

AWEASURE VR: A SOLUTION FOR PHOBIA DISORDER USING VIRTUAL REALITY THERAPY

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Abstract

The concept of virtual reality has become the pen and paper of our digital world and it is the lens through which we experience much of our world today. Virtual reality technologies are widely used to simulate interactive, multimodal, natural environment, and social interactions. This technology is not only limited to entertainment industry, but has also proven its potential in various fields including healthcare, education, engineering, etc. Apart from many applications of virtual reality in healthcare, researchers have explored its application in phobia treatment. The Virtual Reality Therapy (VRT) is a new therapeutic approach that can be effectively used to overcome many difficulties inherent in the traditional treatment of phobias. This paper presents the psychotherapy mobile application that is used to treat the phobic disorder using virtual reality environment. The proposed system - AweCureVR has been developed to treat two phobias: Agyrophobia (fear of crossing roads/bridges) and Glossophobia (fear of public speaking). The AweCureVR provides cognitive behaviour therapy, exposure therapy and system desensitization sessions for each phobia. Moreover, the application also tracks user's progress regularly and generates reports for assessments. Experiments were conducted to evaluate the effectiveness and usability of the application. Results show that AweCureVR helped users effectively overcome their fear and they were highly comfortable using this application.

Keywords: Virtual reality, cognitive behavioural therapy, exposure therapy, agyrophobia, glossophobia, virtual reality therapy, anxiety disorder

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Introduction

The American Psychiatric Association states that phobias are known to be the most common psychiatric illness. The National Institute of Mental Health further confirms that phobias tend to effect approximately 12% of U.S. adults. These phobias become a major part of the minds and memories during the childhood phase and the symptoms are carried forward into adulthood. Traumatic events play a pivotal role in the development of phobias, like a bite from a dog or an incident leading to the death of a loved one. A phobia is typically defined as an anxiety disorder. It may cause an individual to experience extreme fear about a situation or an object. Some of the commonly known phobias include Acrophobia (fear of heights), Aerophobia (fear of flying), Cynophobia (fear of dogs), Astraphobia (fear of thunder and lightning), Social phobia (Social Anxiety Disorder), Aquaphobia (fear of water), Glossophobia (fear of public speaking), and Agyrophobia (fear of crossing streets). Description of these phobias is given in Table 1. When a person, suffering from a particular phobia, comes across such a situation he goes through intense distress and it may lead to panic attacks. Phobias are generally treatable mental disorder, and for many such disorders there are highly effective treatments that do not require drugs. Many people are able to overcome their phobias using psychotherapy such as Cognitive behavioural therapy (CBT) and Exposure therapy. Cognitive behavioural therapy is defined as a short-term, skills focused talking therapy used for altering maladaptive emotional responses by changing the patient's thoughts and behaviours. Cognitive behavioural therapy along with exposure therapy gradually encourages patients to face the disturbing thoughts and fears directly (Lindner *et al.*, 2019). Slowly and gradually, this therapy aims at lowering the peak anxiety the person experiences when they are exposed to their fear (Wang *et al.*, 2004; Zwanzger, 2018). In exposure therapy, person is made to experience phobia progressively to reduce phobic anxiety.

The application of virtual reality in healthcare has allowed alternative methods of treatment for people suffering from psychological

phobias through exposure therapy. Virtual reality exposure therapy (VRET) facilitates in providing the realistic environment for exposure therapy. Virtual reality provides various benefits for such therapies that were not possible using traditional ways of therapies. Virtual reality is an interactive computer generated simulated environment which incorporates mainly auditory and video feedback. It may also allow other types of sensory feedback and forces feedback via haptic technology. This simulated environment can be very similar to the real world. When a person faces his fears via virtual reality he can actually learn to cope up with the fear in real life (Serrano *et al.*, 2019). Augmented reality systems may also be considered a form of virtual reality that aims to perform a perfect blending of the real surrounding experienced by the user with digital content through a software. Augmented reality further tends to layer virtual information over a live camera feed into a headset or through a smartphone or tablet device enabling the user to view three dimensional images. Furthermore, some of the difficulties inherent in the traditional treatment of phobias can be easily overcome by using VRET as a new therapeutically approach which would help the sufferer. VRET can also provide stimuli for patients going through a difficult phase of imagining scenes and/ or are too phobic to experience real situations (North *et al.*, 1998; North *et al.*, 2002; North and North, 2016). Moreover, these VRET based systems exposes the therapeutic levels that are controllable, safer and convenient in all respects (Robillard *et al.*, 2003).

