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Development of Virtual Reality Application for Arachnophobia Using Multimedia Development Life Cycle Method

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Abstract

Arachnophobia or known as irrational fear of spiders, can be detrimental to one's health and overall well-being. Common procedures, such as Cognitive Behavioral Therapy or medication, are often inefficient and take a lot of time to demonstrate results, thus the alternative way of dealing with arachnophobia is urgently needed. Such alternatives can be achieved by utilizing Virtual reality technology, hence the purpose of the following research is to address the matter by developing Virtual reality based application with the help of Multimedia development life cycle method. The MDLC method was chosen due its ability to create multimedia application, and the collected results of the experiment demonstrate that indeed MDLC can be used as a method to develop the arachnophobia therapy application that is both time efficient and works as test shows the decreasing time used for use application as well as two respondents that able to be detected for having arachnophobia. In conclusion the application developed using MDLC is indeed able to be an alternative way of arachnophobia therapy.

Keywords: Arachnophobia, Virtual Reality, Exposure Therapy, Multimedia Development Life Cycle, Anxiety Disorders.

1. INTRODUCTION

Arachnophobia, or spider phobia, is an irrational fear of and aversion to spiders [1]. It is one of the most common if not the most common forms of mental health conditions, it has 7.2% prevalence of the lifetime of specific phobias [2]. As Oosterink FM's research suggests, arachnophobia is a greater concern in women, with around 2.7-6.1% of the population becoming affected [3]. Despite being largely harmless to people, sufferers are afraid of them even posing a threat to their health and life [4]. The symptoms of arachnophobia may include trembling, sweating, fast heart rate while encountering the stimuli as well as emotional disturbance in both men and women [5], [6].

Arachnophobia negatively impacts health and quality of life, leading to avoidance behaviors concerning spiders and related activities [7], [8], [9]. Such avoidance

affects social and professional aspects of life and can worsen the condition [10]. Sufferers may also display abnormal behaviors or cognitive biases towards spiders [11]. The conventional ways of dealing with arachnophobia that known to be effective are: Cognitive behavioral therapy or known as CBT, exposure therapy, and medication.

According to study by Patriarca, CBT has shown to work perfectly in treating anxiety illness in children and adolescents through individual, group, and telehealth means [12]. In addition, the study by Kemp indicates that exposure therapy helps in dealing with the therapist's anxiety before treating patients [13]. Finally, the research by Stein reveals the benefits of using medication called agomelatine that is known as some types of antidepressant medication, as a way of relieving the symptoms of Major Depressive Disorder and Generalized Anxiety Disorder [14]. But despite the known effectiveness, the traditional way as mentioned before still have a number of limitations.

First there may be no improvement or delayed improvement with CBT and exposure therapy [15], and individuals may experience technological challenges associated with these methods of treatment. Indeed, they include the need for economic resources and the need to sacrifice time to the treatment, which most of individuals that suffer from this may not have [16], [17], [18]. In turn, the majority of drugs induce significant side effects, which are electrical shock, akathisia or known as inability for person to stay still, syncope or passing out, vertigo, and vomiting [19]. It is why it is described as vital to review alternative treatments for the problem.

Research from Seuling, Lindner P, and Toffolo MBJ state that Virtual Reality and Augmented Reality are the solutions that can be admitted in the case [20], [21], [22]. Such approaches as Virtual Reality Exposure Therapy or known as VRET connect traditional ways of conducting exposure therapy with the help of special computer applications and equipment [23]. Similarly, ARET or Augmented Reality Exposure Therapy includes the explained methods of exposure therapy integrated with AR applications, and in such a way, proved to be assisting. According to the research of Yeh, the first method, VRET, had better outlined outcomes [24]; therefore, it was chosen as a tool to treating arachnophobia.

Developing VRET has two models: VR equipment and therapy application. VR equipment is relatively accessible nowadays, but creating an effective VRET application is more complicated. MDLC [25], waterfall [26], and agile [27]methods are used for application creation. Research by Fadillah, Nurhasan, and Akbar demonstrate the success of the MDLC method in creating VRET for acrophobia [28], [29], [30]. Therefore, this research uses this method to create VRET for arachnophobia.

