

Effect of MindSearch Intervention Application Based on HCI Design Principles for Depression and Anxiety among Youth

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Submitted: 25/10/2023

Revised: 15/12/2023

Accepted: 25/12/2023

Abstract: The use of digital technology to support and improve young people's psychological health is becoming more popular, and there are increasing indications that these methods are helpful. However, questions have been raised concerning the degrees of user participation, acceptance, and adherence. The most significant proposal for digital health interferences is the importance of intervention and early user participation in knowledge production, assessment, and deployment. This contributes to ensuring that the technology is appealing, useful, fulfilling, and advantageous.

Objective: Our findings point to significant advantages of using codesigning computer-based interventions for depression, and anxiety. There is a lack of research to guide the co-design of computer-based devices that might recover the psychological health of adolescents. The findings are incorporated from ethical considerations and the Human-Computer Interaction (HCI) study perspective in a novel online intervention "MindSearch Application" for youth. Find the effectiveness of the intervention along with the satisfaction of using it.

Methods: The MindSearch Application is based on Rational Emotive Behavioural Therapy (REBT) developed in association with a psychological research institute. The REBT is preferred as the major focus group is youth between 18 to 25 age group. The application design and testing is done through HCI principles, usability study, and finally feedback evaluation. The significance and effect size of the intervention is done through a pretest and post-test of an experimental and controlled group.

Results: The mean depression frequency scores before and after intervention were 7.98 ± 3.56 and 5.90 ± 5.44 , respectively ($p > 0.01$) with $d = 0.58$. The mean depression intensity scores before and after intervention were 8.41 ± 3.97 and 5.56 ± 4.69 , respectively ($p < 0.01$) with $d = 0.72$. The mean anxiety frequency scores before and after intervention were 9.06 ± 3.61 and 5.85 ± 5.55 , respectively ($p < 0.01$) with $d = 0.89$. The mean anxiety intensity scores before and after intervention were 9.11 ± 3.78 and 5.45 ± 4.91 , respectively ($p < 0.01$) with $d = 0.97$. These values define the significance of the result and effect size of the experimental group is more as compared to the control group.

Conclusion: Our results showed that the MindSearch Application intervention has made a statistically significant difference in depression's frequency, intensity, and Anxiety's intensity and frequency of youth. The REBT-base of psychology and HCI design principles of the application increase the effectiveness, efficiency, and satisfaction of the application and population group. The present study's findings underscore the necessity for additional investigation into computer-based intervention techniques aimed at improving functioning and clinical symptoms.

Keywords: depression, anxiety, youth, MindSearch, REBT, HCI

1. Introduction

Most youth who experience problems with their psychological well-being don't get any kind of support. There is a growing body of research supporting the use of technology responsibly, with suggestions supporting digital therapy for conditions including anxiety and depression, for example. This is just one instance of a disease where using specific technology could be beneficial (NICE, 2019).

In addition, a significant number of youths have entered the net and phone devices, which is true even in nations with low and moderate incomes. However, one of the most significant obstacles in this field is the low level of operator involvement, acceptance, and devotion to these

programmers in contexts other than research. During the last several years, there has been an increase in the number of publications that deliver broad direction for the creation of interventions. The guidance that is specific to digital health reflects a broader direction that is being taken in the growth and assessment of multifaceted health interferences. This direction emphasizes the significance of the growth phase as well as the input of users from the beginning stages of the process.

Co-design necessitates moving away from the conventional approach of expert-led growth work, in which interferences are produced "for" youth rather than "with" them. Designing and creating using youth helps to "humanize" the area of numerical technology, which has been criticized by some for being highly organized, inflexible, and unresponsive. Youth is used in both the designing and producing processes. The creation of technology for the psychological health of children and primary people involves unique considerations, and this technology should not just be

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adaptations of "adult programmers." Regarding the structure and content of a programmer, as well as considering the wide variety of interests and preferences held by youth, an approach that is developing or age-correct is required.

The main part of this article is to analyse and evaluate existing computer-based interventions from a design and effectiveness perspective, and develop a novel online intervention application specifically for youth by involving them in design and development process with HCI study.