This paper presents an android based mobile application AweCureVR that utilizes virtual reality to treat Agyrophobia and Glossophobia. The application works with virtual reality headset to create a virtual 3D interactive environment. Agyrophobia is typically defined as the fear of streets or crossing the street where as fear of public speaking or speech anxiety is commonly termed as Glossophobia. The AweCureVR application comprises of modules that provides cognitive behavioural therapy, exposure therapy and

Table 1. Common types of phobia

Types of Phobia	Description
Acrophobia	Fear of heights. Anxiety attacks and avoidance of high places are the most common results of such fear. People who are prone to such phobia will generally avoid high buildings, bridges, theme parks and anything which involves height. Such type of a phobia may lead to panic attacks and various types of actions which link to avoidance behaviours (Coelho <i>et al.</i> , 2009).
Aerophobia	The fear of flying. Such type of a phobia encourages people to avoid flying altogether. It has been observed that many people tend to have some level of flying fear. Trembling, pounding of heartbeat, sweating feeling of disorientation are some of the symptoms attached to aerophobia (Ribeirinho Marques <i>et al.</i> , 2017).
Cynophobia	The fear of dogs. The memory of personally being bitten by a dog during childhood serves as a strong association to such a fear. Such experiences might prove to be intensely traumatic leading to fear responses and eventually finding its way into the world of adulthood. Phobia of this kind proves to be an unfounded and excessive degree fear that can have a serious influence overall on a person's life and functioning. For example, a person having such a phobia might avoid walking down a certain street because of the fear of being bit by a neighbourhood dog. Such an avoidance may have a profound impact on the individual's personality and ability to go about their everyday chores. This further makes it difficult to get to work, school, office or other events outside home (Rentz <i>et al.</i> , 2003).
Astraphobia	The fear of thunder and lightning. Astraphobia tends to create overwhelming feelings of fear in people when they experience or hear any weather related incident. Such a disorder may lead people to take shelter or even hide in creepy places like closets or attics etc. The symptoms of such phobia are constant shaking, pounding of heartbeat or an extreme level of respiration (Harned <i>et al.</i> , 2014).
Social phobia	The fear of social situations or gathering. Also known as Social Anxiety Disorder, is a kind of a phobia which involves people. Many a times these phobias can become so extreme that people tend to avoid crowded places, gatherings and sometimes even people who might trigger an anxiety attack (Stein and Stein, 2008).
Glossophobia	The fear of public speaking, is the most common form of social phobia. People who suffer from Glossophobia tend to shy away from any situation involving speaking to a large or small group of people. The symptoms involve freezing in front of any audience, drying of mouth, weakening of voice and body shaking. In other conditions they might start sweating, blushing and even feel their heart pounding frantically.
Agyrophobia	The fear of crossing streets, intersections, highways etc. People with such phobia are very well aware that it's safe to cross and the streets are not prone to any danger but their anxiety level triggers as soon as they try to cross streets or for that matter go up by an escalator. Such a phobia might be a result of some traumatic event or maybe some kind of a mental disorder. Agyrophobics develop such an extreme fear of crossing roads that it might lead to hindrance in normal day activities like grocery shopping, walking to parks and in extreme conditions avoiding vacations with their families as well

system desensitization sessions for treating both types of phobias. Systematic desensitization is a kind of behavioural therapy that uses relaxation strategies to remove the fear response of phobia. During the sessions, users are exposed to virtual fear triggering scenarios gradually. The sessions are divided in various levels starting from less anxiety provoking situations to more aggressive situations. The users' timings and reactions are recorded for each session and a progress bar is generated for self-assessment. The mobile application has been designed and developed keeping in mind the therapeutically

techniques used by the psychologists to help people overcome their fears.

