Test Anxiety CBT: Further development & evaluation of a mobile app to reduce test anxiety

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ABSTRACT

Test anxiety is a problem student all over the world face. Research has shown that cognitive behavioral therapy can be beneficial in alleviating symptoms connected to test anxiety. Cognitive behavioral therapy is thought based and therefore mobile apps can be suitable tools to deliver therapy directly to students at their own leisure. I conducted a usability and field-study to examine the effect a self-help app could have on students suffering from test anxiety. Four participants were recruited for the field study, each trying the application for a week. Results showed that cognitive behavioral exercises, and behavioral exercises has potential to ground and calm users, thus mitigating anxiety. In the discussion I relate the results to other studies and conclude that a study monitoring participants physiological state would be beneficial moving forward.

KEYWORDS

Cognitive-behavioral therapy, self-help, mobile application, field study

1. INTRODUCTION

Test anxiety is a widespread problem for students everywhere. The American Test Anxieties Association (AMTAA) estimate that around two out of five students are affected by some amount of test anxiety [1], while Hill and Wigfield projected in 1984 that as many as ten million elementary and secondary school students worldwide were experiencing difficulty in evaluative situations. [18]

Test anxiety is according to Zeidner *"the set of phenomenological, psychological, and behavioral responses that accompany concern about possible negative consequences or failure on an exam or similar evaluative situations"* [36]. This can in turn affect academic performance negatively, as many studies have shown [4][7][21][28]. Wine states that worry is consistently and negatively related to task performance, stating that the reason for this is that "*worry is attentionally demanding and thus distracts attention from the task.* " [31].

Now that the scale of the problem has been brought to light, what can be done to reduce or mitigate test anxiety? Many different interventions have been conducted and documented over the years [17][22][25][27][32]. This article will focus primarily on psychological interventions utilizing cognitive behavioral therapy (CBT). The reason CBT can be an effective treatment of test anxiety is because according to Reiss: *"the clinical symptomatology of severe test anxiety can be specified on the basis of the symptoms of social anxiety disorder, or the symptoms of generalized or specific social phobia".* [23]

Therefore, treatments that are effective against generalized or specific social phobia should also be effective against test anxiety. On this basis, various studies have shown that CBT is in fact an effective treatment of social phobia or social anxiety in general [30][24].

Furthermore, CBT techniques, such as cognitive restructuring are already incorporated and utilized in test anxiety treatments [20].

This article aims to describe and explain the further development of the Test Anxiety CBT mobile application. To begin with, cognitive behavioral therapy will be explained, and I will briefly outline the content of the application. I will also outline the related work in the field. Afterwards I conducted two separate studies. The first study was a usability study and was conducted with interaction design students. Its purpose was to get feedback on the design and user interface. This feedback was then used to improve the app, which will be described in section 4. The second study was a field study conducted with four participants struggling with test anxiety. It was conducted by having the participants use the app for a week, the procedure for the study is described in chapter 5. The study's purpose was to review the overall usefulness of the app as a self-help tool for mitigating test anxiety. Afterwards, I will discuss findings from my field study and compare them to other research results, as well as limitations. I will also outline future work, and at the end conclude upon this project.

2. RELATED WORK

As mentioned in the introduction, test anxiety is a problem many students deal with during their education. In this modern age, there have been various approaches to solve this problem. This section will elaborate on the research that has been done recently in the field of reducing test anxiety.

2.1 Effective interventions for test anxiety reduction

A meta-analysis by Ergene in 2003 gives a good understanding of which types of intervention are effective for reducing test anxiety in students. It synthesizes results from 56 different test anxiety intervention-studies, and reveals that average

individuals completing treatment were better off than 74% of their peers who did not receive treatment [27]. This study also notes that the most effective treatment appears to be interventions that combine skill-focused approaches with behavior or cognitive approaches. However, it appears that both behavioral and cognitive approaches individually were also effective at reducing test anxiety. The most effective treatments were systematic desensitization, behavioral techniques, and cognitive therapies such as cognitive restructuring. Skill-focused approaches only seemed effective when paired with other techniques.