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Hence, the goals or aim of the present research are to create a VRET based application on dealing with arachnophobia that simulates or even better than conventional therapy with the help of MDLC method to develop and to analyze the results of the application. The MDLC method is used to create a VRET in the context, as it is an effective method for designing VR applications [31]. This study aims to improve arachnophobia therapy by creating affordable and effective media for customers and professionals.

2. METHODS

The presented study systematically explains the sequence of processes. It includes three stages: problem identification, data collection, and development. The initial stage of this research is problem identification. The following second stage is data collection performed with the help of the mixed methods including literature review and observation. The final, third stage is development, and it uses the multimedia development life cycle method. Research process details seen on Figure 1.

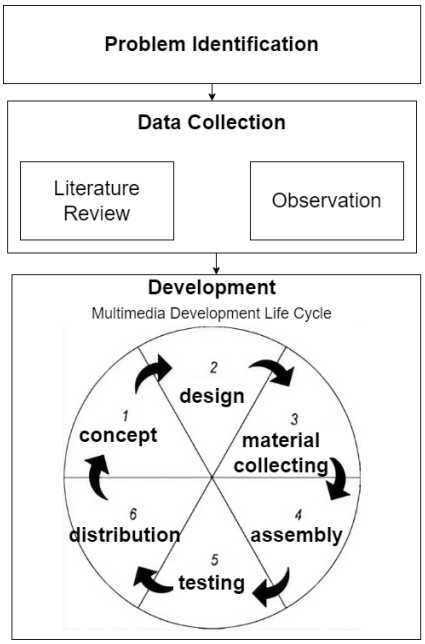

Figure 1. Research Process

2.1. Problem Identification

The Very first stage on this study is doing identification on the problem. This is covering the problem or issues with conventional way to dealing with arachnophobia, such like CBT, therapy traditional exposure, and medication.

Previous study alike shown the result of effectiveness on these way on dealing with arachnophobia, but they have bigger disadvantage or limitation like side effect of usage, lack of human professional that supervise the therapy, and hardly access to the treatment In other word it is not accessible for anyone [32]. For detail example, the implementation of traditional CBT and exposure therapy in the practical situation shows that session first needed more than one to see the result, second not only it needs more than one session of therapy it also needed more time for the therapist perspective, resulting on less accessibility for the treatment [16], [17], [18]. Medication also has shown in previous study a short term symptom relief, yet later there known to be a side effect such dizziness and nausea [19].

2.2. Data Collection

The second stage which is data collection. On this study the data collection is being done by literature review from previous study on way to treat arachnophobia and with observation in the current industry medic standard. This study has at least three aim of what data needed to be collected, first is heart rate criteria rate to get better deep information about how good heart rate should look like, second is categorizing of heart rate so the prototype and the application can be suitable for responded with different demographic, last is standard questions that follows medical instruction to get more conviction on how one is identified as person that has phobia or not. Data that accurate is crucial on making effective therapy tool that personalized [33].

2.3. Development: Concept and Design

The third stage is where the development phase begins, and it begins with get the concept of prototype and application right as well as the design that fit medical instruction. The concept is essentially combining the old traditional way of dealing with arachnophobia such exposure therapy with modern technology of virtual reality that enabling the realistic simulation of spider movement within the environment that can be justify according to needs of therapist.The exposure therapy is gold standard of dealing with anxiety disorder such phobia [34], this works by encouraging the suffer to slowly fight its own fear by exposing it directly to the fear object [35]. previous study has demonstrate and proving this method as effective way to dealing with any kind of phobia such phobia of height [36], phobia of speaking in public situations [32], and phobia of blood [37], thus this study will also has the same concept of creating realistic environment where the suffer will slowly must face its own fear of spider and with the helping of heart rate tracking device, phobia can be spotted. Design phase involve creating the initial blue print for prototype of VR application as well as how the therapy will be conducted, UML or Unified Modeling Language (UML) will be used on this

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study because,it allows to get excellent visualization of architecture and how the system or app flow and iterating with user [38].

