information from each participant, concerning the variables identified as relevant to the study, such as sex, occupation, frequency of use of technologies, the year that the participant attends in college, among others.

The decision to use STICSA was based on the need to verify the state anxiety levels in two separate moments, namely at the beginning of the developed procedure and at the end. Additionally, we measured the trait anxiety to future compare the individual predisposition to experience anxiety with the momentary anxiety felt during the procedure implementation. Being an anxiety assessment instrument, STICSA (annex E) asses state and trait anxiety, however it also considers the somatic and cognitive dimensions of anxiety (Mendes, Barros, Figueiredo, & Soares, 2018; Ree et al., 2008). STICSA is a 42-item instrument divided into two scales, STICSA-state and STICSA-trait (Ree et al., 2008). These two scales evaluate the two dimensions of anxiety, the cognitive (10 items) and somatic (10 items), in which participants must answer between 1 "Nothing" and 4 "Much". STICSA was developed by Melissa J. Ree, Davina French, Colin MacLeod and Vance Locke in 2000 and validated by Mendes, Barros, Figueiredo and Soares, to the Portuguese population, in 2018. Considering the SITCSA developing studies, Ree and Colleagues (2000) where able to examine the factorial structure of both STICSA-trait and stait scales, resorting to an exploratory and confirmatory factor analysis in a sample of college students (Ree et al., 2008). In this sense a confirmatory factor analysis goodness-of-fit indices was used, ranging from adequate-to-excellent, based on established standards in the area (Hu & Bentler, 1999), confirming the existence of two subscales, namely the cognitive and somatic subscale (Grös, Antony, Simms, & McCabe, 2007). Moreover, all items of the scale performed strongly on the predicted factors, being the factor intercorrelation of .73 for the state and .66 for the trait scales of the STICSA. Additionally, this instrument demonstrated excellent internal consistency (αs > .90). The STICSA-State was found to be sensible in measuring state anxiety, once, compared with baseline scores, it reported higher scores during periods of increased stress. As opposed, the STICSA-Trait did not report changes throughout the same stress manipulations. As it stands, these initial findings ensured the validity and reliability of the STICSA (Grös et al., 2007). For this reason, STICSA can be used as a measure of cognitive and somatic aspects of anxiety (Grös et al., 2007).

Not only focused on obtaining subjective data, we also considered the gathering of more feasible and reliable objective data. For this purpose, we relied on the combined use of the Vital Jacket (VJ) and Vitals Recorder System (VR) to measure the participants' electrophysiology, particularly their hearth rate.

The VJ is a vital sign monitoring system design and developed as a wearable practical approach in several clinical contexts (Cunha et al., 2010). This system was developed under the need to gather continuous or frequent high-quality vital signs from its wearer. The VJ was developed in the University of Aveiro and has been licensed by Biodevices S.A., a small biomedical engineering spin-off company pioneers on the development of wearable cardiology platforms and high-performance sports (Cunha et al., 2010). This system is certificated according with the standards ISO 9001 and ISO 13485 and approved as a medical "Ambulatory ECG Device" in accordance with the MDD directive 42/93/CE, responsible for the regulation of medical devices in Europe. Depending on the needs of the user, the wearable system can be configured to acquire various vital signs, namely ECG, breathing, body temperature, posture, oxygen saturation, among others (Cunha et al., 2010). However, we only relied on the gathering of ECG data. The system we used had three ECG leads connect to a box that recorded the information, in real time, which in turn was connected to the VR that displayed the information on a cell phone.

The VR is a data gathering system composed by three main components, an app that controls the data gathering (Vitals Recorder Remote), an app that posts as a client to that controller (Vitals Recorder Unit), which connects to the sensors or uses his own mobile sensors and even an web app responsible for the data export (Basto, 2018).

Procedure and Task

First Phase: Characterization of the personas, context scenarios and requirements

In the first phase, our main goal was to obtain the requirements essential to the development of the AMS prototype. For this reason, we decided to adopt the methodology proposed by Cooper et al., (2007), which brings together several stages. The first stage incorporates the formulation of the personas and context scenarios. We first resorted to the research and gathering of data resorting to the reading and the understanding of previous studies, with support and empirical basis. Also, brainstorming sessions, involving multidisciplinary teams, were carried out to acquire the main characteristics of the target users, as well as the etiology of the problem, namely the anxiety in the university context involving the newcomers students. The results obtained from these two sources guided the creation of the first version of the personas and the context scenarios. Personas play a vital role considering that they are used in the portrayal of end-users alongside with their relationship with the problem and the context, presenting a set of characteristics that assigns them a human character (Silva et al., 2018). It is worth mentioning that personas are categorized into primary, secondary, as well as served. On the other hand, context scenarios

present a vision of the system's functionalities, followed by the way the system will perform them (Cooper et al., 2007). By the end of this first stage, a brief etiology of the problem was established, providing a basis for the formation of the following steps.

        With these first versions drawn up, we needed a way to corroborate this information with the real context. For this reason, we held sessions with potential end-users together with experts in the area to gather ideas through open discussion of key topics, concerning the issue in question, the users, and, also, their former experiences with assistive technologies. Considering the diversity of available methods for data collection, with the purpose of later complete the previous version of personas and context scenarios, we have privileged the use of focus groups. In this regard, three focus groups were organized, aiming to approach and contact the possible end-users, providing data gathering, and maintaining a constant contact throughout the product development (Bazzano et al., 2017; Chammas et al., 2015). It should be noted that the focus groups followed an iterative user-centered approach, since it encompassed some methods, to maintain focus on the needs and motivations of end-users, comprising four phases: specifying the context of use, requirements, design, and development, as well as evaluation (Gulliksen, Lantz, & Boivie, 1999). The implementation of the focus group followed a set of principles, as well as the active participation of a multidisciplinary team, aimed at obtaining the needs and motivations of the end-users, considering the view of the various professionals in the areas involved (Gulliksen et al., 1999). Based on the information gathered, from the perspective of each professional, it was discussed the results among a multidisciplinary team aiming at obtaining the guiding principles. These principles served as a basis for the complement of the personas, as well as the elaboration of context scenarios. Subsequently, the general and specific requirements essential for the achievement of the final product were extracted. It is important to mention that in each stage of the personas and the scenarios formulation, we took the time to delivered them to professionals from various areas, including the area of psychology and engineering (Cooper et al., 2007; Gulliksen et al., 1999). This method was imperative to verify if the language used followed the standards of simplicity and universality, central to the broad population understanding. In this way, the user's involvement in the feedback is ensured when executing the different sections of the AMS. In this stage it is worth mentioning the importance of the psychologist role, among the multidisciplinary team, as they have the ability to better expose and characterize the knowledge towards the definition of our target population, contexts and the techniques that best suit the needs and motivations of the potential end-users, improving the understanding of all major key topics inherent to the psychology field.

Second Phase: AMS prototype development

Considering the subset of requirements previously determined, the technological engineering professionals developed a functional prototype of the system, aimed at fulfilling the potential end-users needs and specificities. In this sense, the engineering team attempted to develop a system following the same iterative methodology as they contacted with potential end-users throughout the several phases of the AMS prototype development. These contacts contemplated usability tests as they tried to improve usability by identifying potential drawbacks and flaws, as well as to align the tools with the needs of the target users. After these iterations, they accomplished a prototype version of the AMS that displayed a subset of empirically validated relaxation techniques aimed at reducing stress and anxiety levels.

Third Phase: AMS prototype evaluation

After the development of the AMS, we acknowledged the fact that we needed a way to robustly induce acute stress responses, under an experimentally controlled condition. Additionally, as mentioned previously, it is essential to evaluate m-health tools resorting to empirical supported validated instruments, avoiding, in the best way possible, the difficulties and challenges inherent to the real context evaluation. For this reason, we considered the Trier Social Stress Test (TSST), developed as an ecologically valid stressor, able to induce psychological and physiological stress responses through public speaking (Kirschbaum et al., 1993). Within this framework, this stressor has two variables, as it combines a social evaluation paired with the unpredictability of delivering a speech in front of an unresponsive board of judges. Additionally, participants are surprised with a mental arithmetic test. Kirschbaum, Pirke, & Hellhammer (1993) developed the TSST under the need of having a task capable of inducing consistent responses over the humans hypothalamic-pituitary-adrenal (HPA) axis. Activation of the HPA axis comprises the center of neuroendocrine responses to stress and many physical and mental health disorders may emerge if humans experience certain dysfunctions over this axis. In this sense, accordingly with Dickerson & Kemeny (2004), the threat of being socially evaluated plus the sense of control lost are the main psychological elements capable of producing the best HPA axis response.