2.2 Social media interventions

One new approach that has appeared in recent time to reduce test anxiety, is the phenomenon of social media interventions and social support. Social support is defined as *"an interpersonal transaction in which one can rely on others for information, help and advice"*. Social support consists of several categories, but this section will only look at emotional support (encouragement, sympathy, love). A study within this area shows that reading supportive and encouraging messages from social media before a mentally stressful activity decreased state anxiety by 21%. Results also showed that the number of messages received correlated with the reduction, however the amount of "likes" did not [6]. Another study elaborated on this idea, by comparing human and automated sources of social media. Results showed that autogenerated sources of encouragement was not as effective, as getting messages from a human [2].

2.2 Gamification as a treatment

Gamification as a term was coined by Nick Pelling in 2002. The most accepted definition by Sebastian Deterding. He defines gamification as the use of game design elements in non-game contexts [8]. This can be applied to a variety of different areas including test anxiety interventions. Various studies have shown that gamification elements can help reduce anxiety in students [5,13]. These two studies are vastly different, one aims to reduce test anxiety using a quiz program, while the other seeks to define a new exam structure through gamification.

2.3 Music therapy

Music therapy has proven to be effective as a tool to reduce anxiety [34]. This can also be applied to test anxiety, and research shows that music therapy has the potential to be effective in reducing test anxiety; both by passively listening to music but also by actively playing music. [14] Furthermore, a study shows that while music therapy was effective in reducing test anxiety it did not increase test scores. Music therapy as a treatment form is however still appealing due to its low cost and non-invasiveness. [9]

2.4 Imagery-based treatment

Time constraints required by using standard cognitive therapy methods has left researchers looking for different solutions to reduce test anxiety. A promising solution to address underlying emotional beliefs involves the emotion-based technique of imagery. [22] Research shows that mental-imagery has the ability to get directly to the underlying issues of individuals distress, particularly images of bad experiences activate memories and associated emotions [35]. This has prompted various studies, and imagery-based techniques such as imagery rescripting has proven to be helpful in overcoming individual fears. [22]

2.5 Study preparation

Study preparation can also be a valuable component for reducing test anxiety. A quasi-experimental study conducted in 2019 [33] showed that by providing study preparation items and content, findings revealed that these measures influenced test anxiety and exam scores significantly. These study preparation items included refresher course in the beginning of class sessions, class presentations, end-session summaries, suggestions, and Q&A. Students were incentivized to join the study by being able to earn 10-35% of total scores from class activities. This study showed that if students know that some degree of their score is already accounted for by participating in class activities, they will experience a lower amount of stress before and up to an exam.

2.6 Mitigating public speaking anxiety through digital means

In recent years virtual reality has become readily available for consumers all over the world. According to Statista the VR market size is worth an estimated 4.8 billion USD, with an estimated 6 million units sold so far in 2021 [37]. This new technology comes with possibilities to also be utilized as a tool for treating public speaking anxiety. Research in the field lately has sought to predict the effectiveness of systematic desensitization through VR for mitigating speaking anxiety [11]. Data for this study was obtained from a user study with 23 participants. Participants completed 10 public speaking sessions while wearing an Empatica E4 wristband collecting EDA, blood volume pulse, body temperature and 3-axis acceleration during sessions. The participants' public speaking anxiety was evaluated based on a pre-and-post VR training encounter where participants presented for a live audience. Findings from the study revealed that bio-behavioral reactions obtained during sessions were able to predict the effectiveness of the treatment. A different approach towards reducing public speaking anxiety has been conducted through the usage of digital personal assistants [19]. The Amazon Alexa platform was used to develop a tutor to let users take part in a cognitive reconstruction intervention. Findings suggested that this could be a viable solution for helping people with fear of speaking publicly overcome their anxiety.