2.4. Development: Material Collecting and Assembly

Then development phase continues with collecting material needed for building the prototype as well as assembling it in way that fit the requirements of the virtual reality device. To build virtual reality application that could actually helping on simulating the exposure therapy or even better, it requires 3D asset that can be create or outsource and also the program in which it controls the whole application on how it works. The 3D assets for this application consist of the spider object and ideally it has realistic and procedural animated to create simulation of spider that so realistic close to real life spider, then the application also needed the environment where the therapy will be happening. spider phobic or phobia suffer in general tends to complaints about how their day to day live is miserable due to this anxiety issue [39], [40], the reason for that is spider usually tends to appear in the area where the suffer spend the most time in, such bedroom, bathroom, and kitchen, so its important to create Virtual Reality simulation that can simulate this environment and make sure that suffer can recover slowly and gain their ability to face fear of spider in these area, so this study will collect the 3d area where it can simulate these particular environment. The assembly is process where all the material that has been collected being craft together that fits the requirements of virtual reality device such oculus. the output of it, is the multimedia program that shows 3d environment with realistic behaviour spider and player that can interact with whole simulation.

2.5. Development: Testing and Distribution

The development stage ends with the testing of prototype and application as well as the distribution of the program. For every kind of software, no matter what device or media it used it always needed to be tested before releasing it to public, usually in the form of prototype, this study will follow the same principle. the testing part of development will be done to the prototype of virtual reality app as well as the final application, this way it can gives the comparison on how well the user can use the app as well as later the therapy it gives to the user. The testing of this study first will be conducted on user experience usability testing, with the aim of knowing how well the user will be performing upon completing task. Then the efficiency also will be test by doing calculation on how long user perform on prototype compare to final software. The distribution is the part where the application is ready to be open to public, the aim of the paper is to create application that can actually help suffers arachnophobia deal with its problem as well as the therapist, it is best to distribute the application to be open source, so it can be used and access by those who needed.

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3. RESULTS AND DISCUSSION

3.1 Data Collection

Data collection stage was done via the literature review and observation. The sources include data from study by Fadillah [28] and the study conducted by P.Muris [41]. The data are presented in Tables 1, Table 2, and Table 3.

Tabel 1. Max Heart Rate Target

Age group	Heart Rate Bpm Target (50%-85%)	Median Max Rate Bpm (100%)
20	100-170	200
30	95-162	190
35	93-157	185
40	90-153	180
45	88-149	175

Table 1 shows the data of the target heart rate or HR ranges, in different groups demographics like age there are maximum range heart rate in which it provides a references for cardiovascular during on the exercise intensity.Along with different groups of demographics age, each of the group has its own target HR range that expresses in the measurement in the minute or beats per minute (bpm), and can be calculated as 50%-85% estimation maximum HR group, the formula for this is 220−age220 - \age 220−age.For brief instance, if someone at age 20, the target HR range will be 95-162 bpm, and will also has maximum HR of 200 bpm; meanwhile if someone is at age of 45 lets says he would have the target HR range of 88-149 bpm with the maximum HR going to be 175 bpm.This value is important as a guideline of aiding every individual in any age group to monitoring its own improvement during cardiovascular fitness activity.

Tabel 2. Heart Rate Resting Criteria For male

Age group	18-25	26-35	36-45	46-55	56-65	65+
Is (Athlete)	49-55	49-54	50-56	50-57	51-56	50-55
Is (Excellent)	56-61	55-61	57-62	58-63	57-61	56-61
Is (Good)	62-65	62-65	63-66	64-67	62-67	62-65

Is (above Average)	66-69	66-70	67-70	68-71	68-71	66-69
Is (Average)	70-73	71-74	71-75	72-76	72-75	70-73
Is (Below Average)	74-81	75-81	76-82	77-83	76-81	74-79
Is Poor	82+	82+	83+	84+	82+	80+

Table 2 shows the resting heart rate or RHR for male, in order word it shows the rate of male's heart during resting time. Similar to previous data in table 1, the RHR also has its own different groups demographics, but now this Table also soft of categorizing them across six categories of fitness. The idea is for instance, if a male in age of 18-25, he would categorize as "Athlete" if his RHR ranges from 40-52 bpm, and if male in the age of 46-55 can get RHR of 49-54 he could also be in the "athlete category" despite age different. In this table it shows that as the male age increasing the RHR also will be increasing due to change of cardiovascular efficiency in the body. Another important thing to know is women also has RHR value that close to this table but just 2-7 bpm higher than on male category.