Related Work

Virtual reality has been employed for the treatment of phobias extensively. Several studies have been conducted in this domain. An experiment on fear of public speaking in virtual reality was conducted by the Departments of Psychology and Computer Science, University College London. This

experiment focused on a small pilot study of 10 people presented before a virtual audience. The sole purpose of this experiment was to observe and evaluate the extent to which virtual audience impacts social anxiety specially fear of public speaking (Pertaub *et al.*, 2001). Researchers at University College London in collaboration with the Institute of Psychiatry, Kings College London, UK conducted a study that examines a necessary condition for successful exploitation of a virtual environment (VE) in therapeutic intervention for fear of public speaking. The condition involves clients experiencing a degree of anxiety in the VE which is a replica of what they would have been expected to experience while being in a similar real world setting (Slater *et al.*, 2006). An Experiment was also carried out for the cognitive behaviour therapy for public speaking using virtual reality by the University of Haifa, Mount Carmel. This study inspected and proved that Virtual Reality CBT (VRCBT) complements traditional CBT. Various difficulties such as lack of therapist control, patient's inability to imagine, loss of confidentiality resulting from public exposure, can be easily overcome by VRCBT which offers new doors for therapist control (Wallach *et al.*, 2009). Similarly, many studies have been conducted for treating phobias that are based on VRT (Gebara *et al.*, 2015; Maskey *et al.*, 2019). As virtual reality applications converges to mobile phone with virtual reality headset and gears available with most mobile phones, various mobile applications were developed for phobia therapies. Below is the brief summary of applications that are currently available.

- a) Itsy: This app aims to slowly expose users to a wide variety of spiders in different, life-like environments. In the

initial state the spiders tend to be pretty tame, almost depicting cartoon characters. However, gradually they become more realistic with increased stimulus intensity. Users during the experience are comfortably seated to get the most out of the app.

- b) Fear of Public Speaking - Personal Life: This virtual reality app has been designed by Samsung to help people overcome their fear of public speaking. The best advantage this app offers is to give you a lifelong experience in learning to speak comfortably in five different scenarios which depicts real work life.
- c) Fear of Heights- Cityscapes: This virtual reality app has also been designed by Samsung for people who have a fear of heights. Through this app one is exposed to a rich 360 degree visual in namely three different outdoor settings— elevator, skywalk, and a virtually created tower.

Many other VR based applications are also available such as Richie's Plank Experience developed for fear of heights, Samsung's BeFearless that different fears, Ovation and Limelight for public speaking training. Most of the these applications are commercial products. Table 2 lists few such applications. AweCure is non-commercial product that is available freely. AweCure includes therapies for both public speaking fear and height fear whereas most of the other applications are specifically designed for treating one phobia only. Also, AwerCure not only includes cognitive and exposure therapy sessions but also incorporates system desensitization to relax the user after exposure therapy.

Table 2. Various VR applications for phobia therapy

	Fear of Heights	Fear of public speaking	Fear of Spiders
Arachnophobia	N	N	Y
Richie's Plank Experience	Y	N	N
Limelight	N	Y	N
Ovation	N	Y	N
AweCure	Y	Y	N

AweCure VR – The Proposed System

The proposed system AweCureVR has been designed using an android platform to facilitate people in overcoming two fears-the fear of public speaking and the fear of crossing roads/bridges. The system itself serves as a therapist for the people using it for the sole purpose of eliminating or reducing their above stated fears. The mobile application has been designed and developed keeping in mind the therapeutically techniques used by the psychologists to help people overcome their fears. The application comprises of two major modules, that is Agyrophobia module and Glossophobia module. Each module presents five sub-modules, cognitive behaviour therapy, exposure therapy, system desensitization, progress and exercises.

- a) **Cognitive Behaviour Therapy:** Cognitive behaviour therapy is a short-term, goal oriented psychotherapy treatment. This technique aims to change the pattern of thinking or behaviour of the people experiencing anxiety or phobia, and thus make them change the way they feel. This helps in reducing the anxiety levels to a great extent.
- b) **Exposure Therapy:** Users tend to experience their fear in virtual reality via virtual reality headset. Users go through the exposure therapy sessions step by step which helps them to step out of their comfort zones and ease their sufferings slowly and gradually. If the user experiences anxiety during exposure therapy session, they have the option to switch to desensitization level just by eyeing the button during exposure therapy.
- c) **System Desensitization:** Desensitization technique is used to relax the patient during exposure therapy in reality by a psychologist. The same process has been cloned in the system such that the user's anxiety level is brought down during the exposure therapy via relaxing scenes which depicts a green garden, a peaceful sea view, and other pleasant scenes to relax user's mind. This helps the user in

- d) **Progress:** Each exposure therapy level records user's progress in terms of time and score. These progress reports are generated regularly to for assessments and suggestions. Figure shows the progress and exercise screen in the AweCure App.
- e) **Exercise Videos:** Another interesting feature offered by the system is the opportunity for users to watch the basic workout videos. This promotes healthier life style for the users as they exercise daily and moves them towards becoming a healthier person both mentally and physically. There are three categories of exercise videos, deep breathing, meditation and muscle relaxation as shown in Figure 1.