3. Usability study

This section describes the usability study, including the prototype used, participants, procedure, and findings. This study's purpose was to receive feedback in relation to the user interface and design of the application.

3.1 Prototype

The prototype which participants used in this study featured the following 'screens':
(1) Login & register user, (2) Schedule exam prompt, (3) homepage with access to schedule exercise (not time slotted), (4) dashboard where you can view completed exercises. The prototype featured one exercise and one behavioral task. Due to the purpose of this study the prototype was not focused on being content-heavy.

3.2 Participants

This study consisted of 5 participants, 4 interaction design students and 1 web developer. All participants recruited were living in Aalborg at the time.

3.3 Procedure

The procedure for this study was as follows: I scheduled meetings with the participants using Microsoft Teams. During this meeting the participants would then try using a prototype of TestAnxiety CBT through an emulator. I would briefly explain the application to the users, and instruct them to "think-a-loud" during their trial with the prototype. I would record, audio and video, while also observing the participants in real-time. After the trial I conducted an interview using the a pre-made interview guide.

3.4 Findings

By watching the interviews and transcribing these, I was able to narrow down key points that multiple participants commented on, the biggest one of these being the ability for users to schedule exercises themselves. One participant mentioned:

> *"I think it's important that users are able to choose their own time frame for scheduling the exercises. I might be busy, and only have time to do the exercises between 8 and 9 pm."*

another key point which surfaced was a lack of understanding and description, one participant commented:

> *"It's easy to navigate through the app but it's a bit unclear; the biggest challenge for me is to understand why I should do these exercises? What is the purpose?"*

another participant mentioned that he thought the application was missing an introduction and that it is unclear what the point of the application is. To alleviate this lack of understanding, several participants mentioned that they thought an introduction could be useful, one participant commented:

> *"It's kind of difficult to understand what the purpose is and what the goal is. I really feel I'm missing some context."*

These were the crucial findings - However this study also revealed various UI bugs and outlined various suggestions for improvement.

