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A Framework for Next Generation iCBT Applications for *SAD* Patients

Full Paper

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Abstract

Our paper aims to develop a web-based IT system based on a framework for internet based Cognitive Behavioral Therapy (iCBT) and Computer based Cognitive Behavioral Therapy (CCBT) applications, for the treatment of mild to moderate Social Anxiety Disorder (SAD) diagnoses. We place our research in the intervention area of iCBT, where the facilitation of interaction with therapists in a non-threatening environment, peer interaction, and access to self-help and educational resources, will likely lead to changes in the perception of the self and a reduction of SAD symptoms in patients. The contributions of the paper are: (1) a generalizable framework for computer based therapies; (2) a new design approach, informed by Activity Theory that leverages the SAD model to deliver the conceptual framework; and (3) an implemented artifact for evaluation.

Keywords

Social Anxiety Disorder, Cognitive Behavioral Therapy, internet based Cognitive Behavioral Therapy, Design Science Research, Activity Theory

Introduction

The Diagnostic and Statistical Manual of Mental Disorders defines Social Anxiety Disorder (SAD) (APA 2013) as a fear or anxiety in a disproportionate way that causes suffering of significant distress or impairment that interferes with his or her ordinary routine in social settings, at work or school, or during other everyday activities. This disorder affects 12% of the population and is one of the most common psychiatric disorders (Kessler et al. 2005).

SAD is a crippling disorder that can lead to academic and professional underachievement, hindering of social interactions, and debilitating relationships (Katzelnick et al. 2001). SAD also has a high incidence of comorbidities, the majority of which are coexisting phobias, depression, substance abuse, and affective disorders (Schneier 2006).

Increase use of computer and internet based health care artifacts has also made its way into the realm of mental health, with studies showing that internet based Cognitive Behavioral Therapy (iCBT) and Computer based Cognitive Behavioral Therapy (CCBT) are effective in the treatment of Social Anxiety Disorder (Foroushani et al. 2011), and promote the decrease in prevalence rates because they make Cognitive Behavioral Therapies (CBT) available to a wider range of SAD patients (Marks et al. 2003).

Our paper aims to develop a web-based IT system based on a framework for iCBT and CCBT applications for the treatment of mild to moderate SAD diagnoses. We place our research in the intervention area of iCBT, where the facilitation of interaction with therapists in a non-threatening environment, peer interaction, and access to self-help and educational resources, will likely lead to changes in the perception of the self and a reduction of SAD symptoms in patients. This Design Science Research proposal contributes with a novel requirements engineering and validation process through an adaptation of Activity Theory. It also leveraged the SAD model to derive a framework that caters to SAD patients. And lastly it provides an artifact that acts like a platform to deliver CBT that can be generalized to other disorders.

The remainder of the paper is organized as follows. First we examine literature on SAD and CBT, and Activity Theory. We then present a new framework development methodology, and highlight the contributions to both research and practice. Next we elaborate on the methodology and design details. We further present the implemented artifact that will allow for the validation and evaluation of the suggested framework. Finally we discuss the paper's implications, limitations and directions for future research.

Theoretical Foundation

In this section we provide a deeper insight into Social Anxiety Disorder, the treatment model and how Activity Theory can be leveraged to obtain an internet based treatment framework.

Social Anxiety Disorder Model

Social Anxiety Disorder is a pervasive condition that often results in suffering and diminishing quality of life (Schneier 2006). The cognitive model of Social Anxiety (Figure 1) has at its core the (erroneous) perception of self that is enhanced by physical and cognitive symptoms that are caused by the perception of a threat triggered by social situations.

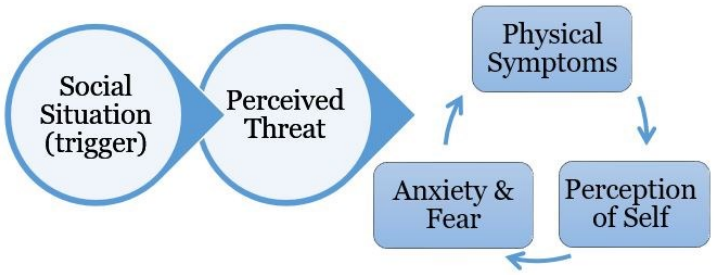

Figure 1 - Social Anxiety Disorder Model

The anxiety and fear caused by the perceived threat, lead to the onset of physical symptoms not limited to blushing, profuse sweating, trembling and other not so visible symptoms like nausea, headaches, and feelings of loss of self-control among others (ADAA 2015). The physical symptoms often lead to increased anxiety and fear of being noticed and negatively evaluated, which in a vicious cycle can enhance the physical symptoms (Marcus and Katzman 2007).