Tabel 3. Spider Fear Questionnaire (SPQ) score

Grouping	SPQ score (scale runs from 0 to 31)
Non-phobics	2.7
Spider Phobics before treatment	23.2
Spider Phobics after treatment	14.2

The table 3 shows one of the finding of research that was done by P Muris [41], which is score to scale if individual could be identified as having arachnophobia, it known as The Spider Phobia Questionnaire (SPQ) score. This score ranges from lowest 0 to highest 31 and in across different groups like table 1 and 2. for example is someone have average SPQ score in the 2.7, he may not indicate to having spider phobia, so he would be categorizing as non-phobic individual. In the contrary if someone manage to be having SPQ score up to or higher than 23.2 he would categorize as individual with spider phobic before receiving treatment. Lastly if someone previously had been reported to having spider phobic and manage to get treatment and scoring on 14.2, he would categorize as person with spider phobic after treatment.

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3.2 Concept

The concept for this study is essentially simulating the traditional way of dealing with arachnophobia by exposure therapy with the combinations of virtual reality technology or could be prefer as virtual reality exposure therapy (VRET). The idea is the person that suspected to having spider phobia or person that is actually has one must deal with the scenario in which it will trigger their phobia by interacting actively with the object, and slowly the scenario will be increased by the supervision of therapist [42], this way one could step by step overcoming the fear of the phobic object [43]. this concept of alternative way for dealing anxiety issue such phobia has been done by many previous study, such research by CJ Gilbertson where VRET could be used to managing needle phobia [37], also research by SC van Veen where VRET is utilized for way to dealing with anxiety of public speaking [32], and research by H Hui where the same concept is used as way to deal with phobia of height [36]. The how application on this study works is by begin with ask a patient about their fears to identify their current situation. Then offer the patient to engage in the safe exposure exercises or use the virtual exposure. The patient would put on the setting and the fear-provoking objects and situation would appear around the familiar environments. Every ten minutes the researcher will get the heart rate of the person and estimate whether they are overcoming their scare. Once the person was exposed and overcame the objects or thinking, they would be transferring the objects to another setting.

3.3 Design

After the completion of concept stage, the design stage will begin. The idea for the design of this application is the app allows user into interacting with two main components: the therapy guideline and a smart watch. The guideline is the procedure of conventional traditional exposure therapy and are linked into Virtual environment. Meanwhile the smart watch will be the source in which used as tracking progression of user's BPM heart rate, this allows real time feedback to therapist. This very design have been used in previous study on different anxiety issue such study by Fadillah where this design model used to threat the phobia of height [28]. The broader yet still related study that used similar principle in the design can be found in the study conducted by Syeda Hoor-Ul-Ain where similar model design used for tackling mental issue at the COVID-19 time [44]. more detail can be found below on Figure 2

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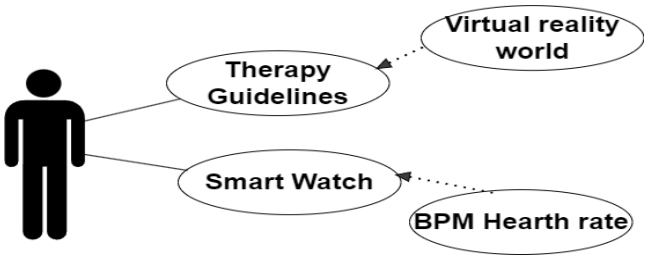


Figure 2. Use Case Diagram

3.4 Material Collecting

During the material collecting stage, resources for the application to be developed are collected from the Unity Asset Store and Unity software library. Various materials are listed in Table 4.