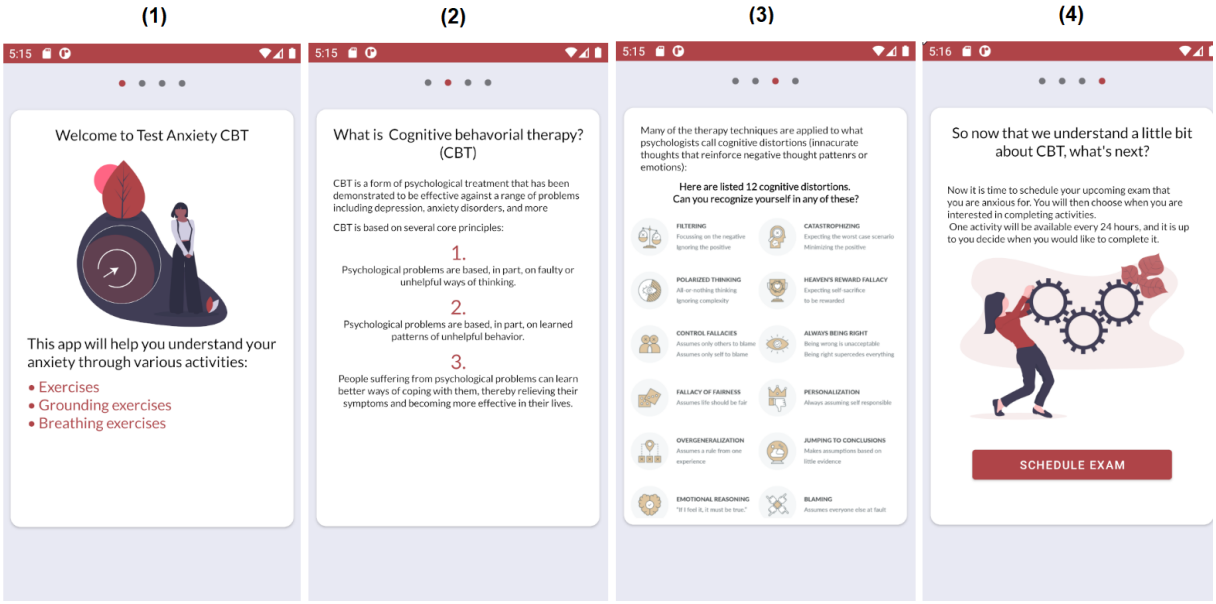

Figure 1: Introduction

4. IMPROVEMENTS

This section will explain the improvements that were made to the application based on the findings from the first study. Findings from the first study made it apparent that there was missing some sort of introduction for the user, to instruct and ease them into using the app. Findings also revealed a desire for users to schedule exercises to their own timeslots, instead of automatically becoming available after 24 hours. Therefore, I chose to focus on implementing these two features:

(1) Introduction
(2) Adding the ability to let users schedule exercises themselves.

I also realized at this point that there would need to be more exercises incorporated in the app. The added exercises will also be explained in this section.

4.1 Designing the introduction

The inspiration for the introduction came from exploring various CBT-focused apps and seeing how they on-boarded new users. I looked at three CBT focused apps: CBT Companion, MindShift CBT and Excel At Life. These apps were selected because all three apps had a large quantity of reviews, and a rating above 4 on the Google Play store. All 3 apps had similar introductions, and they were each focused on being short and precise. They were also focused on illustrations, rather than text. I used this new information to design the introduction (appendix 2). It uses 4 pages/tabs, and tries to convey the most crucial information to the user, these can be seen on figure 1:
(1) Introduction to what kind of exercises you will complete in the app. (2) Brief introduction to cognitive behavioral therapy (3) Cognitive distortions explained and (4) What's next

4.2 Allowing users to schedule exercises

This feature was highly requested by the participants of the usability study. It uses a Date Picker module and a Time Picker module to allow users to input their timeslot. This data is then inserted into the database. To check whether an activity is available, the app checks every second whether the timeslot from the database has exceeded the current time, if this is the case the button is set to enabled, and the user can start the exercise.

4.3 Adding more content

At this point there was only one exercise included. I decided to add four more exercises, based around various therapy techniques. The exercises in the app are the following:

1. Westside Test Anxiety Scale
2. 10 Study tips for better studying
3. Decatastrophizing exercise
4. Imagery-based exercise
5. Test exam exercise

The first exercise I added is based on the westside test anxiety scale. I believe it makes sense to have this be the first exercise because it helps users quantify the amount of anxiety they feel, and it also eases them into using the app. The second exercise is a showcase of 10 tips for studying. I decided to include the decatastrophizing exercise afterwards. This exercise was based on a therapy-worksheet [38] and it probes the participant into reflecting about the worst possibilities of an outcome. I included an imagery-based exercise where the participant re-experiences an aversive experience through their memory. In this instance this aversive experience is an exam where something went wrong. The exercise also tries to help them measure their discomfort and welcomes reflection. The final exercise is a test exam simulation. It prompts the user to simulate the exam situation by either presenting for someone or by completing a test exam.

5. FIELD STUDY

This section will describe the conducted field study, including participants, procedure, findings, and analysis. The purpose of this study was to test the apps usefulness and ability to reduce test anxiety.

5.1 Participants

The participants for this study was recruited through Facebook and through university channels like student mail. The only condition for participating was suffering from test anxiety to some extent. The study had 4 participants in total, 2 males (24, 25) and 2 females (23, 25). All participants were university students in their twenties. It should be noted that other initiatives were attempted for recruiting – However they yielded zero participants. The most significant of these initiatives was recruitment through AAU's studievejledning, which is Aalborg University's proposition for students with study-related problems.