The study and methodology are used from the objective e of collaboration between HCI and Psychology with

1. Find the effect and significance of using the intervention for depression and anxiety among youth.
2. Designing and testing application user interface on HCI principles and conducting usability studies.

2. Literature Review

From the year 2012 to 2022, a variety of research articles were gathered from the study. The publications from various journals that fall under the categories or topics were gathered. IEEE, Springer, ACM, and other medical journals are among the publishers of the journals that publish the chosen papers. To comprehend or identify the methodologies and strategies used by various writers, an analysis of several articles was done.

The investigation was carried out from different perspectives in several research areas by considering the following objectives for the study.

- Mental health disorders and related work
- Work related to depression and anxiety
- Role of early detection and intervention in depression and anxiety
- Major age group facing problems of depression and anxiety
- Conventional method of psychological therapy and counseling
- Online therapy applications

The review is focused on age, development studies, language, depression, and anxiety, type of work in detection and intervention, and intervention mechanism as offline or online. We are going to discuss here the review of the most applicable papers from the domain perspective and after analysis of all the articles given applicability, design, algorithmic techniques, effectiveness, and evaluation, will finalize the discussion with a review conclusion. The study is useful to improve the research in this field and to understand more insights for research.

Danbi Yang et al., (2018)[1] have conducted a meta-

analysis to determine whether persons suffering from depression and impairments to their quality of life may benefit from participating in treatment programs that were delivered through the Internet. The amount of impact that web-based therapy had on the severity of depression symptoms was 0.72 on average.

According to our findings, there may be substantial advantages to using therapies that are delivered through the Internet for depression symptoms. On the other hand, it was discovered that the effectiveness of these relatively new intervention methods for those who experience significant decreases in their quality of life was inadequate. The search of this schoolwork highlights the essential of continuing to investigate the development of web-based intervention strategies that may help individuals with psychological illnesses improve both their general functioning and their clinical symptoms.

Judith Borghouts et al., (2021)[2] have proposed a methodical study is to classify shared obstacles and organizers that impact user involvement with digital mental health interventions. A total of 208 articles satisfied the requirements to be included. Three types of factors were extracted for the coding process: the end user, the content or program provided by the interference, and the skill or application atmosphere. A lack of customization, serious psychological health concerns, and technological difficulties were three of the most common types of obstacles. Common facilitators were enhanced health understanding, a sense of overseeing one's health, and increased social connectivity, which was made possible by the intervention. The criteria that were found in this research may serve as a guide for analyzing interventions to assist in the explanation and comprehension of user involvement. Additionally, these aspects can help influence the project and growth of new digital interventions.

Mario Alvarez-Jimenez et.al., (2020)[3] have proposed a co-design, which is a process that aims to guarantee that digital technologies satisfy the requirements and preferences of their end users, with the end goal of making such technologies possibly more attractive, practicable, satisfactory, and real. Co-design is an approach that may be used at any point through the life cycle of a skill as well as at any level of research, including the phases of creation, assessment, and execution. Many different strategies can be used to involve kids, teenagers, and other stakeholders in the co-design process. Future research in this field will need to consider the ever-changing nature of technology, the diversity of user groups, the need for quicker public conversion of findings, and the valuation of the co-design procedure and its effect.

A. S. Neilsen (2019)[4] has proposed a consolidative literature review which was carried out to determine how well HCI principles and user-centered design are combined

in the creation of online psychological health interventions for the betterment of depression and anxiety, and how these interventions are then reported in the works to inform sign-based practice.

Finding, choosing, and including the 30 most relevant articles required the use of the PRISMA paradigm. The primary conclusion of this research is that online psychological health therapies are commonly adopted without fully explaining the key HCI design characteristics that are used. Because of this limitation, the validity of the assessment of e-psychological interventions, in general, is put in jeopardy. Consequently, there are not enough indicators left for the intervention administrators to back up the safe, dependable, credible, and trustworthy execution of the interventions.

The conclusion drawn from this analysis is that HCI should be given careful consideration whenever psychological health practitioners adopt online psychological health interventions for therapeutic purposes. This is the recommendation that has been derived from the review, and it is meant to ensure the eminence and safety of the online psychological health interventions that are made available to patients.