The TSST main procedural stages incorporate each of these essential elements. Within the standard TSST protocol, participants play part in a role-playing scenario, convicted that they are applying for a particular job. After a brief preparation period, participants are required to expose the reasons why they consider being the best applicant for the position, having to do it in front of a committee of judges. Following the speech task, participants are required to complete a surprise arithmetic task (Allen,

Kennedy, Cryan, Dinan, & Clarke, 2014). In this sense, the performance of each task, while under an evaluation context in tandem with the knowledge that their performances are being videoed and voiced recorded (for further analysis purposes) and evaluated by a panel of behavior analysis professionals, trained at withholding any social involvement and positive feedback, enhances the element of social-evaluation threat (Allen et al., 2017; Kirschbaum et al., 1993). Nevertheless, the TSST incorporates some uncontrollable elements throughout the protocol, namely the participants lack of knowledge about the tasks, only having information three to 10 minutes before the task starts, the short period provided to prepare to and for the task, the unexpected arithmetic component and the judges lack of communication and social involvement (Allen et al., 2017).

Baring this in mind, the developed protocol (annex F) followed the same footsteps once it aimed to test the effectiveness of one of the AMS prototype relaxation techniques, by inducing an acute stress response in participants. We approached participants via email where they were given little information about what we expected them to do. The email sent described that the intended study aimed to ascertain the difficulties in public communication in the academic community, in order to understand, on one hand, the main difficulties encountered in public presentations, and, on the other hand, to assist in the development of useful tools that improve students' speaking skills. We also informed participants about the need to perform a particular task followed by the completion of some brief questionnaires.

Given the versatility regarding the adaptability of this stressor to the various contexts, we have developed a protocol capable of producing a constant identical anxiety response in all individuals. We devised two groups, an experimental group, that benefited from the use of the AMS, and a control group, that did not benefit from the use of the AMS.

The procedure took place in two separate rooms being one for the evaluation stage, where the judges performed their role as adjudicators, and the other aimed at preparing each participant and each devised task. It was explained to each participant that their involvement would be voluntary, and that anonymity and confidentiality of their responses would be guaranteed. For this matter, we used two informed consents, one at the beginning with the cover story explanation, and the other at the end with the real aim of this study.

In this sense, upon the participant's arrival at the study room, they received the first informed consent followed by the placement of three electrodes, in the abdominal region, to register their heart rate throughout the procedure, if they agreed with this condition. After this moment, participants had to complete a STICSA-State questionnaire to acquire data of their present anxiety state, as well as a sociodemographic questionnaire. Hereupon, the conditions were met to begin the TSST implementation. At first, participants received a brief explanation of the study objective. They received five minutes to

prepare a five minutes speech on the main experiences of social interaction, from the moment they became college students until the present time. Participants were provided with writing material but could only use it during the speech preparation stage. Simultaneously, the researcher was absent from the room at the same time.

Following this period, the researcher returned to the room and escorted the participants to a second room where the judges were. While changing rooms, the researcher reminded the participants about the topic of the presentation and that they were required to speak for the whole five minutes. Once they entered the presentation room, they were asked to stand in front of the judges. The judges kept a neutral posture, ruled by the absence of any positive and negative feedback, only being instructed to interact if participants stopped talking before the end of the provided time. However, they could only interact to inform participants that they still had time to keep talking. At the end of the 5-minute speech presentation, the researcher entered the room and escorted the participant back into the previous room.

Back in the first room, they were asked to answer a second STICSA-State questionnaire. Subsequently, to test the AMS efficacy, participants performed the AMS 5-minute diaphragmatic breathing technique. Participants received instructions to get acquainted with the AMS and to read the instructions to perform the given technique while their results would be discussed between the researcher and the judges. In the end, participants answered the STICSA-Stait and Trait questionnaires. The procedure ended with the explanation of the real objective of the proposed tasks, the withdrawal of the previously placed electrodes and the clarification of any participant doubt. To obtain permission to use the data gathered during the procedure, participants signed a final informed consent that acknowledged this request.

Results

First phase: Personas, Context Scenarios and Requirements

Personas

The design and development of the final product were supported by the conception of two personas, with relevance to the characterization of the product context. One of the elaborated personas, Henrique, covered a student from the language field, who exhibited anxious symptomatology when faced with new social contexts and the lack of support of his peers. The second persona developed portrayed a clinician, Margarida, who acted as a served persona. Served personas comprise a set of individuals that do not interact or take little benefit from the developed product as they exhibit distinct motivations and

objectives (Cooper et al., 2004). In this instance, the served persona plays an essential role in the management of the problems faced by the primary persona, Henrique.

Henrique is a 19-year-old first-year student studying Modern Languages at Aveiro University. Henrique lives in Bragança so he ought to stay in an academic residence throw the entire school year. Considering the distance between the two towns, is life took a turn once, many friends whom he used to be with from childhood entered other universities or decided to start working. Henrique always had the support of its peers who helped him throw difficult times, even when he felt more nervous throughout his school years. Currently, the new responsibilities enlisted to Henrique, namely the house management and the organization of a coherent routine according to Henrique´s needs, narrow his time to socially interact with others. Henriques´s main concerns are the unfamiliarity with the new city, where he currently lives, and the lack of support concerning his worries and anxieties, provided by his old peers. This position puts Henrique in a vulnerable and scary state, in which he experiences trouble sleeping at night, contributing to the emergence of persistent negative thoughts, concerning his future. Lately, he started isolating himself making it difficult to create new social bonds.

MOTIVATION: Henrique desires to be helped on finding and meeting other students that share the same situation or that used to have the same status-quo so that, he would be able to better adapt to his new life stage and possibly help others in need of such support.

a   Image retrieved from https://pxhere.com/pt/photo/773318

Figure 2: Primary Persona, a newcomer student who exhibits high levels of stress and anxiety when faced with social events, social interactions or the anticipation of them.

Margarida is a 50-year-old Health and Clinic Psychologist, that performs her duties, for 20 years, in the University Health Center of the University of Aveiro. She takes interest and is very devoted to helping all the academic community. Beyond her working hours, she has other leisure activities, namely, gym, which she practices at least twice a week, strolling with her family and learning about new cultures.

[b] As a psychologist in the university context, she contacts several students and teachers daily, who often exhibit anxiety-related difficulties. One of Margarida's main difficulties is to monitor the progress of all patients to whom she provides her service, due to the high prevalence of this problem in the academic community. Margarida is willing to change the current standard procedure she uses to monitor and to follow her anxiety patients for a technological supported alternative, that may reveal to be more flexible an easy to use.

MOTIVATION: Margarida would like to improve the way she monitors her anxiety patient during her clinical practice.

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[b] Image adapted from https://pxhere.com/pt/photo/266372

Figure 3: Served Persona, a mental health professional who performs her duties on the academic campus health center, as clinical psychologist

Context Scenarios

Context scenarios depict how the proposed system, in this case, the mobile AMS, integrates with the potential end-users' daily activities, providing a vision on how this interaction will help these users on the management of their worries and needs as well as on the achievement of their motivations (Cooper et al., 2007). The information coming from the focus groups contributed to the development of many context scenarios, that were subsequently discussed among a multidisciplinary team. This methodology allowed us to understand, through the professional experience of each intervenient, if the scenarios made sense, as well as if they would reflect the product's capabilities on helping the user, regarding the scope of the motivations and needs displayed. Given the nature of this dissertation, only two scenarios will be presented below, being the others attached in the annex D.

The first context scenario depicted Henriques´s involvement, for the first time, with the AMS alongside with his interaction with some functionalities.