5.2 Procedure

The procedure for this study was as follows: Participants would use the application for one week. Before this, an interview was conducted which sought to outline the participants former experience with test anxiety as well as their expectations for trying the application. During this interview participants were also instructed to complete a maximum of one exercise per day. After a week, a post-interview was conducted. The purpose of this interview was to deduce the usefulness of the application and gather various feedback regarding the application. These interviews were conducted virtually through the online-meeting programs Zoom and Microsoft Teams, and were recorded and transcribed for analysis purposes. Analysis was conducted through coding the transcripts from each participant. This resulted in an affinity diagram that can be seen on figure 2.

5.3 Findings

The study revealed a wide variety of findings. These are based on analysis of the initial and post interview. First the findings

of the pre-interview will be explained and then I will explain the post-interview findings.

5.3.1 Pre-interview findings

The pre-interview was used to gather rudimentary geographical information about the participants including name, age, and occupation. It also sought to provide an insight regarding why participants were interested in trying the application in the first place, as well as their previous experience with test anxiety. Lastly it touched on their expectations for participating in the study. Participants noted various experiences with test anxiety, mainly emphasizing on the physiological and mental effects before an exam:

"I get shivers, anxiety, headaches and have problems sleeping before an exam, but I also experience these effects more severely during the exam." – P1

Another participants noted that before an exam she would become stressed and unable to control her thoughts:

"I will get so many thoughts in my head that I won't be able to control them – Before an exam my head is literally spinning." – P3

All four participants also mentioned during the pre-interview that they thought their test anxiety was influencing their academic performance during verbal exams. Participants expectations varied, but one reshowing theme was a hope for the app to reduce their anxiety, and for the app to show them some new tools to manage their anxiety.

5.3.2 Post-interview findings

Coding each transcript from the post-interview resulted in the following categories emerging from the data:

- App design
- Introduction
- Suggestions
- Expectations
- Navigation
- Time management
- Notifications
- Issues
- CBT Exercises
- Grounding Exercises

The post-interview aimed to shed light on both the usefulness of the app as a self-help tool for handling exam anxiety, as well as the usefulness as a mobile app. The app was built with the material design guidelines [16] in mind, and questions regarding the app design in general was met with positive responses, mentioning that the design was "clean" and that the app "worked fine design wise". One participant also mentioned that the design was "very modern":

"In general, the design was quite nice, and very modern." -P4

The introduction in the application was as mentioned before added due to participants of the usability study repeating that they didn't understand the purpose and the goal of the app. The introduction seems to have resolved this issue, with three out of four participants mentioning that the introduction outlined the purpose and the goal of the app:

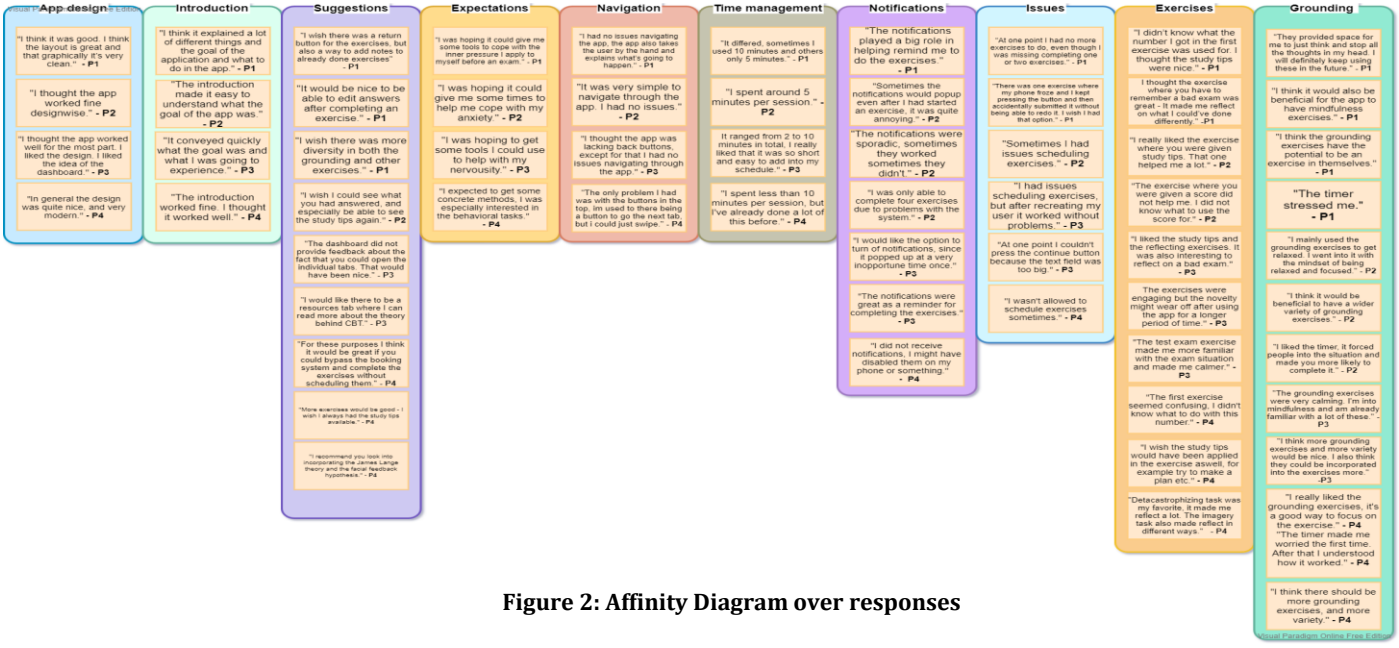

Figure 2: Affinity Diagram over responses

"I think it explained a lot of different things and the goal of the application and what to do in the app." – P1

Participant 3 noted that

"The introduction quickly conveyed what the goal was and what I was going to experience."

The interviews also generated various suggestions for improvement. A repeating suggestion was the ability to edit their answers. Several participants also mentioned that they would like more CBT exercises and grounding exercises, as well as more diversity in general:

"I wish there was more diversity in both the grounding and other exercises" -P1
"More exercises would be good." -P4

One participant also recommended that new grounding exercises incorporate the James-Lange theory of emotion [3]. Participants were also questioned in regard to navigating in the app, and except for one participant mentioning the need for a 'return' button, there was no issues navigating the app. Participants spent approximately 5-10 minutes on each session, and one participant noted that this was advantageous:

"I really liked that it was so short, it made it easy to add it into my schedule." -P3

The application also utilized push notifications to remind users to complete the scheduled exercises. P1 and P3 mentioned that the notifications helped remind them to do the exercises, while P4 mentioned not receiving any notifications and realizing during the post-interview that they had all notifications turned off. P2 had issues with the notifications, noting that the notifications only sometimes would show up, and that they sometimes wouldn't stop showing up:

"Sometimes the notifications would popup even after I had started an exercise. It was quite annoying", "The notifications were sporadic, sometimes they worked sometimes they didn't."- P2

The interview also revealed various issues with the applications built-in calendar system. These ranged from being unable to schedule and/or access exercises. Every participant had these issues and contacted me during the study. I was able to resolve these issues with a new version, allowing all users to complete at least four out of five exercises during the study. The exercises themselves were well received; Each exercise seemed to have some merit and reason to be included, however the first exercise that utilizes the Westside Test Anxiety Scale [10] seems to have missed the mark. Participants did not know what this score meant and what to do use it for:

"I didn't know what the score I got in the first exercise was used for." -P1
"The exercise where you were given a score did not help me. I did not know what to use the score for." – P2

Participants expressed positivity for the other exercises, however the exercise that provided 10 study tips was well-received:

"I really liked the exercise where you were given study tips. That one helped me a lot." -P1

One participant also noted that they wish that the study tips exercise would also apply the tips, by providing UI elements to try the tips (for example make a study plan).
The exercises incorporating cognitive behavioral therapy techniques were also liked, participants stated that the exercises made them reflective and revealed new innovative thought patterns. Each participant was prompted what their favorite exercise was, and a majority answered that the decatastrophizing exercise was the most beneficial. The grounding exercises proved very useful for the app in general, participants expressed that they allowed them to relax and become grounded:

"They provided space for me to just relax and stop all the thoughts in my head. I will keep using these in the future." -P1

Another participant mentioned that they believed these grounding exercises have potential to be a "real" exercise in themselves. Several participants conveyed a desire for more diversified grounding exercises. Participants also explained that they felt that the grounding exercises made them more focused when completing the CBT-related exercises.