Emily G Lattie et al., (2019) [5] have suggested conducting a literature review on Digital Mental Health (DMH) interventions, to help students with anxiety and depression and to enhance their mental health. This was done to assess the degree to which these programs were useful, acceptable, embraced, and adopted. Most of the interventions focused on enhancing mental health and treating anxiety and depression. The findings imply that digital psychological health interventions could be beneficial for college students' general mental health as well as their anxiety and depression. To determine which aspects of these interventions are effective, more in-depth research is nevertheless required.

David T. Parry et al., (2016) [6] have conducted a drive of investigation to travel the methodologies that have remained utilized, if any, to assess the in-person psychological experience of people who have used self-help psychosocial therapies that were delivered over the Internet. It was decided to conduct a comprehensive literature evaluation of databases spanning several disciplines, with a particular emphasis on health and computer science.

The two most common ways to understand the experiences of the users were semi-structured interviews conducted after treatment or questionnaires distributed following intervention sessions. The research that has been conducted to evaluate how users interact with Web-based psychological health or behavior change artifacts has not clearly defined many methods. Two of the most important limitations of the study were the significance of the problem

and the cross-disciplinary nature of the field. As soon as possible, techniques for examining users' psychological experiences while utilizing an intervention must be created and put into practice.

F. Alqahtani and R. Orji et al., (2020) [7] have proposed a study to analyze user evaluations of psychological health apps that are open to the public to identify the applications' strengths, shortcomings, and gaps, which will in turn indicate the reasons why users stop using these programs. We used theme analysis on 13,549 reviews obtained from App Store of Apple and Google Play after mining reviews of 106 psychological health applications. These reviews were gathered from their respective app stores. According to the findings of the study of the reviews, users put a greater emphasis on the user interface and usability of the app.

Applications that offer a variety of options for features, functionalities, and content are also highly appreciated by users. Once more, users gave top marks to apps with customizable features that let them change specific app features. Customers have more control over these types of apps. However, it became clear that a poor user experience was the main cause of users ceasing to use psychological health applications. Concerns about security and privacy are among the other negative aspects, along with a lack of variety in the content, poor customer service, a lack of personalization, and a lack of trust.

It is also vital to make sure that users have access to an extensive range of rich information, and features for customizing, and that the app does not place too many constraints on how they may use it. Additionally, enhancing the app's credibility by including security features to safeguard users' data and by regularly releasing updates and new features will boost user confidence, which will reduce the high attrition rates that psychological health apps currently face. The product's creators must also prioritize offering excellent customer support and a point of contact in the event of an emergency. Drawing on our findings, we offer some design recommendations for psychological health apps that will improve the app's usability, grab the user's attention, and encourage mental health.

Nymatul J. Nipa et al., (2020) [8] have used the context of third-world nations, this research analyses the quality of life that has been provided in previous studies on mobile health interventions. A comprehensive search of some of the most reputable databases was carried out to locate research on mobile health apps that had been published between the years 2013 and 2018. After a thorough screening process based on methodological standards, 31 papers in total were selected for data extraction and synthesis. We provide several discoveries that are both significant and fascinating. To begin, the researchers and intervention designers working in mobile health in underdeveloped countries have a relatively low degree of knowledge of the mobile health

sign Reporting and Assessment checklist.

Franziska Burger et al., (2020) [9] conducted the literature analysis which provides an overview of the landscape of e-psychological health systems for the treatment and prevention of major depressive disorder by focusing on three main research issues.

- (1) What varieties of systems exist?
- (2) How much contemporary technology are these systems utilizing?
- (3) What kinds of modifications have been made to the system's configuration since 2000?

To facilitate this process of coding, an extensive categorization hierarchy for functions was created, which resulted in a total of 133 systems including 2163 functions. Quantitative analysis was performed on the systems and their functions, with a particular emphasis placed on technical implementation. On average, the number of treatment functions included in a system is twice as high as the amount of adherence support functions included in the system.

In addition, autonomous systems, which are systems that do not include human direction, are just as technologically advanced as guided ones, but they have one-third fewer functions. Therefore, the absence of direction is neither accounted for by adding more functions nor is compensated for by increasing the degree to which functions are technologically advanced. Even if various high-tech solutions might be developed, the typical system is somewhere in between being solely informative and being one that allows for the input of data but does not automatically analyze these data.