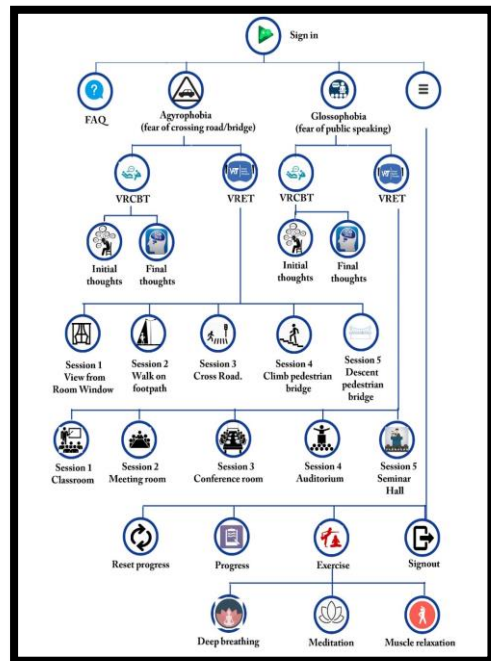


Figure 1. AweCureVR application

The system has been designed in such a way that the user first has to sign in to the app using Google Play Games services. After

signing in the user has the option to select their desire phobia for therapy or can head over to the navigation to watch Exercise Videos. After selecting the desired phobia the user needs to go through the CBT session for an interesting counselling therapy after which the user will enter into the Virtual Reality Exposure Therapy (VRET) zone for the exposure of their fear. VRET will generate an assessment report regarding user's observation during exposure therapy sessions. This will help the users to eventually unlock the next therapy session depending on the basis of the current exposure therapy session and their results. Figure 1 depicts the detailed flow of the AweCureVR application.

In Glossophobia module, exposure therapy includes five sessions comprising of classroom, meeting room, conference room, auditorium and seminar hall scenarios as shown in Figure 3. In each session, realistic virtual presentation scenario is presented to the user with prototypical audience. The level of scenarios is gradually varied such that user gets familiar with the environment and overcomes the fear of facing people. Eye contact of user is tracked during the sessions. Similarly, in Agyrophobia module, exposure therapy also consists of five

sessions. In each session user is presented with various virtual environments such as walking on pavement, crossing road, and pedestrian bridge. The scenarios are made more challenging with each level. At any instant, user can switch to desensitization module to relax. Figure 2 shows the screens from Agyrophobia module of AweCure App.

Material and Methods

Experimental Design

A survey was conducted on a group of people suffering from Agyrophobia and Glossophobia in Karachi. This survey was carried out to test the usability of the mobile application AweCureVR with people suffering from two different anxiety disorders with the aim to evaluate the usability and effectiveness of the system. The survey started off with the users exploring mobile application on their own. Later, a questionnaire was also provided to the users to document their experience. The survey subsequently aimed to test how well the users understood the mobile application and how quickly they acclimatize with the surroundings of the application. The users who