SAD patients are often anxious in the presence of authority figures and perceive physicians to be a threat, and may avoid discussing their symptoms out of fear or shame (Schneier 2006). To bypass this reluctance to participate in a traditional diagnosing process, a self-screening instrument can be used, where the patients rate their perception of the severity of their social fears. The administration of these self-screening instruments has proved to be an accurate form of diagnosing Social Anxiety Disorder (Connor et al. 2001).

Diagnosing approaches have been operationalized to allow for categorical and severity classification of Social Anxiety Disorder, making it easier to determine dimensional boundaries (Schmit and Balkin 2014). A dimensional evaluation also allows comorbid symptoms to be addressed (Schmit and Balkin 2014). The Social Anxiety severity measure consists of 10 items and is captured with a 5 point scale (Craske M 2013), that can be self-administered and be re-assessed as often as the patient or clinician deem appropriate (Lebeau et al. 2012). The scores are weighted and translate into a severity scale that is sensitive to clinical severity levels (Knappe et al. 2013).

The prime route for treatment of Social Anxiety Disorder is individual Cognitive Behavioral Therapy (Pilling et al. 2013). Traditionally Cognitive Behavioral Therapy involves a face-to-face relationship between the therapist and patient (Hofmann and Smits 2008) that aims to operationalize some or all of the SAD symptoms with the objective of changing the beliefs that lead to the formation of the perceived threat, and creating new behaviors in response to social interactions (Tolin 2010).

Nontraditional approaches to CBT, where instead of a face-to-face relationship, there is a computer mediated interaction, have also shown to be effective in the treatment of SAD (Foroushani et al. 2011). Both Computer based CBT (CCBT) and internet-delivered CBT (iCBT) facilitate a wider penetration into the affected population not only because they reduce costs (Andrews et al. 2010) and bypass the lack of therapist availability, reaching those who might otherwise remain untreated (Marks et al. 2003); but also, because they remove the presence of an authority figure that might be the trigger to SAD symptoms and behaviors (Schneier 2006). We propose an artifact that will be positioned to provide services for mild-moderate diagnoses (Figure 2).

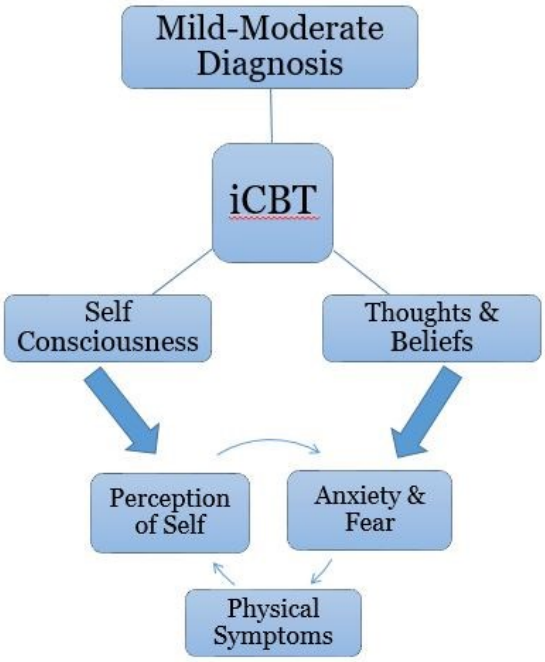

Figure 2 – iCBT Framework

Studies have shown that the increase in the use of Social Interaction Technologies (SITs) and computer mediated communication (Pierce 2009), make people more prone to achieve success rates with the use of CCBT or iCBT tools (Anderson et al. 2003). SPARX, an internet based game, is an iCBT tool that was tested in SAD youth patients, achieved remarkable results in the reduction of levels of anxiety (Merry et al. 2012). This success can only be enhanced in the young adult and teen populations where the use of SITs is very prevalent because it provides both control over social interactions (Madell and Muncer 2007), and a perception of social support (Erwin et al. 2004), while avoiding the face-to-face interactions that trigger SAD.