It's the first time Henrique uses his AMS, due to his concern in recognizing some anxiety symptomatology, as a result of upcoming social interactions. As the system gets the knowledge that

Henrique is home, <u>it suggests the completion of a task, namely the 16-muscle group progressive muscular relaxation.</u> Henrique begins the technique however, he starts feeling bored and experiences no differences within the lowering of his anxiety symptomatology, eventually giving up the technique. Subsequently, the system verifies that there were no changes in the anxiety levels, as well as it detects that Henrique did not finish the task. Thus, the AMS asks Henrique about his interest in the proposed technique, offering him an alternative suggestion for reducing his anxiety levels.

We chose this scenario based on the fact that it depicts Henrique's first interaction with AMS when faced with one of his biggest fears, social interaction. Additionally, it shows the AMS ability to suggest a relaxation technique based on the levels of anxiety displayed by Henrique. Another reason behind this choice dwells on the fact that it shows that the system is capable of monitoring Henriques´s activity, being able to detect his forfeit. Moreover, it shows its capabilities to update preferences to ensure that it can, more accurately, suggest further techniques based on Henriques´s interests and needs.

In the second scenario, Henrique encounters one of his insecurities, which centers on his fear of interacting with his new peer group. Henrique performs a relaxation technique, aiming to reduce his anxious symptomatology.

<u>Following one week of interaction with other students,</u> that share the same fears and problems as Henrique, <u>through the AMS,</u> he decides to take the next step of going to the physical space, provided by Aveiro University, to contact these students in person. <u>However, as usual, Henrique starts feeling anxious and he decides to fire up his AMS to perform a mindfulness technique.</u> <u>According to his preferences and interests, the system suggests a mindfulness technique that aims at exploring the body sensations.</u> In this sense, after he positions himself comfortably, the system initially suggests he should direct his attention to the way he executes breathing. Subsequently, the system requests Henrique to change his attentional focus to sensations of other body parts, beginning with the feet and ankles, followed by the legs, spine, abdomen, and chest, arms and hands, neck and shoulders, finishing with the head and face. Five minutes elapsed time, Henrique is requested to redirect his attention again to the way he breathes. <u>At the end of this task, Henrique starts experiencing feelings of tranquility and relaxation which powers is security to deal with new challenges.</u> By the time he enters this physical space to socialize with other students, he displays a confident and smooth image, making it easy to interact socially. This new experience allowed Henrique the deconstruction of some of his beliefs that contributed to the anxiety he used to feel.

The reason behind the highlight of this second scenario is the fact that it depicts the way the AMS provides other methods to meet and engage in interaction with other students through a virtual room, as a way to learn and to teach ways to overcome fears and difficulties related to anxiety and stress. Additionally, it shows the versatility of the system in working with other contexts, namely suggesting Henrique to undergo his fears and interact with other students in person in the real context. Also, it demonstrates how the system provides instructions to make sure Henrique perform the technique correctly.

Technical and usage requirements

With the elaboration of the context scenarios, we were able to gather the initial set of requirements (table 1). In this sense, with the results from the focus groups with the potential end-users and the brainstorming sessions with the multidisciplinary team that developed the system, we were able to discuss the context scenarios and extract the best requirements to incorporate on the AMS prototype. To evaluate the efficacy of the relaxation techniques provided by the system and the initial usability of it, we periodized the requirements to provide a prototype capable of being submitted to evaluation. This first set of requirements was essential to understand the best way to integrate the relaxation techniques in the proposed AMS, being the psychologist role crucial to understand the most effective way to display them to be as close to the results of the techniques performed in the clinical context.

It is worth noting that, after the completion of the evaluations, no changes were performed in the initial set of requirements. Nevertheless, these requirements are susceptible to future modifications based on future brainstorming session conclusions. As it stands, so far, the extracted requirements are the following:

Prot.	Subset of Elicited Requirements
1	1. **Implement relaxation techniques**
	2. **Identify users' emotional states**
	3. **Create safe and highly available user's data models**
2	4. **Allow time scheduling**
	5. **Present users progress statistics**
	6. **Adapt application to the users' context**
	7. **Learn about user references**
3	8. **Allow users to register their thoughts (wav, txt,…)**
	9. **Provide psychoeducation section for learning purposes**
	10. **Provide psychoeducation between patients and clinicians**
	11. **Enable communication between patients and clinicians**
	12. **Enable communication among peers**

Table 1: Requirements considered along the iterative development of the proposed AMS, for each iteration (prototype).

Second phase: AMS Prototype Version Description

With the considered iterative design approach, the engineering team was able to acquire a feasible prototype ready for submission to a preliminary evaluation of the AMS techniques. Furthermore, based on the results gathered from the usability evaluation sessions, the engineering team found out that the develop version provided a pleasant usage experience. Finally, we ended up with a prototype of the idealized AMS, offering a set of tools focused on the relaxation methods.

The proposed AMS prototype was developed under a mobile platform, offering a range of resources focused on the monitoring and lowering of stress and anxiety levels. Additionally, it focuses on the management and creation of coping techniques essential to deal with stress and anxiety. At this stage, the AMS prototype only offers a range of relaxation techniques, namely, progressive muscle relaxation technique of four, seven and 16 muscle groups, mindfulness as well as the diaphragmatic breathing techniques (Fig. 4), all scientifically proved to be effective in the management and reduction of the anxiety and stress levels.
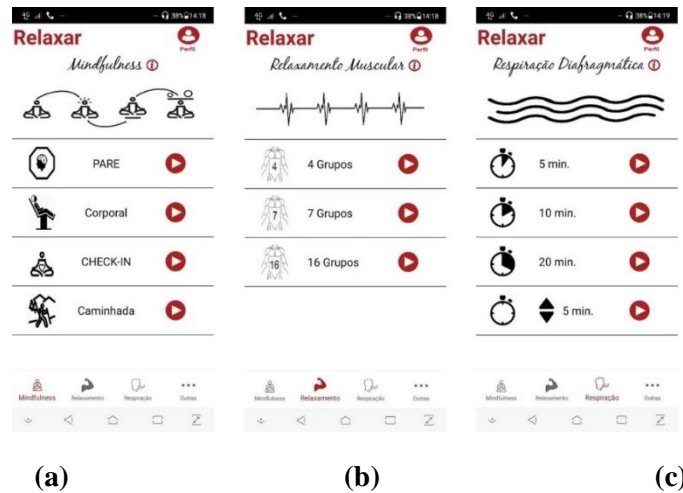
Figure 4: Screens of the AMS prototype: (a) mindfulness technique; (b) muscle relaxation technique;
(c) diaphragmatic breathing technique.

Taking as an example the muscle relaxation technique, figure 5 shows how the AMS displays and provides information to the user on how the technique should be properly performed. Apart from the provided visual instructions information, the user also benefits from audible guide information, such as voice and sounds, for moments where the user wishes to better focus on the given technique not having to divert his attention to the visual information.
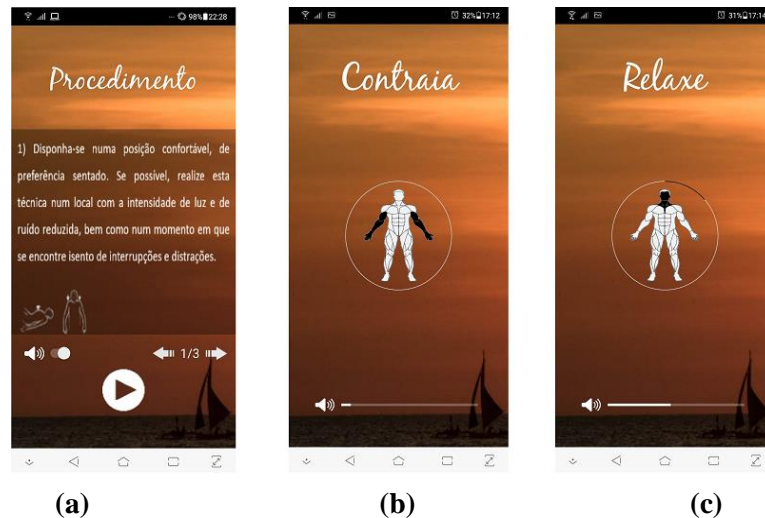

Figure 5: Screens of the AMS prototype muscle relaxation technique: (a) display of the visual instructions (procedure) provided by the AMS; (b) display on the instruction to contract the muscle on both arms; (c) display on the instruction to relax the muscle on both arms.