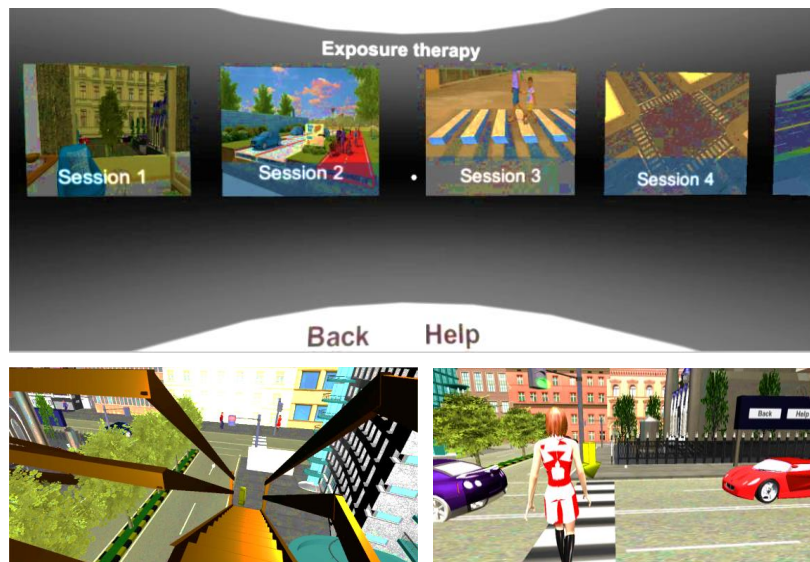


Figure 2. Agyrophobia Exposure Therapy sessions screen in AweCureVR application

participated in this survey were all adults belonging to (18-35) age group. The selected users were familiar with the usage of virtual reality headset. After explaining the functionality of the system and objective of the experiment to the users, the mobile application and headset was handed over to each user. A questionnaire was prepared using customized version of Post-Study Usability Questionnaire (PSSUQ)

(Rosa *et al.*, 2015). The subjects were requested to provide feedback after using and becoming familiar with the AweCureVR mobile application. The usability of the system was tested in terms of Design/Layout, Functionality, Ease of Use and Learnability. Following section discusses the results accumulated from the responses recorded by the users while filling in the questionnaire:



Figure 3. Screenshot of Glossophobia exposure therapy sessions screen in AweCureVR app

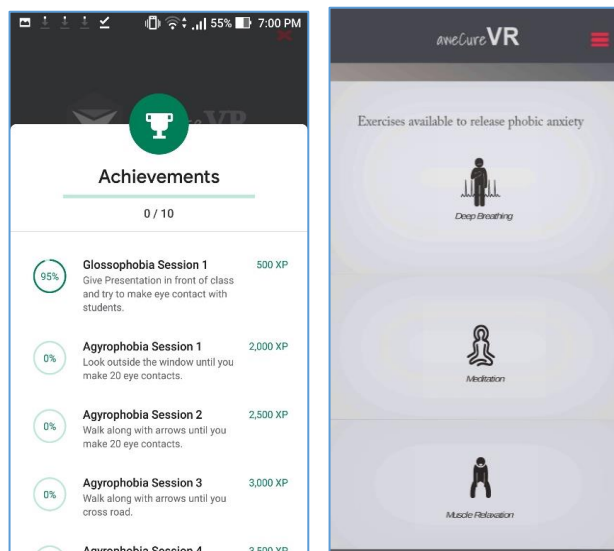


Figure 4. Progress and exercise screens in AweCureVR app

Results and Discussion

Design/Layout: The questions asked for the design/layout in the questionnaire and recorded responses of the users have been clearly crafted below in the graph as given in Figure 5. Majority of the users liked the interface of the system and were satisfied with the organization of information presented to them. However, the users who were less familiar with using virtual reality headset were not comfortable with the system.

Functionality: The functionality section of questionnaire was prepared to evaluate the effectiveness of system. The Figure 6 depicts the summary of users' responses. User's responses for statement "the system has all the functions and capabilities that I expect it to have" shows how much AweCureVR fulfilled the desired expectations of the users regarding phobia therapy. According to the accumulated results 40% users agree that the system has all the functions and capabilities which meet their

expectations. While other 40% users responded as neutral for statement 1 and 20% users responded as strongly agree. Hence, majority of the users were satisfied with the features of the system. Similarly, 80% users were agreed that information provided by the system was helpful in completing the tasks. The results show that VRET sessions were helpful to users' in overcoming their fears. According to the statistics 50% users agreed that the VRET sessions were interesting and beneficial for phobia therapy. While the other 30% users responded as neutral. Furthermore, 50% users agreed that cognitive behavioural therapy is very beneficial feature for counselling.