Tabel 4. Material Application

No	Image	Description
1		Object 3d environment main room apartement, this is the first-place users enter during therapy.
2		Object 3d environment bathroom, it simulates the common place that spiders tend to appear in daily life.

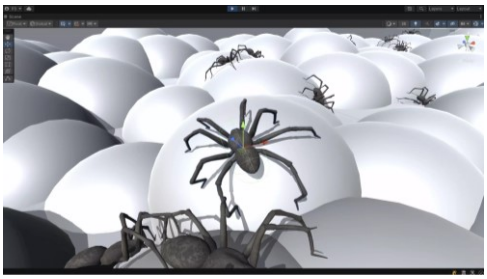
No	Image	Description
3		Object 3d procedural spider, it simulates a spider with realistic movement and behavior.

Table 4 shows the materials that were gathered to make the prototype and application. Number one shows image of a living room setting, this where the the user will start their exciting therapy session. Number two image shows clearly a bathroom, this environment is chosen for increased session arachnophobia due to spider habits that tends to appear in bathroom [45]. last is number three which shows spider, but this is not ordinary 3d spider, instead it is procedural generated spider with that allows spider to act super realistic, this way the therapy can get as close as possible to real life.

3.5 Assembly

This is the assembly stage or stage where the previous gathered material is being united. The way previous material will be integrated into VR application is through Unity software. This software was chosen because, first it is industry standard when it comes to creating multimedia product such VR and because previous study, such study Purwati by has shown the success in using the software to tackle the development of multimedia VR [46]. the assembly stage gives two outputs first the prototype and final application in which will be test later.

3.6 Virtual Reality Application for Arachnophobia Therapy

The exposure therapy for arachnophobia in this application starts at Level 1 where the respondent first will be place at the setting of large apartment and must interact with the spider that spawn around the area. Level 1 has a goal to interact with small quantity of spider in the area where previous study shown spider tend to appear there [45]. During this level the initial heart rate's respondent have will be recorded all the way to end of 15-minute session. The recorded time gives valuable data such peak bpm and overall average bpm that later can be used as base for the session of questionnaire. If the respondents done with 15-minute session in this level, then they will be guides to enter the Level 2. Detail of level 1 can be seen in below Figure 3.

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Figure 3. Level 1

After the completion of previous level, next level will be level 2. In this level the intensity and the behavior of object spider will be increase so that it can trigger more arachnophobia stimulus. The level 2 will be place in the hallway with the population of bigger and more aggressive spider. In this level the session also will be 15 minutes long and heart rate for each respondent will be recorded. After completion of first and second session level, then the respondent can now get into the questionnaire session. The detail of level 2 can be seen in figure 4 below

Figure 4. Level 2

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3.7 Testing

The first step was conducting user experience usability testing, where the users will be performing tasks to examine how well the features they are in the application and see how therapy method has worked [47]. In this particular study, this type of testing was done with 6 respondents, where there will be 3 people that have been chosen because of they might seems have the phobia, and the other group of 3 is random respondents

Tabel 5. Usability testing List of Task

No	Task Perform
1	Choosing all the menus on the application.
2	Interacting with the 3D objects of the apartment and its furniture.
3	Following therapy instructions, Level 1: Interacting with spiders in the living room, bedroom, and kitchen areas.
4	Following therapy instructions, Level 2: Interacting with spiders in the bathroom and apartment hallway areas.
5	Viewing heart rate results on the application.

Table 5 is providing very important outline: the usability test that will be used to testing the prototype as well as application. This test will be consisting of variety task that calculate in seconds, firstly starting with choosing all menu of the application, it is kind of that where it assesses user's ability in navigating interface as well as various feature functionalities. Second task then require user to interacting with the whole 3d object and the environment in the application such the furniture in the apartment. third and fourth are the tasks which focus on the instruction of therapist to interact with phobic object spider. The fifth task will be involved to viewing the heart rate (bpm) result of user, this is very important process during this therapy, because the data will be later measured can calculated.