In case where the SAD diagnosis falls on the mild-moderate spectrum, the guided use of self-help and educational materials has also proven to be effective in the mitigation of symptoms and changing of behaviors (Williams et al. 2013).

The definition and severity classification of Social Anxiety Disorder, as well as the therapeutical framework have significant implications for our study, informing and guiding the design of the artifact in terms of requirements (functional and non-functional) and the testing of the implemented concept in the form of a prototype. The SAD model provides the knowledge and classification that contain the concepts that will inspire the creation of the artifact.

Activity Theory

The design of a system requires a systematic approach (Bækgaard 2015) to identify its elements, structure, rulebooks and relationships. In this paper we use Activity Theory (AT) to guide the requirements gathering process, as well as to inform the testing procedures. We use Activity Theory (AT) as an expression of a Human Computer Interaction (HCI) methodology, meaning that AT provides a requirements gathering framework to determine the environment of the interaction between humans and machines in the Cognitive Behavioral Therapy context.

Activity Theory provides a framework that considers an entire structure (including participants, systems, groups, etc.), in all its complexity, instead of just a single actor (Engeström et al. 1999). Rather than offering a predictive model, Activity Theory allows us to deliver a local, i.e. non-centralized, process that is able to solve conflict by having dynamic boundaries (Engestrom 2000) in the form of a more flexible framework that takes into consideration the dynamics of self-help and online forums. The dynamic nature of activities according to Activity Theory, allow for instabilities and contradictions that may arise within the elements and interactions of the system to be resolved within the activity (Chen et al. 2008).

The proposed methodology uses an activity centric perspective informed by the SAD model and how CBT affects it. The desired outcome in any instance of the use of CBT (internet based or not) is a change in the patients' (subject) thoughts and beliefs, as well as their perception of self. We extend the elements of AT to include "Social Situation" as a significant construct. The *Diagnostic and Statistical Manual of Mental*

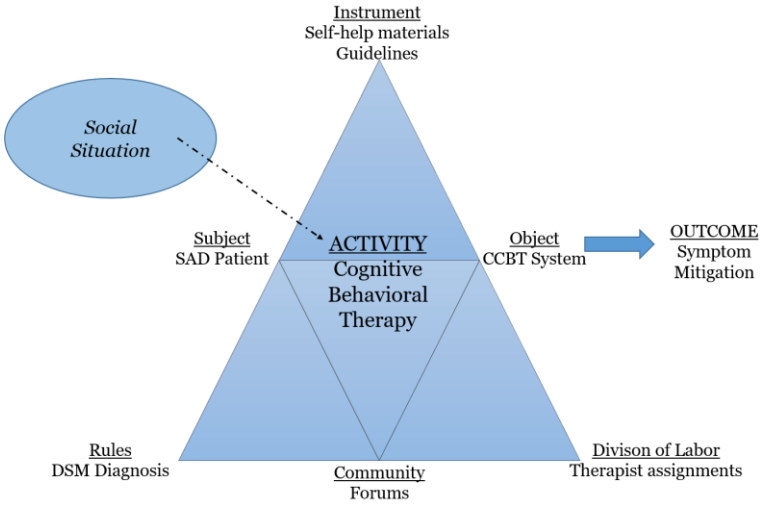

Figure 3 - Application of AT on the iCBT Framework

Disorders (DSM-5 (APA 2013)) introduces a performance only specifier in the operationalization of the Social Anxiety Disorder diagnosis. This allows us to characterize the distinct subsets of SAD in terms of etiology, as defined by DSM-5 (APA 2013). Social Situation will impact all the elements in the Activity.

The concepts of Activity Theory have substantial impact on our study. Both CCBT and iCBT involve a system of actors, resources, and processes. The interactions take place in a highly dynamic setting that is shaped by the different interactions and influenced by the social situations. The iCBT module is permanently undergoing reconfiguration as a result of changes in the elements (membership changes, new forums created, new resources added, etc.), and transformed interactions.

By applying AT we investigate iCBT along the dimensions of activity, subject, instrument, object, division of labor, community and rules, as seen in Figure 3. The descriptive framework provided by AT allows us to identify the pivotal interest of the research and formalize the requirements identification and gathering process. We illustrate this process in Figure 5, and include the extension of AT to include the previously presented construct of "Social Situation", which allows to operationalize the impact that different triggers have on the iCBT process.