Due to the little time available to develop the whole functionalities of the system, future iterations will be conducted until reaching the final product. This is essential, as the proposed AMS is intended to provide a wide range of resources displayed through different menus, such as schedule planning, psychoeducation, thoughts diary and a socialization area (chat room).

Third phase: AMS prototype preliminary evaluation (Protocol efficacy evaluation)

Statistical analysis was conducted using SPSS 24. As we wanted to verify the changing in the anxiety and stress levels throughout the procedure, we resorted to the analysis of the state anxiety (cognitive and somatic dimensions) of the STICSA-state. Resorting to chart building, we were able to analyze these levels, in three different stages, namely at baseline, before the beginning of the protocol implementation, at evaluation, throughout the speech delivery, and at the end, during and after the technique implementation.

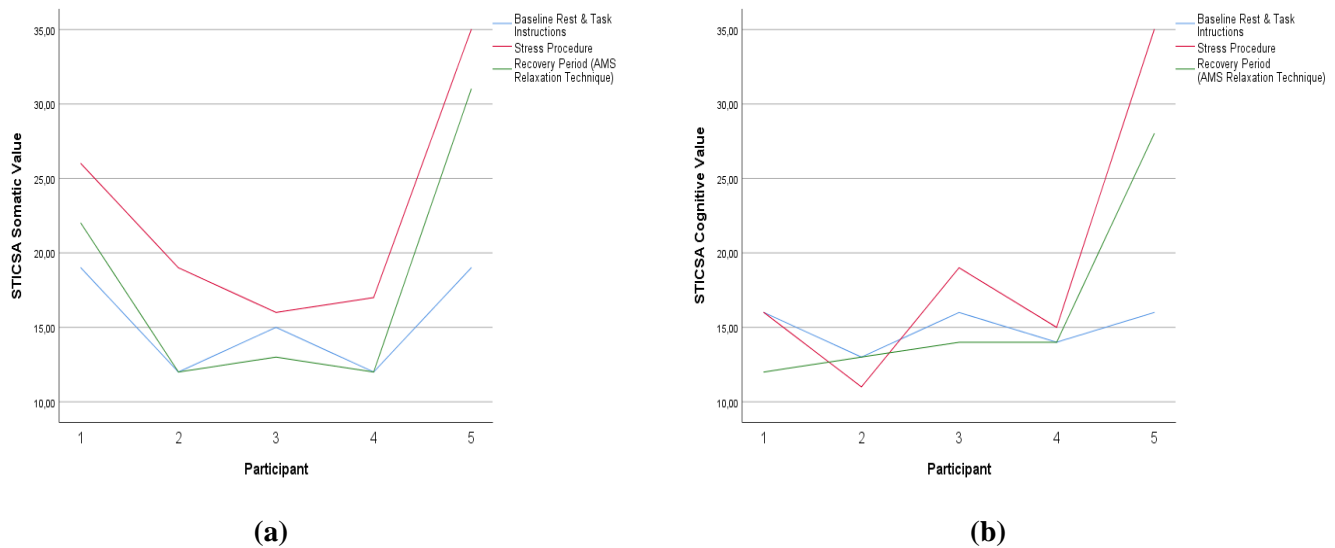**(a)**   **(b)**

Figure 6: Charts representing the levels of anxiety gathered from STICSA, during baseline, evaluation and at the end for every participant; (a) chart of the cognitive values of anxiety of each participant; (b) chart of the somatic values of anxiety of each participant;

Regarding the somatic facet of anxiety, chart a, from figure six, shows an increase in the somatic values of anxiety during the speech delivery stage, in all participants, in comparison with the baseline scores. The same is observed in the cognitive dimension of anxiety, as participants exhibited an increase in the cognitive symptomatology during the evaluation stage (chart b, figure 6). However, it can be

observed that participant number two displayed higher anxiety levels at baseline compared to anxiety levels during his presentation, showing a different outcome when it comes to the procedure efficacy in increasing anxiety levels.

In this sense, we observed a majority increase in the newcomer's anxiety and stress levels when faced with a situation of social evaluation. Therefore, the developed protocol revealed itself as being effective in recreating a laboratory setting similar to the real context. Given that, we were able to meet the ideal conditions capable of verifying the efficacy of AMS techniques in reducing the levels of stress and anxiety.

Discussion

Considering that the main objective of this study was to develop a system capable of managing and reducing stress and anxiety levels, mainly in newcomers, we resorted to a user-centered iterative methodology. Additionally, we followed a transactional technological approach as we relied on the characterization of potential end-users, by the development of personas and context scenarios. By working among a multidisciplinary team, we benefited from multiple visions and knowledge from every expert in the area (Silva & Teixeira, 2019). Regarding the psychologist role, we attempted to use our expertise and jargon to produce and adapt our knowledge to a tool capable of replicating, in the best way possible, the results in a similar way as done in a clinical and controlled context. By using this approach, we were able to better understand the needs and motivations of the potential end-users and to extract the best technical and usage requirements.

According to Cooper and collegues (2004), the development of personas requires the use of data gathered from the observation of the real context of the potential end-users plus the information coming from ethnographic interviews. This information must be complemented using information consulted in validated scientific literature (Cooper et al., 2007). However, due to the short time available, we firstly resorted to the data gathering in the literature and brainstorming sessions, with experts in the area, hence achieving a first version of the personas. This first version was later validated and complemented using the information gathered from the contact with potential end-users, namely newcomers and university health center clinicians, in focus groups. Considering all the information gathered, we ended up with a validated final version of two personas, Henrique, the primary persona, and Margarida, the served persona. Despite the fact that this study explores the needs and motivations of Portuguese and foreign (Brazilian) newcomers, only one persona was conceptualized given the fact that the needs and motivations of both newcomers are identical, considering the different experiences and backgrounds.

However, in future studies, it would be relevant to explore these differences and to understand in more detailed way how both different nationalities newcomers deal with their first integration experiences during their first year of college, in order to achieve a more representative and close to the reality group. This would give rise to set of studies exploring this matter, contributing to the lack of information in the literature concerning this specific topic. Both personas succeeded in exhibiting, in the best way possible, the needs and motivations of the target population.

Regarding the context scenarios, we tried to depict how the personas could achieve their needs and motivations by using the proposed AMS. These scenarios led the way to the extraction of the technical and usage requirements (Cooper et al., 2007). Similarly to the development of the personas, we held brainstorming sessions with professionals in the area to validate the final version of these scenarios. However, future focus groups are required to verify if the newcomer's daily life needs and motivations remain in frame. It is worth mentioning that both personas and scenarios were consecutively read and evaluated by different individuals of the public they represented to verify if they met the population characteristics as well as their daily challenges and difficulties (Silva & Teixeira, 2019).

All things considered, we were able to extract the technical and usage requirements essential to the development of the AMS. Until now, all the extracted requirements did not suffer any changes however, considering the implemented iterative methodology, future iterations will be required to achieve the requirements that best suit the needs and motivations of the potential end-users. After the AMS development, the engineering team conducted a series of usage evaluations to verify if the system was meeting the needs and motivations of the target-users. These evaluations were conducted until the reaching of the prototype version of the AMS that was submitted to a preliminary evaluation of the efficacy of its relaxation techniques.