Tabel 6. Singe East Question Measure

Very Difficult						**Very Easy**
1	**2**	**3**	**4**	**5**	**6**	**7**

Table 6 shows the measurement in which will be used to rating the application and prototype based on how user experience during session, in other word it is Single

Ease Question (SEQ) measure. This method of measurement is very common practice that aims to evaluate software based on how user completing the task given during usage of software. This measurement scale ranging from lowest 1 which mean "Very Difficult" to 7 the highest which mean "Very Easy", and with this measurement the researcher or developer will get valuable information or data that can later be used as base for improvement. For brief instance, if user complete task then rate it at 1 on the scale which indicate that the overall task to complete software feature is "Very Difficult", the researcher later can make the necessary adjustment based on this data for better improvement software. Below are the formula that used on calculating this measurement:

$$Effectiveness = \frac{Total\ number\ of\ tasks\ undertaken}{Number\ of\ tasks\ completed\ successfully} \times 100\% \quad (1)$$

Next, To check the efficiency of each component within the application and prototype, figuring out how fast users can finishing the each tasks is needed this is called Time-based efficiency. And can be calculated using formula that says higher value in second means better user experience for the application. The formula can is as follow:

$$Time\ Based\ Efficiency = \frac{\sum_{j=1}^{R} \sum_{i=1}^{N} \frac{n_{ij}}{t_{ij}}}{NR} \quad (2)$$

N = Participants.
R = Tasks.
t_{ij} = Successful completions of task j by participant i.
n_{ij} = the time taken by participant i to complete task j.
NR = All of tasks multiplied by the participants.

Table 7 are test results depending on the design that was created.

Tabel 7. Comparison of Task Completion Time in Seconds

No	Task	Task Completed	Prototype	Application
1	R1	5	1250	980
2	R2	5	1100	850
3	R2	5	1300	1000
4	R4	5	1000	900

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No	Task	Task Completed	Prototype	Application
5	R5	5	1150	920
6	R6	5	1350	1100

Table 7 shows important data that were the result of recorded time of users to finish the tasks while using the application and the prototype that was measured and given in seconds. The table also shows that task completion times ranges from 1 to 6 task which were completed by respondent one to six or R1 - R6. Data that appear on table shows that R1 for instance had a completion time of 1250 seconds in the prototype but surprisingly can manage to get only 980 seconds to complete in the final application, the meaning of this is, there is a substantial in reduction of time require if someone had to use final application instead of the prototype. This goes also for R2, R4, and even R6 that also shows reduction in time usage if they were to use the final application. This indicate only one thing The application was faster for all users, indicating it is time efficient.

Tabel 8. Comparison of Efficiency Results in Seconds

No	Task	Task Completed	Prototype	Application
1	R1	5	0.004	0.005102
2	R2	5	0.004545	0.005882
3	R2	5	0.003846	0.005
4	R4	5	0.005	0.005556
5	R5	5	0.004348	0.005435
6	R6	5	0.003704	0.004545

Table 8 providing the data in which, is the result of efficiency comparison result. Like previous table 7 the comparison of Task Completion, this data also calculated with the user or R1 to R6 completing given task on both the application and prototype and measure in seconds. The different is, instead of raw data, the efficiency comparison is the final calculated using the above math formula of time-based efficiency. This data is very important as an initial guide to analyze how well user can respond to the prototype and final application.

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Tabel 9. Comparison of Task Satisfaction Results

No	Task	Prototype	Application
1	T1	4.5	5.5
2	T2	5.2	6.3
3	T3	3.8	5.0
4	T4	6.0	6.8
5	T5	4.7	5.8

Table 9 is also important data to be care about, it is the result of how satisfy the respondent or user during their time of completing the given task on both the prototype and final application. The score range measured is mentioned on the table 6, where the range score is starting from 1 which indicates "Very Difficult" and all the way up to the 7, means "Very Easy". the result can be analyzed and shows that for instance, T1 had the satisfaction score on only 4.5 in the prototype yet it increases in the final application up to 5.3. This also like the case of T2 which get 5.2 in prototype yet manage to increase up to 6.3 in the final application. Also, the satisfaction for all users increased with the final application in place, Conclusion from the usability test is that users are more satisfied with the application's efficiency. The final application would be used by users with arachnophobia or suspected to have it.