CONCEPTUAL FRAMEWORK / MODEL

To support the iCBT process we develop an interaction framework. We apply Activity Theory in the development of the system, and tailor the user interaction with the CCBT system to their diagnosis severity and subcategory of SAD.

The framework provides a full range of capabilities accessible to users who register to use the application. Following registration and login, the framework provides and assessment of the severity of Social Anxiety Disorder using a diagnostic test.

The model proposed has inbuilt capability to triage the users based on the severity of their condition as determined by their test score. Users with mild-moderate conditions will be routed to forums and self-help materials that includes educational resources and automated response to their queries. The educational materials will help these users to understand their condition better besides educating them on coping methods. The model accounts for an automated query response module which will answer the most frequently asked questions and address the usual concerns the users tend to have. Our implementation of the model, borrows high quality responses from practicing psychologists and experts in the field.

It is human nature to have a sense of belonging (Hagerty et al. 1992), however SAD patients may have difficulty in fulfilling this vital need because of their fear of face-to-face interactions (Pierce 2009). iCBT will act as a proxy for personal interactions and satisfy the need for the sense of belonging (Erwin et al. 2004). We incorporate this concept in the forums component of the iCBT, allowing SAD users to participate in interactions with their peers.

Users with more severe diagnoses will be routed to a therapist referral module. The framework allows for the inclusion of a comprehensive list of therapists and their contact information. Users will also have the opportunity to make an appointment with the practitioner of their choice. These patients will also have information on iCBT and other supporting material made available to them.

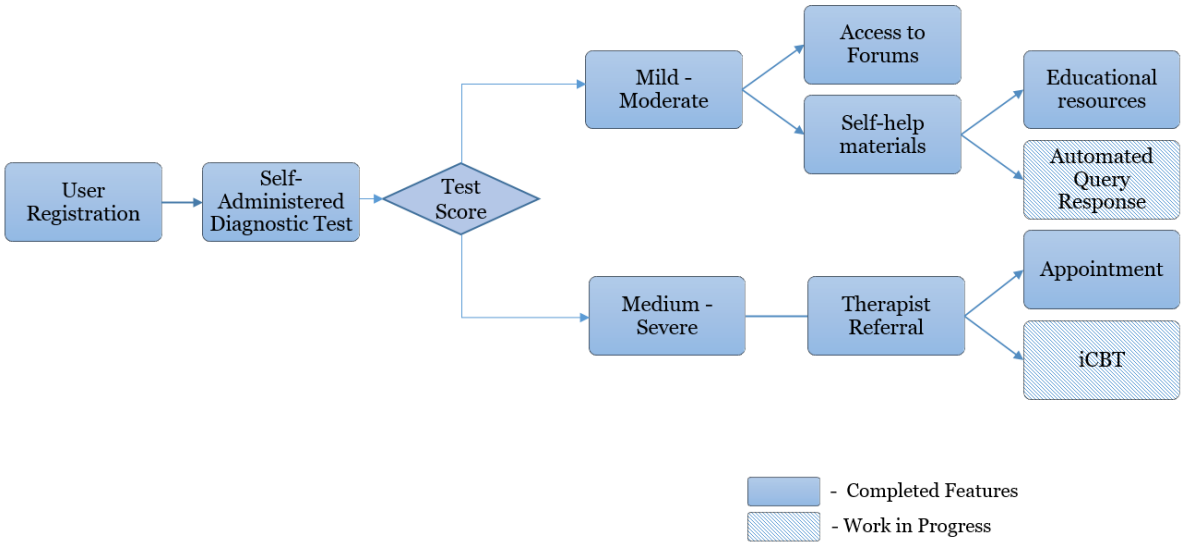

Figure 4 - Conceptual Framework for iCBT

The framework is flexible and can be extended with the addition of more modules and features as and when future research makes them viable. The framework is also flexible enough to accommodate changes and adaptions necessary to target other types of disorders that use Cognitive Behavioral Therapy as treatment, i.e. addictions, depressions, stress, etc.

Contributions

Health information systems research has been ripe with development (Agarwal et al. 2010), however the mental health area has not been privy to IS adoption (Drake et al. 2005). This paper informs the IS Research Community of how Mental Health solutions can be implemented, by providing a theoretical framework for building and evaluating eMH (e Mental Health) artifacts. The framework developed, addresses an interesting and current topic; provides the SAD community with a tool that is accessible to the population that falls under the iCBT scope; and, creates a mold that is applicable to the development of other computer based health artifacts, making it relevant (Benbasat and Zmud 1999) in today's ISR landscape.