One of the problems that are described for most m-health approaches to anxiety management, and even for other domains, is the tremendous lack of reviews of their actual impact (Sucala et al., 2017). For this reason, measurement of the impact of the provided techniques should, therefore, be done "in the wild" in the real contexts where anxiety arises. However, going into a more ecological context also hinders the evaluation process because it is required a more sophisticated technical infrastructure to support evaluation (Borycki et al., 2013). Moreover, the ecological context opens the scene to many other variables that we cannot control or measure, and we do not know how they will influence the impact of the proposed technique efficacy (Borycki et al., 2013). In this sense, the goal of the third phase was to do a pilot study where we proposed and tested a way to do a more controlled initial evaluation of the AMS prototype techniques. To put it differently, we aimed at introducing a new protocol to induce anxiety and stress responses in newcomers students, based on the TSST, to evaluate and validate the

efficacy of the developed m-health supported techniques, under a controlled laboratory setting. This led the way to establish a set of guidelines (Sucala et al., 2017) to address not only what works, but what needs to be improved within the developed protocol (e.g. is the proposed protocol effective on increasing the anxiety and stress levels experienced by participants?).

Through the instrumentality of the TSST protocol, we realize that it is a versatile and complete tool capable of inducing anxiety and stress levels through social exposure and surprise tasks (Allen et al., 2017). One of the great advantages of this protocol is its ability to adapt to the various contexts and its sensitivity in changing parameters based on the researcher's needs (Allen et al., 2017). In this sense, as psychologists, we tried to develop, based on our expertise, a protocol where we could incorporate measures for assessing the participants' momentary state of anxiety, along with the individual's predisposition to manifest anxious symptomatology (trait anxiety). Considering this, STICSA proved to be a simple, easy and reliable measure of anxiety within the nonclinical population (Ree et al., 2008). Based on our objective of testing the efficacy of the proposed protocol, we only analyzed the cognitive and somatic state of anxiety. This choice was based on the fact that we wanted to observe the changes throughout the procedure in the three delineated moments (at baseline, during the stress procedure and at the recovery period). Furthermore, state cognitive and somatic dimensions are highly correlated, and authors believe that these dimensions are somehow connected, feeding off one another (Ree et al., 2008). For this reason, in future studies, it is relevant to consider the differences between these two domains of anxiety to understand how they influence and correlate with each other and with the results. The findings obtained in the STICSA-state showed an increase in the levels of somatic and cognitive levels of anxiety, a similar result observed in previous studies that used this protocol as a standard measure of anxiety assessment (Allen et al., 2017). Overall, the majority of participants exhibited an increase in the somatic and cognitive levels of anxiety apart from one individual. This participant exhibited lower levels of anxiety during the speech delivery in comparison with the baseline scores. This could be related to the lower number of participants that took part in the study, which in turn increases de variability of the results making it an outlier score (Sugiyama & Borgwardt, 2013). Another reason could be the simple fact of the protocol was not effective in increasing the levels of anxiety and stress in this particular participant. Considering these results, it would be an added value if future studies could increase the samples of participants, allowing better results and deeper and more complete analysis of these factors.

Apart from the data provided by the STICSA, some authors believe that this subjective information should be paired with the acquisition of data from other sources (e.g. heart rate, breathing) to increase the insight (Allen et al., 2017; Kirschbaum et al., 1993). In this sense, we considered the implementation of a viable objective measure, namely the VJ and VR (Basto, 2018). Throughout the

pilot study, we stated that it was a viable measure to record the participants' electrophysiology, particularly their hearth rate, however it was not possible to obtain and discuss these results. VJ and VR have proven to be two practical and easy-to-use data-gathering instruments, allowing a constant data collection regardless of the movements that the participant needed to perform.

As psychologists, our main role was to translate the practices we use in the psychology context, adapting them to a more practical way, in this case, the developed AMS. Considering all this, we acknowledge that we achieved our objective as we manage to bring the anxiety management knowledge that we use and deal daily, to a preventive and practical tool accessible to all individuals in a more practical and coherent way. This work revealed itself challenging because we had to shape our way of thinking and dealing with the problems of the new acting context, namely the technological field.

Difficulties, limitations and future suggestions

Regarding the limitations of the present study, it should be emphasized the lack of literature concerning newcomer students from foreign countries that sought to choose Portugal as a destination to persuade their academic goals. Additionally, we found few studies that compare the difficulties and struggles between Portuguese and foreign students, when facing the academic context for the first time. Another limitation was the reduced sample of participants not only in the focus groups but also in the preliminary evaluation of the AMS prototype, which makes it impossible to produce a comprehensive outcome generalization of the results. Another limitation was the lack of observation made to potential user's contexts, essential to elaborate more congruent versions of personas and context scenarios, accurate with the reality. If we had done this, we would have achieved more accurate motivations and needs and, subsequently, more accurate requirements. The lack of time was the main reason behind this drawback. For this reason, future studies should carefully address this matter in order to better plan and execute the various phases.

Regarding our main difficulties, it is relevant to emphasize the struggles faced when trying to understand and get acquainted with the more technological knowledge. This was particularly relevant when trying to understand the best way to incorporate and adapt the psychological knowledge and face to face interventions to a tool capable of replicating the same results. Working among a multidisciplinary team was an added value as we got shared multiple and various visions, always trying to achieve a universal outcome capable of helping and being useful to every individual.

For future suggestions, it would be interesting to carry on with the development of the proposed AMS. In this sense, it would be ideal to integrate new tools, namely, psychoeducation, once this system is not only intended for individuals that have anxiety, as a disorder, but for all individuals as a preventive

tool. As it stands, psychoeducation is a crucial tool to prevent the escalation of mild states of anxiety to a disorder by teaching the main symptoms and how to address them in early stages (Cuijpers & Schuurmans, 2007; Keeley & Storch, 2009). Besides, another important feature to integrate the AMS would be the ability to manage the user's schedule since, during the focus groups, this question was heavily addressed as it established a particular source of stress and anxiety for newcomers. Generally speaking, the focus groups participants made it clear that it would be an added value if the system could adapt its functionalities to the user's biological rhythms and by suggesting attainable daily tasks. This would be possible if the system asked the user to identify the volume of tasks and leisure activities for each week. With this information, the system would be able to generate a schedule that organized the user´s rhythms and activities. Finally, it would be interesting to add a feature that could evaluate the contextual conditions and the context in which the user is found, for the system to adapt its functionalities and orientations accordingly. One way the system could achieve this would be to monitor the levels of anxiety when the user faces certain contexts or by smartphone tracking. For instance, if the system presumed that a certain user is more vulnerable to experience higher levels of anxiety when he is in public places, the system would suggest a more discrete technique and, automatically, change the noise alerts to vibratory ones. This kind of feature would be ideal as it would give the system a more individual and personal facet, which, accordingly with the focus groups participants, not only presents essential aspects for the users but also steps up the techniques implementation effectiveness and efficiency of the system, on the user's daily routine.

In a final analysis, it would be an added value to carry on the evaluation of the efficacy of the proposed AMS techniques on a bigger sample of newcomer students. Then it would be interesting to study the degree of stress and anxiety the design procedure would inflict on the newcomers plus the way both Portuguese and foreign newcomers would benefit from the AMS use. For this purpose, it would be necessary a longitudinal study, in which we could evaluate subjective and psychophysiological measures periodically based on the work done in this study.

Conclusion

Bearing in mind that the development of the AMS was done in a multidisciplinary context, there was a need to considerate interdisciplinary methodologies that allowed a more efficient and effective teamwork. As such, tools like Personas and Context Scenarios were used, to both foster an easier communication between the team members and enable an appropriate elicitation of the requirements that served as the foundation for the correct development of an m-health tools. Given these points, a proof-

of-concept system was drawn up, adopting an iterative User-Centered Design and development approach, which ensured that the resulting AMS met the goals and needs of its potential users. Therefore, the resulting system incorporates several techniques, namely Mindfulness, Diaphragmatic Breathing, and Progressive Muscular Relaxation, which are scientifically proven as being capable of helping its practitioners in managing and reducing their own anxiety levels also playing an important role when it comes to the prevention of the anxiety as a pathology.