6. DISCUSSION

Through the presented study I aim to attempt to quantify whether the app was able to influence participants test anxiety. Results from the post-interview revealed that participants of the study enjoyed completing the exercises, and that some of them felt that they were beneficial in helping them think in new alternative ways. However, the way the effect of this study was measured is purely through analysis of the interviews. Therefore, it is only based on participants feelings and emotions, but not their physiology. Therefore, it could be beneficial to conduct another study where the purpose is to also measure changes in participants physiological state through a wearable. This would allow me to compare any increases or decreases in their physiological state over time, and the results would be more credible as it would take both the participants word and their physiological state into

consideration. My results also align with results from Yusefzadeh [33], by participants referring to the study tips exercise as the most impactful. This could be due to its direct nature of just providing various tips – Whereas the exercises involving cognitive behavioral techniques require more reflection. Other studies also indicate that results to review anxiety differentials requires one to rely on longitudinal studies, one study [23] using six session treatments and a six month follow-up to measure differences in test anxiety levels. Another study also involved six sessions of 50 minutes [22]. Ergene's [27] meta-analysis also points towards this, noting that clients that spent 201-350 minutes in treatment produced a larger effect size in comparison to single session 0-60 minute therapies. The results from the field study was also aligned with Embse et al.'s [12] findings. They explain that various meta-analyses have identified cognitive, behavioral and a combination to be effective in treating test anxiety. This aligns with my findings, because most participants noted that the behavioral exercises before the CBT-related exercise were beneficial in getting them centered and relaxed.

ADAA [39] (The Anxiety & Depression Association of America) also explains that success of treatment various greatly, and that benefits from CBT are seen after 12 to 16 weeks of treatments, which also points towards one week being too little to observe any change in severity. Another interesting spin that could be put on this idea would be the involvement of a therapist. Katarzynka et al. [26] mentions that commonly CBT interventions are tailored directly to the patient based on their needs. Furthermore, Katarzynka et al. explains reveals that the results from their study showed that both users and therapists appreciated the ability to customize treatment. In the case of the Test Anxiety CBT app this could be integrated by allowing therapists to tailor exercises directly to the user, and the app would switch to become an interim tool for participants to use between therapeutic sessions. This could potentially improve the effectiveness of the app; however, it would also be a complete overhaul, moving the app away from being a self-help tool and more towards being a supportive tool therapist could use during a patient's therapeutic process.

6.1 Recruitment for the field study

As formerly mentioned in section 5.1, various initiatives were taken to recruit participants for the field study. However, some of these failed and did not yield any participants. This subsection will seek to analyze why this might have been the case. One reason might be that not many people seek treatment: Wang et al. surveyed 10000 people, and only 25 percent had received treatment in the year leading up to the study [29]. Goetter et al. [15] identifies the reasons that people suffering from generalized anxiety disorder and social anxiety disorder do not get proper treatment. The biggest reasons chalked up to be logistics, stigma or shame. Specifically, for social anxiety disorder the most referenced reason was handling their own problems, embarrassment and not knowing proper channels to get care. This could possibly align with my recruitment strategies – As formerly explained in the introduction test anxiety has the same symptomatology as social anxiety disorder, and therefore potential candidates did not contact me, potentially due to the aforementioned reasons such as wanting to handle their problems themselves or embarrassment.