Using Hevner et al. (von Alan et al. 2004) guidelines for Design Science Research we identify the aspects that break the paradigms identified by the DSR body of literature.

- The proposed artifact (framework for iCBT), developed and used for the benefit of the social anxiety disorder patients through internet mediation (Pierce 2009) – G1
- Social anxiety disorder is a grave problem. It affects 12% of the population and is one of the most common psychiatric disorders. The United States spends about 42 billion USD each year on anxiety disorders. Our framework intends to provide a platform that SAD patients can use to during diagnosis, treatment to help increase coping mechanisms – G2
- The prototype is built on the strong foundations of Object Oriented Design methods leading to a highly modular design. The requirements for the application were engineered by leveraging the 'Social Anxiety Disorder model' with an adaptation of Activity Theory. Expert validation was also employed during the design process – G3
- This DSR proposal contributes with a novel requirements engineering and validation process through an adaptation of Activity Theory. It also leveraged the SAD model to derive a framework that caters to SAD patients. And lastly it provides an artifact that acts like a platform to deliver CBT that can be generalized to other disorders – G4

- The prototype were developed based on a substantial research on SAD models, theories and treatment approaches, Activity Theory and multisided platforms. Involvement of experts during the analysis and validation of the artifact adds credibility to the prototype is an instantiation of the proposed framework – G5
- The prototype designed uses leverages existing technologies and access to information to achieve the goal of mitigation of SAD symptoms, while taking into consideration the constraints imposed by the disorder itself (i.e. face-to-face contact can be detrimental for the disorder (Schneier , 2006 #6) – G6
- The intention is to develop a platform that informs new users (SAD patients) about their condition, provides them with professional and peer support using information technology platform – G7

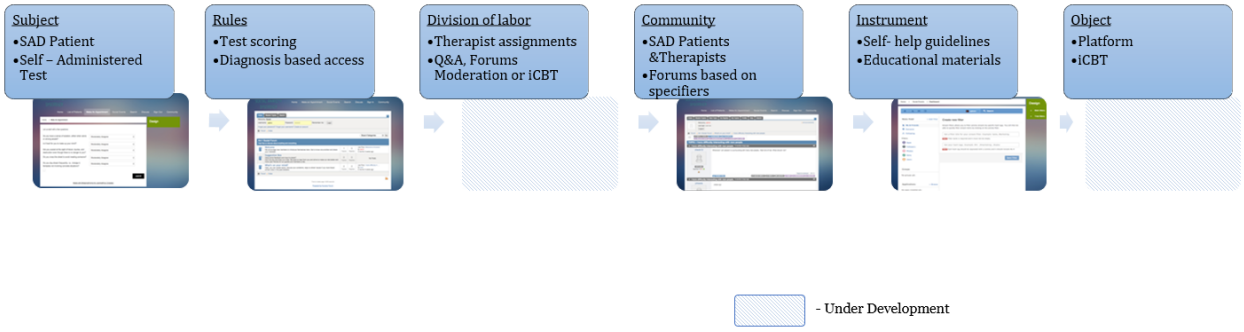

Figure 5 - Mapping of AT Elements to iCBT Concepts and System Features

The lens of Activity Theory allows us to gain a profound understanding of both social and technical systems, and to produce requirements for the iCBT framework development. The mapping of AT elements in an iCBT context illustrates the applicability of AT as a requirements gathering framework, as shown below.

The mental health profession has been slow to adopt digital and information technologies into practice. Our artifact will help change that by providing a platform that allows the various stakeholders involved in CBTs to communicate and collaborate more effectively with patients. Our system will enable any SAD patient to start improving their mental health and to assist in the improvement of the mental health of others by acting as a peer in the support system provided by the user forums.

The iCBT application will serve as a platform for SAD patients to connect to other patients and fulfill their need for a sense of belonging, allowing them to develop coping mechanisms that will allow them to change their perception of self, and change their thoughts and beliefs. The system will act as a multi-sided platform that will bring together a multitude of agents who have a common SAD mitigation oriented goal. The focus of iCBT is to have a positive impact on mental wellbeing – reducing SAD prevalence and lessen comorbidities.