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Annexes

Annex A: Informed consent given to the focus group participants

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Consentimento Informado

No âmbito da dissertação de Mestrado, orientada pela Prof.ª Dra. Sandra Soares e coorientada pelo Prof.º Dr. Samuel Silva, os mestrandos, Andreia Santo, Daniela Melo, David Ferreira e Pedro Marques, estudantes do 2º ano do Mestrado em Psicologia da Saúde e Reabilitação Neuropsicológica e do Mestrado em Engenharia Informática, do Departamento de Educação e Psicologia e do Departamento de Engenharia Informática, respetivamente, da Universidade de Aveiro, encontram-se a desenvolver uma aplicação que visa a redução da ansiedade na comunidade académica.

Objetivo: O objetivo desta sessão de *focus group* consiste no apuramento dos requisitos necessários, a fim de desenvolver a aplicação.

Procedimento: A sessão de *focus group* comtempla um momento de discussão de temas relevantes ao desenvolvimento de uma aplicação.

Duração: A sessão de *focus group* não excederá 60 minutos.

Confidencialidade: Assegura-se que a informação fornecida ou quaisquer dados recolhidos serão mantidos em confidencialidade. Mesmo concordando em participar, poderá recusar qualquer partilha de informação indesejada, assim como poderá desistir da sessão a qualquer momento, sem qualquer penalização, devendo, para o efeito, comunicá-lo a um dos elementos do grupo. É necessário referir, ainda, que não se prevê qualquer risco na participação nesta sessão de *focus group*.

Informação de contacto: Andreia Santo (santo.andreia@ua.pt); Daniela Melo (filipamelo@ua.pt); David Ferreira (davidcruzferreira@ua.pt); Pedro Marques (pedromarquess@ua.pt).

Agradecemos, desde já, a sua importante contribuição para a realização desta dissertação de mestrado.
Ao assinar este documento, assume que a sua participação é voluntária, assim como teve oportunidade de ler este documento e de esclarecer as dúvidas.
Assim, declaro que aceito participar nesta sessão de *focus group* proposta:

_____
Assinatura do(a) Participante

_____
Assinatura dos Elementos do Grupo

_____/_____/2019

Annex B: Informed consents given to the newcomers that participated in the study third phase

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Consentimento Informado

No âmbito da dissertação de Mestrado, orientada pela Prof.ª Doutora Sandra Soares e coorientada pelo Prof.º Doutor Samuel Silva, os mestrandos, Andreia Santo, Daniela Melo e Pedro Marques, estudantes do 2º ano do Mestrado em Psicologia da Saúde e Reabilitação Neuropsicológica, do Departamento de Educação e Psicologia da Universidade de Aveiro, encontram-se a desenvolver um estudo relativo às dificuldades de comunicação na comunidade académica.

Objetivo: Compreender as principais dificuldades oratórias dos estudantes universitários perante comunicações em público.

Procedimento: Realização de uma tarefa, seguida da realização da técnica de respiração diafragmática via aplicação móvel ou período de espera equivalente ao tempo de realizado da técnica. Os dados serão gravados para uma análise mais detalhada do seu desempenho.

Duração: A sessão não excederá 30 minutos.

Confidencialidade: Assegura-se que a informação fornecida ou quaisquer dados recolhidos serão mantidos em confidencialidade. Mesmo concordando em participar, poderá recusar qualquer partilha de informação indesejada, assim como poderá desistir da sessão a qualquer momento, sem qualquer penalização, devendo, para o efeito, comunicá-lo a um dos elementos do grupo. É necessário referir, ainda, que não se prevê qualquer risco na participação nesta sessão.

Informação de contacto: Andreia Santo (santo.andreia@ua.pt); Daniela Melo (filipamelo@ua.pt); Pedro Marques (pedromarquess@ua.pt).

Agradecemos, desde já, a sua importante contribuição para a realização desta dissertação de mestrado.
Ao assinar este documento, assume que a sua participação é voluntária, assim como teve oportunidade de ler este documento e de esclarecer as dúvidas.
Assim, declaro que aceito participar nesta sessão proposta:

_____
Assinatura do(a) Participante

_____
Assinatura dos Elementos do Grupo

_____/_____/2019

Annex B: Informed consents given to the newcomers that participated in the study third phase

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Consentimento Informado

No âmbito da dissertação de Mestrado, orientada pela Prof.ª Doutora Sandra Soares e coorientada pelo Prof.º Doutor Samuel Silva, os mestrandos, Andreia Santo, Daniela Melo e Pedro Marques, estudantes do 2º ano do Mestrado em Psicologia da Saúde e Reabilitação Neuropsicológica, do Departamento de Educação e Psicologia da Universidade de Aveiro, encontram-se a desenvolver uma aplicação que visa a redução da ansiedade na comunidade académica.

Objetivo: Avaliar a eficácia da técnica de respiração diafragmática disponibilizada pela aplicação StopAnxiety.

Procedimento: Realização de uma tarefa de indução de ansiedade, adaptada do protocolo experimental *"Trier Social Stress Test"*, seguido do preenchimento de uns instrumentos e da realização da técnica de respiração diafragmática via aplicação móvel ou período de espera equivalente ao tempo de realizado da técnica.

Duração: A sessão não excederá 30 minutos.

Confidencialidade: Assegura-se que a informação fornecida ou quaisquer dados recolhidos serão mantidos em confidencialidade. Mesmo concordando em participar, poderá recusar qualquer partilha de informação indesejada, assim como poderá desistir da sessão a qualquer momento, sem qualquer penalização, devendo, para o efeito, comunicá-lo a um dos elementos do grupo. É necessário referir, ainda, que não se prevê qualquer risco na participação nesta sessão.

Informação de contacto: Andreia Santo (santo.andreia@ua.pt); Daniela Melo (filipamelo@ua.pt); Pedro Marques (pedromarquess@ua.pt).

Agradecemos, desde já, a sua importante contribuição para a realização desta dissertação de mestrado.
Ao assinar este documento, assume que a sua participação é voluntária, assim como teve oportunidade de ler este documento e de esclarecer as dúvidas.
Assim, declaro que aceito participar nesta sessão proposta:

_____
Assinatura do(a) Participante

_____
Assinatura dos Elementos do Grupo

____/_____/2019

Annex C: Socio Demographic Questionnaire

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ID: ___

Questionário Sociodemográfico

Dados pessoais

1. **Idade:** _____ anos

2. **Sexo:** Masculino ☐ Feminino ☐

3. **Nacionalidade:** _____

4. **Concelho de residência:** _____

5. **Estado civil:** Solteiro/a ☐

                União de facto ☐

                Casado/a ☐

                Divorciado/a ☐

                Viúvo/a ☐

6. **Habilitações literárias:** Ensino básico/obrigatório ☐

                           Ensino Secundário ☐

                           Ensino superior ☐

                           Outro (Especifique, por favor): _____

7. **Situação profissional:** Estudante ☐

                    Trabalhador por conta própria/trabalhador independente ☐

                    Trabalhador por conta de outrem ☐

                    Tabalhador-estudante ☐

                    Outra (especifique, por favor): _____

7.1. Se escolheu a opção "Estudante" ou "Trabalhador-estudante", preencha ainda os seguintes campos:

              7.1.1. Nível que frequenta: Licenciatura ☐

                                  Mestrado ☐

                                  Doutoramento ☐

                                  Outro (especifique, por favor): _____

              7.1.2. Curso: _____

7.2. Se escolheu a opção "Trabalhador-estudante" preencha ainda o seguinte campo:

              7.2.1. Profissão: _____

Annex C: Socio Demographic Questionnaire

ID: ___

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8. É fumador? Não ☐
             Sim ☐

9. Tem algum problema psicológico ou psiquiátrico (por exemplo: depressão, perturbação de ansiedade, perturbação de sono, etc.)