3.8 Discussion

During the study, the following methods of determining arachnophobia levels were applied: the control of heart rates of users during the application test and the use of the SPQ method. The latter method was designed by Klorman et al. [48]and was used by Polák et al. [7].

Tabel 10. Spider Questionnaire (SPQ)

No	Statement	T	F
1	I avoid going to parks or on camping trips because there may be spiders about.		
2	I would feel some anxiety holding a toy spider in my hand.		

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No	Statement	T	F
3	If a picture of a spider crawling on a person appears on the screen during a motion picture, I turn my head away.		
4	I dislike looking at pictures of spiders in a magazine.		
5	If there is a spider on the ceiling over my bed, I cannot go to sleep unless someone kills it for me.		
6	I am terrified by the thought of touching a harmless spider.		
7	If someone says that there are spiders anywhere, I become alert and edgy.		
8	I would feel uncomfortable if a spider crawled out of my shoe as I took it out of the closet to put it on.		
9	When I see a spider, I feel tense and restless.		
10	I feel sick when I see a spider.		

Table 10 shows what it called the Spider Questionnaire (SPQ), it is a kind of tool of measurement that has the use to get to know whether individual might have arachnophobia or not. This question is ranging from all kinds of scenario that related to spider and individual reaction towards it. For instance, one of the questions might ask "If someone says that there are spiders anywhere around, I become alert and edgy", and individual could answer with "T" which stand for True or "F" which stand for False. And depending on how individual answer the questions all above, one might be categorized as someone that have phobia of spider if the overall score from this scale measurement is high enough.

Table 11 shows what are the devices used to create and testing this Arachnophobia Application and prototype. The first device that appears is the Virtual reality device, this study uses Oculus Meta Quest 2 as the main device where the application and prototype will be deployed,test, and distribute. Second is smart watch, this device is very important to this study and overall process of the therapeutic session, due to its ability to shows progressively the heart rate or BPM of the individual who wears it. As quick guide, the adult resting heart rate will be between 60-100 bpm [35]. This study used Aukey Smartwatch with the version of LS02 which can be found easily in the market. The important thing to know is, the different in device might generate different result.

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Tabel 11. Device Used

No	Image	Device	Version
1		Oculus	Meta Quest 2
2		Aukey Smart watch	LS02

Tabel 12. Heart Rate Assessment

Heart Rate in Bpm	Description
60 -100	Good
105 -115	Normal
120 -200	Poor

Table 12 shows the category of heart rate that this study develops according to data in the table 1 as well as table 2. this study is categorizing the heart rate into three different class: from "Good"," Normal", to "Poor". the value for the "Good" class is when the individual's heart rate is ranging between 60-100 bpm, this also mean that the individual is healthy. Contrarily if the individual has heart rate between 120-200 bpm, the individual will be categorizing as "Poor", and this also highly indicate that individual might experiencing some physiological stress such exposure to phobic object.

Tabel 13. Test Results of the Application

No	Name	Initial Heart Rate	Highest Heart Rate	Final Heart Rate	Duration of Use in minute	Result
1	Mei Ling Sari	90 bpm	115 bpm	95 bpm	15	Good
2	Muhammad Fajar	85 bpm	110 bpm	90 bpm	15	Good
3	Yuni Kartika	95 bpm	120 bpm	100 bpm	15	Normal
4	Putri Maharani	100 bpm	130 bpm	110 bpm	15	Poor
5	Arya Kusuma	100 bpm	125 bpm	105 bpm	15	Normal
6	Alisha Zahra	110 bpm	140 bpm	130 bpm	15	Poor