As far as we know there are no other frameworks like this, and our proposal makes significant contributions to both research and practice:

We offer a novel way to engineer requirements for Design Science Research (DSR), informed by Activity Theory. This methodology allows requirements elements to be derived with the guidance of Activity Theory Elements; which are then mapped to system components (Figure 5), which are then mapped to validation points, and evaluation processes. We created a sequential and generalizable DSR method that is applicable from conception to implementation, with a solid theoretical basis. The full methodology application is depicted in Figure 6.

The existing iCBT services offer online based therapy in the form of individual sessions with therapists, and some also offer the ability to use online forums. In both of these, the return for any interaction the patient engages in, is dependent on the participant on the other side of the interaction being online, i.e. if there are no other patients or therapists online, then there is no response. Our proposed framework incorporates a variety of self-help components that are independent and still have therapeutic purpose - educational resources, blogs, videos, and Q&As.

The system can grow to include other focus areas, different strategies for each one of those areas and change to fit needs of the mental health community as it evolves in its quest for understanding and treatments. The system can also be customized taking into consideration the economic, social, geographical characteristics of a region to promote the same objectives in a different community and strategies to implement the artifact

METHODOLOGY

We started the framework development with a literature collection process to understand SAD, its diagnosis and treatment. This collection provided us with an idea of the core process of CBT and how it can be implemented into iCBT systems. Next we extracted the critical elements guided by experts. First we identified taxonomy used in SAD identification and treatment, second we defined a basic framework structure to be implemented in the artifact. Lastly we grouped the taxonomy into groups relevant for both the design and evaluation of the CCBT framework and the evaluation artifact.

The iCBT framework is evaluated through the implementation of an artifact. The artifact is deployed on a web server and acts like a multi-sided platform that matches the different groups that participate in the SAD reality. The iCBT platform acts as intermediary that will create value for all the sides involved. The SAD patients will have access to physician lists, computer based therapy, peer support, self-help resources, educational materials, regardless of their geographical location, and without having to engage in an often threatening face-to-face interaction. The physicians will be able to reach a higher number of potential patients and increase their productivity by providing care to more than one patient at any given point in time.

DESIGN

The operating goal of a Two-sided platform is to maximize the positive externality effects (Hagiu and Wright 2015) through the facilitation of direct contact between the involved groups. By providing this "matching" service, the search costs are reduced for the sides involved in each transaction (Hagiu 2008). The iCBT platform also identifies patient education as well as some self-help objectives.

Even though the iCBT platform's objective is not to maximize profit (Evans 2009), some consideration must still be made on the impact of each service provided on social welfare. Pricing considerations (Eisenmann et al. 2006) can still be made, and concepts like price discrimination can still be applied (Rysman 2009), and, charging or subsidizing different sides involved might even be dependent on the health insurance coverage.

VALIDATION AND EVALUATION

Our iCBT framework is validated by experts (Boudreau et al. 2001) who evaluated the model and provided feedback. The validation process included 6 psychology scholars. The evaluators are experienced in CBT processes and their knowledge helped identify and address potential problems with the use of an internet based CBT system.

We use a validation charter informed by expert feedback and requirements, and guided by Activity Theory (Engeström et al. 1999). The artifact has also been validated during its creation (ex-ante evaluation) through literature referencing, and expert evaluation. See Figure 5 for validation elements. This is an ongoing study with the validation process following the same Agile development methodology as the system development.