             Não   ☐
             Sim   ☐
             Se respondeu "Sim", especifique, por favor: _____
             _____

9.1. Tem acompanhamento psicológico ou psiquiátrico atualmente?   Não   ☐
                                                                  Sim   ☐

9.2. Se respondeu "Sim" à questão anterior, qual o motivo do acompanhamento? _____
_____

10. Tem algum outro problema de saúde (por exemplo: asma, patologia cardíaca, insuficiência renal, diabetes, doença músculo-esquelética, etc.)   Não ☐
                                                      Sim ☐
             Se respondeu "Sim", especifique, por favor: _____
_____

11. Toma alguma medicação?   Não ☐
                             Sim ☐

11.1. Se respondeu "Sim", especifique qual/quais, por favor: _____
_____

12. Durante o último ano, passou por algum evento traumático para si? Não ☐
                                                                      Sim ☐

12.1. Se respondeu "Sim", por favor descreva sucintamente a que tipo de evento se refere:
_____

13. Tem conhecimento acerca da técnica de respiração diafragmática? Não ☐
                                                                    Sim ☐

13.1. Se respondeu "Sim", refira com que frequência costuma utilizer essa técnica:

_____

Annex D: Developed context scenarios

Context Scenario A

The time has come for the first academic dinners. Considering that Henrique entered college later than his classmates, he feels highly nervous due to the oncoming social events. While he prepares for dinner, the system acquires information about the presence of anxiety symptomatology, which has triggered a relaxation technique suggestion alert, specifically diaphragmatic breathing. Has this was the first tome Henrique got acquaintance with the technique, and considering h was alone in his room, the system informed him that he should position himself in the most comfortable way, closing his eyes as well if he felt that way more relaxed. Subsequently, it is explained that, to accomplish the inhalation and exhalation series, Henrique would require to breath, essentially through his nose, being that this breathing done at the abdomen level. For the purpose of verify the correct technique use, the system suggests Henrique the placement of one of his hands above his abdominal region and the other one above his chest. The goal is to maintain the hand above his chest still, only being able to feel his breathing movements from the hand located in his abdomen. The inhalation and exhalation series start, having a duration of four second each, being his movements of inhalation and exhalation monitored by the anxiety management system. After 10 minutes of continuous practice of these series, Henrique starts to feel calmer and more relaxed. By the time he arrives for dinner, with a more relaxed posture, he gets pleasantly welcomed which debases the negative thoughts associated with this event.

Context Scenario B

Tomorrow, Henrique has a workgroup focused class and, considering he still isn't integrated among his classmates, he starts manifesting sleep difficulties, namely early insomnia. After a few attempts to fall asleep, he seeks help, for the first time, in his anxiety management system. Henrique encounters a list of situations that may arise from anxious symptomatology, namely trouble sleeping, faster breathing, muscle tension, motor agitation, among others. Therefore, Henrique selects the option of trouble sleeping, allowing the system to provide a suggestion of a muscle relaxation technique. The system requests Henrique to focus his attention on several muscle groups beginning, progressively, with the contraction and relaxation of the muscles of both arms, followed by the muscles in the face and neck, and ending with the muscles of the legs. To monitor the muscle contraction cycle, the system signals a warning, whereas, for the muscle relaxation, it provides a different warning. When Henrique finishes

the technique, he starts experiencing less muscle tension, promoting a greater state of relaxation leading, consequently, to a restful night's sleep. This rest will allow Henrique to build up biological resources that will assist him when he interacts with his classmates.

Context Scenario C

At the end of a busy week of classes and academic works, Henrique has the opportunity to spend the weekend with his family. Family moments trigger, in Henrique, feelings of calmness and tranquility. During the weekend, the anxiety management system recognizes that he experiences lower levels of anxiety, suggesting Henrique a skill training exercise. To do this exercise the system presents several scenarios that aim the replication of social interaction which is the main situation that triggers anxiety in Henrique. His main objective is to focus his attention on the possible outcomes coming from the presented situations, creating, in Henrique, skills to produce an effective response when faced with the real situation. In this way, his system questions him how he would start a virtual conversation with his classmates, recording his answers if he agrees so. As Henrique answers effectively to each proposed scenario, the system presents, progressively, scenarios with more anxiety load. At the end of the exercises, Henrique has the conscience that he improved his social skills, giving him the strength to deal with these scenarios in real life.

Context Scenario D

After one week of interacting with other students that shared the same fears and problems as Henrique via AMS, he decides it is time to go to the physical space, provided by the University of Aveiro, to contact these students in person. However, as usual, Henrique starts feeling anxious and he decides to fire up his AMS to perform a mindfulness technique. Accordingly, with his preferences and interests, the system suggests a mindfulness technique that aims at exploring the body sensations. In this sense, after he positions himself comfortably the system initially suggests he should direct his attention to the way he breathes. After the system asks Henrique to change his attentional focus to the sensations of other body parts, beginning with the feet and ankles, followed by the legs, spine, abdomen, and chest, arms and hands, neck and shoulders finishing with the head and face. Five minutes elapsed time, Henrique should redirect his attention to the breathing. At the end of this task, Henrique experiences a feeling of tranquility and relaxation which powers is security to deal with new challenges. By the time he enters this physical space to socialize, he shows a confident and smooth

image, making it easy to interact socially with the other students. This new experience allowed Henrique the deconstruction of some of his beliefs that contributed to the anxiety he used to feel.

Context Scenario E

Its the first time Henrique uses his AMS, due to his concern in recognizing some anxiety symptomatology, as a result of an upcoming social event. As the system gets the knowledge that Henrique is home, it suggests the completion of a task, namely the 16-muscle group progressive muscular relaxation. Henrique begins the technique however, he starts feeling bored and experiences no differences within the lowering of his anxiety symptomatology, eventually giving up the technique. Subsequently, the system verifies that there were no changes in the anxiety level, as well as it detects that Henrique did not finish the task. Thus, the AMS asks Henrique about his interest in the proposed technique, offering him an alternative suggestion for reducing anxiety.

Contact with the clinician –
1st Consultation:

In one of the first consultations, Dr. Margarida, following the gathering of all the information regarding the clinical history, takes time to explain to the student the therapeutic model chosen for the intervention, namely that thoughts influence emotions and, consequently, behaviors. In this sense, she explains to the students what automatic thoughts consist of, indicating that they will be collected during the therapeutic process, using an AMS. Between consultations, the system will implement the thought sample technique to gather student thoughts regarding everyday events. Throughout the day, this system will resort to an alert which will ask the student the record of his moment thought.

2nd Consultation:

In the following consultation, Dr. Margarida asks the patient to access his stored thought records to deduce the patient's beliefs about himself, the others and the world. In this sense, resorting to the cognitive reconstruction technique, Dr. Margarida teaches the student how to modify their automatic negative thoughts into alternative rational thoughts. Finally, the psychologist informs the student that they can perform the technique resorting to their AMS.

Follow-up Consultations

One month after the previous consultation, Dr. Margarida starts the session questioning last month highlights once it was a month marked by exams, a period that triggers high levels of anxiety. As agreed in the previous consultation, the student recorded his negative automatic thoughts as well as his proposed alternative rational thoughts in the provided section of the AMS. Therefore, the students share the information with Dra. Margarida, alongside with some statistics concerning his evolution since the last session. During the consultation, the psychologist manages to propose rational alternative thoughts most of the time, working with him on the situations that he failed to accomplish. After analyzing the statistics, the psychologist states that the student is progressing positively. In this sense, Dra. Margarida proposes a bigger spacing period between consultations, reminding that, in case of a crisis, the students can contact the psychologist via the system or by the consultation anticipation. At the end of the session, the user is safeguarded, as usual, concerning the information he shared by the system. This information will no longer be available to the psychologist at the end of each consultation.

Social Interaction

Henrique, who entered the University of Aveiro in the second phase, found the existence of several predefined peer groups, having difficulty integrating socially. On the day of his registration, volunteer students in the integration program informed him about the existence of an anxiety management system that could assist him in his integration process. By contacting his University's tutoring program tutor, he became aware of the existence of a physical space provided by the institution for users of the system to meet and interact socially. Besides, the tutor made it possible to access the system chat, as he realized that Henrique was shy and that he was not comfortable to initially move to this physical space. By interacting with other students virtually, he found that they also shared similar concerns and difficulties, which reassured him and made it easier to interact with the peer group.

Psychoeducation

Once again, the student receives an alert from his AMS, which asks him about the following: "Did you know that your thoughts affect your emotions and therefore your behaviors?". The fact of not knowing this information, triggered his interest in this subject, being redirected to his area related to anxiety psychoeducation within his system. By contacting this mode of education, the student gained a more comprehensive awareness of how thoughts affect his behaviors.