Table 13 shows the test result of the final application during the therapeutic session of arachnophobia. These are the six respondents that previously had been participating on test until now, the table shows their name, and for each individual this study observes initial heart rate of respondent as well as highest and the end heart rate during their 15 minute of therapy. And based on data that shown, it appears that user experiencing a range of their heart rate being fluctuated during therapy session. First example, Mei Ling Sari started her initial heart rate at 90 bpm then later increase at the peak of 115 bpm and ended with 95 bpm, and based on class category that this study develops at table 12, we can conclude that Mei Ling Sari is categorize as "Good". In the contrary Putri Mahari and Alisha Zahra can be seen to having initial, peak, as well as end heart rate above 100 bpm in other word in class category of "Poor", this shows high probability one of them experiencing some physiological issues during therapeutic, that also means it is sign of arachnophobia.

Table 14 shows very important data for the support result on the table 13. this is the result of Spider Questionnaire (SPQ) for each respondent that have been participating in the 15 minutes therapy session previously. This table show the name for each individual and their SPQ score as well as the final conclusion group of whether them having phobia or not. For example in the data from table 13 Mei

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Ling Sari has been reported to having class of "Good" due to her overall bpm, now after done the spider Questionnaire, with the result score of only 12 and based on the data from table 3, she can be categories as "Non-phobics". In contrasts, the individuals that previously reported to be in "Poor" class: Putri Mahari and Alisha Zahra, interestingly also appear to having high score of SPQ. First it means that they belong to category of "Spider Phobics before treatment" according to table 12, second both individual may actually have phobia, and the application is successful at discovering it.

Tabel 14. Test Results of SPQ

No	Respondent Name	SPQ Score	Group
1	Mei Ling Sari	12	Non-phobics
2	Muhammad Fajar	8	Non-phobics
3	Yuni Kartika	15	Non-phobics
4	Putri Maharani	20	Spider Phobics before treatment
5	Arya Kusuma	10	Non-phobics
6	Alisha Zahra	25	Spider Phobics before treatment

4. CONCLUSION

The goal this study has was to prove whether Multimedia Development Life Cycle method (MDLC) can be used as way to develop alternative arachnophobia therapy that can simulate conventional traditional exposure therapy using the technology of Virtual reality, and indeed it does. In this study's conclusion we found out that not only the method of development using MDLC successfully deliver a Virtual reality application that can be seen in figure 2 and figure 3, but also the application is efficient as seen in table 7 and table 8, where the of all respondent: R1 - R6 shows the decreasing use of time during testing on application compare to prototype, indicating time efficiency. Another thing is, base on the data from table 9 where it shows the respondents satisfaction result after their time of using application, we can see the increase value score in application compared to the prototype, which indicating that the app is easier to use. And furthermore, on how this application test on dealing with arachnophobia treatment, we found that this application is indeed can simulate how conventional exposure therapy works or even better which was proven on table 13 and 14.

The finding on table 13 shows the ability of this application to create simulation that allows the 6 respondents: R1- R6 to having different physiological reaction. For instance respondent name Mei Ling Sari has the initial bpm of 90 bpm and peak at 115 with the last of 95m which belong to category of "Good", in the other hand 2 respondent shows very different reaction that highly indicating arachnophobia: respondent named Putri Maharani for instance has the initial 100 bpm, peak at 130, and last at bpm 110 bpm which if based on table 12 she belong to category class "Poor", and indicating having arachnophobia. On top of that based on data from table 14 which was the result of of previous spider questionnaire that every respondent must take, interesting thing happened which the previous 2 respondent that high bpm in average: Putri Maharani , Alisha Zahra also got score of 20 and 25, in which if based on data from table 3, both are categorized as individual that belong to" Spider Phobics before treatment", and can confirm that both is indeed have arachnophobia. Despite the capabilities of this study, it had several drawbacks.

First, there was a lack of type of spiders. To identify the type of spider which is most likely to be a trigger of arachnophobia, we should endeavor to examine different types. Secondly, there was the variance of respondents' ages. And third limited to only single brand of virtual reality device. we hope the future study that will be tackling similar problem would considering to first adding more variation to spider and with different behavioral. On top of that the if could add the diversity and quantity of the respondent that will be on the study as well as use different device of virtual reality.

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