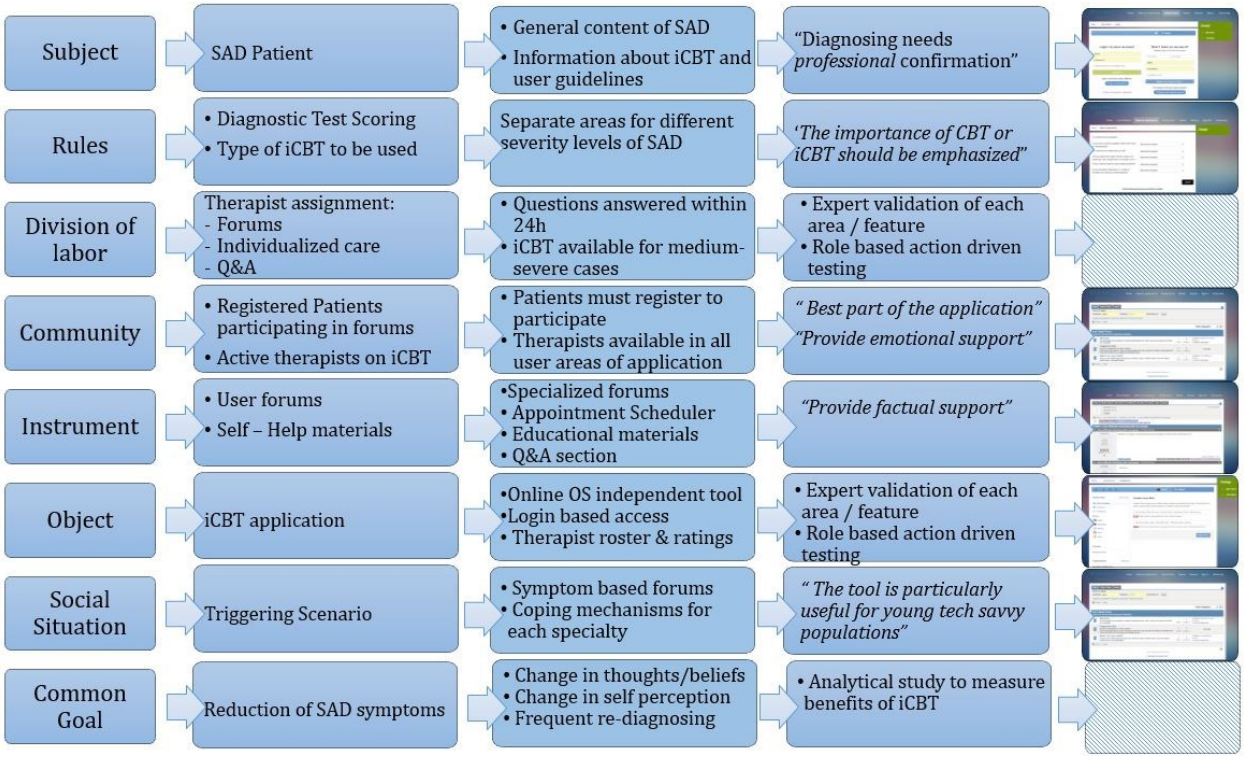

Figure 6 - Mapping of AT Elements from Requirements to Evaluation

The artifact evaluation elements are also informed by the framework provided by AT as shown in the table in Figure 6. The Activity Theory elements are mapped to the iCBT framework elements, which are then mapped to specific areas of the proposed system. We then use these specific areas to develop testing processes. Some of these areas have been validated by experts and implemented, and are in the process of being user and performance tested, while others are still in a development stage.

The evaluation of the completed version of the prototype (ex-post evaluation) includes further technical experiments and illustrative scenarios (most appropriate for instantiations (Peffers et al. 2012)). Due to the nature of the artifact, action research and case studies are part of the evaluation process of future developments of the artifact and the system as a whole (Venable et al. 2012). Functional tests were developed based on the feedback of the psychologists and were guided by Activity Theory. The application was validated by IT professionals with considerable experience in Application testing. User interfaces were reviewed by the professionals from psychology departments

DISCUSSION AND CONCLUSION

This research design is grounded in CBT practices and is supported by the psychology professional community, and the elements that contributed to the usefulness and quality of our proposed framework. The CCBT framework was developed on a solid foundation of thorough requirements gathering and understanding, that creates a sound structure of elements and interactions to deliver iCBT.

The framework developed is generalizable to other disorder types, and the elements identified can be shared with other areas of mental health, for which CBT or similar therapies have shown to be effective. To expand the framework to other types of disorders, outside of the mental health context, the components identified can be replaced with other relevant ones, while still following the framework developed for requirements gathering, understanding and evaluation.

Future research and development includes assessing the penetration, acceptance and therapy completion rates of an iCBT implementation.

Future work also includes some safety and privacy considerations. Adding an e-consent module to the system, not only ensures that patients are informed about the services they receive, therapeutic goal setting, progress (when applicable), costs incurred, etc.; but also mitigates potential vulnerabilities that stem from the nature of establishing online relationships. For example, in an online therapeutic relationship, the therapist might not be able to evaluate visual cues (body language) or make inferences based on vocal inflections; and patient misrepresentation is more difficult to detect.

Legal and ethical guidelines have to addressed, to reflect differences between states or even countries where the services are provided.

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