6.2 Limitations

This section will outline the limitations for the second study. The biggest limitation was the number of participants, due to the small number of participants the data might not be fully representative of the demographic of university students struggling with test anxiety. Another limitation is the amount of time allocated for the users to utilize the app. One week is not a long amount of time and it might be difficult to quantify the ability to reduce test anxiety over a short time span.

The participants also did not utilize the app right before an exam, due to logistical problems. If this was the case, it would have been easier for participants to quantify their psychological state before and after the exam had taken place. This would also have allowed participants to check whether the prediction they had added while scheduling the exam in the app aligned with reality. It should also be noted that while the exercises within the application were created based on psychology literature and research I am by no means a psychologist and therefore my interpretation might be faulty and therefore the exercises might be missing components or features that an expert in the field would be able to notice and correct.

7. FUTURE WORK

This section describes the future work for the project. The goal of this project has been to reduce test anxiety for students, and therefore the next step for the project would be to release the application on the app store. However, while this would be the main goal, there are various steps that would be taken beforehand.

7.1 App improvements

As explained before, I was during this project in contact with AAU's studievejledning. During the initial meeting, I was offered a meeting with their UX Designer. I sent an apk-file of the application to the designer, who tried it and provided various feedback, most importantly regarding the user interface. During this meeting I received copious feedback to enhance and improve the user experience. The designer also had some other suggestions and noted that while the application was fully functional it was missing a reason to use it. This led to a conversation about gamification.

7.2 Gamification

and culminated with the idea of adding a system that would 'cheer on' the user. For example, after completing an exercise a

toast could pop-up saying, “Great Job!”, or potentially a mascot could be cheering you on as you use the app. Another way gamification could manifest in the app could be through achievements, or logistics such as graphs or meters. The purpose of these would be to give the user a sense of accomplishment by showing them their progress. This is already the intention with the dashboard – However, it would be redesigned to be more detailed and informative for the user.

7.3 Inspiration for AAU student app

The UX designer that I met with from studievejledningen was impressed with the exercises within Test Anxiety CBT. It was explained during the meeting that Aalborg University was working on a similar section to combat test anxiety for the “AAU student”-app. The designer commented that they were interested in using the application and exercises as inspiration for their official application, and that they had plans to discuss potential integration during their next formal meeting.

7.4 Expert study & future development

It would be beneficial to conduct a study with an expert to verify the application’s usefulness. An expert in this context refer to a professional psychologist with experience treating people with social or test anxiety. This was also something I sought to do during this project after conducting the field study. However, due to logistical issues I was not able to conduct this study in the time frame of this project. In an ideal world the application would be finished and contain a lot more exercises before this study was conducted. The procedure for this study would involve a brief presentation of the project and the application. Afterwards, I would showcase the application, through a brief demonstration showcasing it’s functionality – However, the important part of this expert study would be receiving the expert’s feedback on the grounding & CBT-based exercises, and their assessment as to whether or not it would be able to influence the users test anxiety. After analyzing and incorporating this feedback into the application it would be beneficial to conduct another field study with people affected by test anxiety. This time the duration of users trying the app would be extended to 1 month. It would have to utilized before an actual exam. A post-interview would be conducted after the exam. This would lead to users being able to compare their test anxiety during this period to previous periods.

8. CONCLUSION

This study investigated reducing test anxiety by using a self-help mobile app based around cognitive behavioral therapy. The goal of the study was to measure the effect of the apps capability to help alleviate test anxiety. Findings showed that the application was engaging and was able to give participants respite and allow them to think in different ways. The study also showed that the included behavioral exercises were beneficial in calming them down. Participants also explained that they thought that the application was a good starting point, and that it could potentially influence their test anxiety if used over a longer period, however this would require another study. My work should be seen as a preliminary study, showing that users can be affected through a self-help app to some degree. However, to measure the physiological impact as well actuators should be incorporated. I recommend for future work that another study be conducted measuring participants vitals throughout the study, *e.g.* by using a wearable actuator.

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