Over the course of lunchtime, the student, finding himself with free time, decide to look for more information about anxiety. As such, he consults his AMS by accessing the mental health literacy section, since he knows that the information in this section is based on unvarying validated literature. This section provides information in different ways, including namely through schemes, videos, audio, scientific articles, recommended bibliography, among others. By accessing this section, the student acknowledges that, to a certain extent, they have increased their knowledge of this subject, enabling them to recognize some triggers effectively.

Annex E: State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) (State)

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STICSA-1

(Ree, MacLeod, French, & Locke, 2000; VP: Barros, Figueiredo, & Soares, 2019)

Abaixo encontra-se uma lista de frases que podem ser usadas para descrever como as pessoas se sentem. Ao lado de cada frase estão quatro números que indicam o grau com que cada frase pode descrever o seu humor ou o modo como se está a sentir neste momento (por exemplo, 1 – Nada, 4 – Muito).

Por favor leia cada frase atentamente e assinale o número que melhor indica <u>COMO SE SENTE NESTE MOMENTO,</u> neste preciso momento, mesmo que não seja a forma como se sente habitualmente.

	Nada	Um pouco	Moderadamente	Muito
1. O meu coração bate rápido	1	2	3	4
2. Os meus músculos estão tensos	1	2	3	4
3. Sinto-me agoniado com os meus problemas	1	2	3	4
4. Eu penso que os outros não me aprovarão	1	2	3	4
5. Eu sinto que me vou perdendo porque não consigo decidir-me atempadamente	1	2	3	4
6. Sinto-me tonto	1	2	3	4
7. Sinto fraqueza nos meus músculos	1	2	3	4
8. Sinto-me trémulo e instável	1	2	3	4
9. Eu perspetivo algumas desgraças futuras	1	2	3	4
10. Não consigo tirar alguns pensamentos da minha cabeça	1	2	3	4
11. Tenho dificuldade em relembrar coisas	1	2	3	4
12. Sinto a minha face quente	1	2	3	4
13. Eu penso que o pior vai acontecer	1	2	3	4
14. Sinto que os meus braços e pernas estão hirtos	1	2	3	4
15. Sinto a garganta seca	1	2	3	4
16. Eu esforço-me a evitar pensamentos desconfortáveis	1	2	3	4
17. Não me consigo concentrar sem a intrusão de pensamentos irrelevantes	1	2	3	4
18. A minha respiração é rápida e superficial	1	2	3	4
19. Preocupo-me por não conseguir controlar os meus pensamentos tão bem como eu gostaria	1	2	3	4
20. Tenho borboletas no estômago	1	2	3	4
21. Sinto as palmas das mãos húmidas	1	2	3	4

Annex E: State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) (Trait)

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STICSA-2

Abaixo encontra-se uma lista de frases que podem ser usadas para descrever como as pessoas se sentem. Ao lado de cada frase estão quatro números que indicam com que frequência cada frase é verdadeira para si (por exemplo, 1 – Nada, 4 – Muito).

Por favor leia cada frase atentamente e assinale o número que melhor indica <u>COM QUE FREQUÊNCIA, EM GERAL, A FRASE É VERDADEIRA PARA SI.</u>

	Nada	Um pouco	Moderadamente	Muito
1. O meu coração bate rápido	1	2	3	4
2. Os meus músculos estão tensos	1	2	3	4
3. Sinto-me agoniado com os meus problemas	1	2	3	4
4. Eu penso que os outros não me aprovarão	1	2	3	4
5. Eu sinto que me vou perdendo porque não consigo decidir-me atempadamente	1	2	3	4
6. Sinto-me tonto	1	2	3	4
7. Sinto fraqueza nos meus músculos	1	2	3	4
8. Sinto-me trémulo e instável	1	2	3	4
9. Eu perspetivo algumas desgraças futuras	1	2	3	4
10. Não consigo tirar alguns pensamentos da minha cabeça	1	2	3	4
11. Tenho dificuldade em relembrar coisas	1	2	3	4
12. Sinto a minha face quente	1	2	3	4
13. Eu penso que o pior vai acontecer	1	2	3	4
14. Sinto que os meus braços e pernas estão hirtos	1	2	3	4
15. Sinto a garganta seca	1	2	3	4
16. Eu esforço-me a evitar pensamentos desconfortáveis	1	2	3	4
17. Não me consigo concentrar sem a intrusão de pensamentos irrelevantes	1	2	3	4
18. A minha respiração é rápida e superficial	1	2	3	4
19. Preocupo-me por não conseguir controlar os meus pensamentos tão bem como eu gostaria	1	2	3	4
20. Tenho borboletas no estômago	1	2	3	4
21. Sinto as palmas das mãos húmidas	1	2	3	4

Annex F: Implemented protocol in the third phase of this study

Protocol

1. Participants arrive. Extend a welcome and allow them to sit comfortably on the waiting room:

Newcomers: *Hello, good morning/good afternoon,*

Welcome to IEETA, you may sit comfortably in this room. In this document you will find a brief explanation of the objective, the duration and other important ethical questions essential to the elaboration of this study. This study aims to ascertain the first experiences of integration in this university, having a duration of about half an hour and it is not expected any risks associated with your participation. Now I would like you to fill this questionnaire focusing on who do you feel in this moment, as well as a socio demographic questionnaire. In order to obtain a more precise data gathering we will place some electrode on your abdominal region/chest. After we would like you to stick comfortably while we prepare the next task.

2. Obtain the informed consent and the social demographic data from the participant.

3. Gather baseline physiological measures and apply the STICSA state

4. Meanwhile, still in the waiting room, during the registration of physiological measures, point to the following:

Newcomers: *In this section of the task, you will have to prepare a speech with a duration of 5 minutes, describing the main experiences of social interaction since you first became a college student at UA. According to some studies, there is a strong link between the social integration skills and study maintenance, being that students that experience greater difficulties when interacting with their peers tend to quit their academic path in the short and medium-term. Being said, to evaluate those skills, you will have the perform a speech in front of a three expert jurors' panel. Your performance will be recorded for later analysis of your nonverbal*

behavior during your presentation. The juror panel will be composed of Prof. Doctor Samuel Silva, a specialist in social communication, by Prof^a. Doctor Claudia Figueiredo, psychologist specialized in evaluating micro-expressions and by X, an expert psychologist in social interaction in human relations. You will be given 5 minutes to prepare your speech. Your 5 minutes start now!

5. Record the physiological measures during the 5 minutes speech preparation. Set the digital timer and leave the room.

6. After 5 minutes of preparation, return to the waiting room.

7. Refer the participant to the interview room, while giving the following instructions:

   Newcomers: *The time has come to deliver the speech. As mentioned before, you will have to perform a speech talking about your main experiences of social interaction since you began this new stage as a UA student. You must speak for about 5 minutes. You may enter and stand in front of the jurors. Good luck.*
   *(**Jurors Presentation:** Good afternoon, my name is Samuel Silva, to my right I have Dra. Claudia Figueiredo.)*

8. The video recorder must be turned on now, in order to increase the stress associated to the development/ to the evaluation.

9. The recording of the physiological measures must proceed across the 5 minutes of the speech delivery. If the participant stops talking during his speech, allow him to remain silent for 20 seconds. In case he doesn't proceed with the speech, the jurors must say "You still have time. Please continue."

10. Escort the participant to the waiting room in order to complete the STICSA-State

"We will ask you to fill out again this questionnaire, focusing only on the present moment"

11. Anxiety reduction technique, while gathering physiological measures.

    Experimental group: *"While we wait for the result you will perform this diaphragmatic breathing technique for 5 minutes. The instructions to perform this technique are in the device you will use."*

    Control group*: "We ask know to wait for the results, for about 5 minutes. Make yourself comfortable"*

12. Administer the STICSA state and STICSA trait.
    "Lastly, we ask you to fill out the following questionnaires, one relative to the way you now feel and the remain relative to the way you normally respond to the presented situations"

13. Enlightenment on the real objective of the study (debriefing) and retrieve the informed consent.