Ease of Use and Learnability: Around 90% of the users were of the view that AweCureVR is easy to use and does not have learning curve. Users learned the system quickly and no training session were needed. However, it was noted that users who were accustomed to using virtual reality headsets were most quick learners. Majority of the users agree that

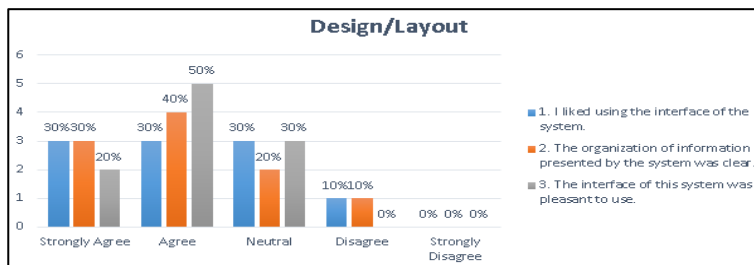


Figure 5. Evaluating design - questions and results

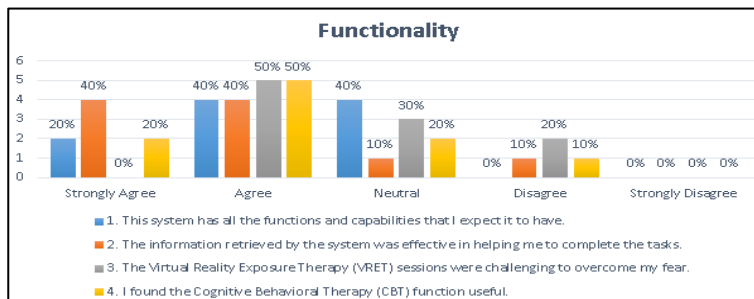


Figure 6. Evaluating functionality- questions and results

AweCureVR does provide easy to understand instructions wherever needed. Figures 7 and 8 depicts the results of ease of use and learnability questionnaire.

Conclusions

This paper presents a virtual reality based mobile application- AweCureVR that offers cognitive behavioural therapy and exposure therapy sessions for Agyrophobia and Glossophobia. The application presents virtual environments created using 3D technology of fear situations which are used for therapy. The

AweCureVR has potential for treatment of fear of public speaking and street crossing. However, the preliminary research is most focused on development of highly usable application with prototypical scenarios. Further, along with therapies AweCureVR can also monitor and record the user's progress in terms of their phobias via observation and user's eye contact in VRET. The experimental results show that AweCureVR can prove to be very useful to overcome the sufferer's fear and further help to raise their self-confidence. The mobile application "AweCureVR" is available on Google Play Store for users and is freely available for download.

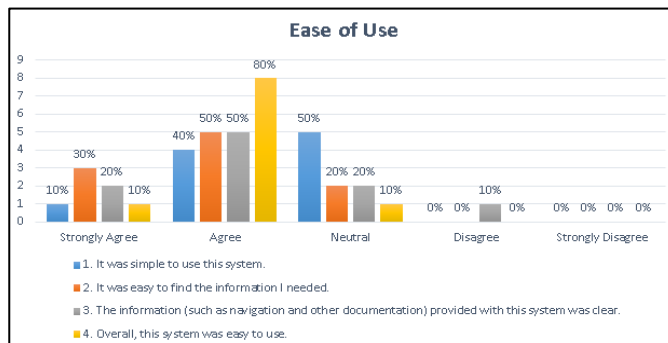


Figure 7. Evaluating ease of use - questions and results

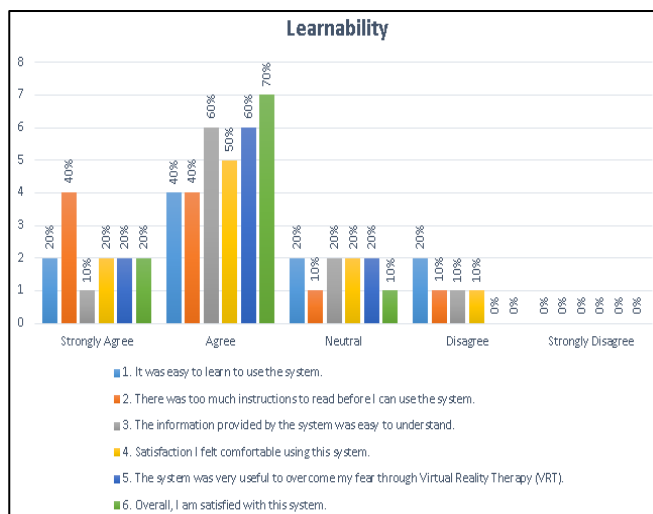


Figure 8. Evaluating learnability - questions and results

Disclaimer

This project developed for academic and research purpose only. This is not a commercial product and publishing of this paper in the journal is by no means endorsing nor promoting the commercialization of the product and its derivatives.

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