In addition, despite the significant rise in the total number of systems in the field between the years 2000 and 2017, there was no discernible improvement in the technical capabilities of the systems. In conclusion, more complex systems were tested for their effectiveness in comparative studies a lesser number of times than less complex ones (OR 0.59). According to the results, system designers place a larger emphasis on successfully treating patients with therapeutic interventions than they do on ensuring patients comply with their treatment plans.

R. Grist et al., (2018)[10] have investigated the existing sign for the result of online-based interventions for treating depression and anxiety to bring up to date any previous research that had been done in this area.

Following an exhaustive search of eight digital databases, a total of 34 randomized controlled studies including 3,113 samples between the 6-18 age group were discovered. Both Cognitive Behavioral Therapy (CBT) and "other" therapies were unable to show a substantial improvement above the control groups. There was a large amount of variation in

effect sizes depending on the kind of control condition, the severity of the issue, the therapeutic assistance, the parental support, and the continuance of any other continuing therapy. According to the results of our study, there may be an advantage to employing CBT-based technology-delivered treatments in situations when access to conventional psychotherapies is restricted or delayed.

In general, the outcomes of the study lend weight to the idea that CBT-based technology-delivered therapies are more successful than wait-list controls for the behavior of anxiety and depression. CBM and 'other' programmers were unable to show a substantial improvement above the control groups. The ABMT-based intervention produced only a small effect size.

Ana Fonseca et al., (2021)[11] have proposed the presence of certain pre-conditions, such as a kind relationship with a doctor and suitable parental monitoring, to provide the benefits of the intervention to young people. Because of this Special Issue, we are now able to highlight some of the opportunities that the use of ICTs in psychological health research presents to both academics and practitioners working in the psychological health field. From a clinical standpoint (prevention, promotion, and treatment), as we briefly discussed earlier, a few of the manuscripts have described various approaches to addressing one of the challenges facing the field of psychological health in the modern era, which is the inability to assist the maximum number of people who need assistance.

People can reap the benefits of sign-based preventative and therapeutic psychological treatments made possible by ICTs without having to compromise their right to privacy and by incorporating the intervention into their typical day-to-day activities. ICT can provide important aids throughout psychotherapy. These benefits include preserving therapeutic cooperation and enabling doctors to measure and receive responses on certain experimental variables throughout the interventions.

3. Literature Review Conclusion

Many of the initiatives were focused on "intervention." Many studies addressed confidentiality mostly for safeguarding the confidentiality of study contributors, with comparatively little context-specific discussion. There were very few studies that specifically addressed ethics as a topic of concern. No study specifically addressed legal concerns, even though some studies made fleeting reference to various legal issues, such as user subjects' rights and compliance with applicable privacy and data protection legislation.

HCI has the most important role which is underestimated in the different studies and application developments. To begin, app developers should concentrate on making their products as user-friendly as possible. Designers of

applications for psychological health should undertake usability studies of both their original versions and updated versions of their applications. HCI can be used to overcome barriers such as drop-out rate, and engagement in the application.

Online Interventions mainly use CBT for depression and anxiety with or without randomized control trials, and therapist assistance. CBT has efficacy but has some of limitations with its use in online interventions. The different factors like control condition, severity of illness, type of support, and other treatments affect the efficacy of the online intervention.

The computer-based intervention meta-analysis found that the mean impact size was significantly different. Based on a random-effect model, the results showed notable heterogeneity between the studies in terms of indication of heterogeneity and the fixed-effect model-based meta-analysis found a difference in quality of life that suggested the web-based intervention was superior.

Online psychological health interventions often included self-monitoring elements; however, there was not enough detail provided to draw conclusions about which design elements are best suited for self-monitoring in electronic psychological health interventions generally. Goal-setting processes were frequently used to try and demonstrate it, but once more, the specific design elements were not clearly documented, making it impossible to repeat the outcomes. These characteristics may have an impact on the clinical efficiency of the therapy as well as the patient's adherence to it; as a result, they must be meticulously characterized to make it feasible to replicate each research.

On the other hand, precise information regarding the real use and nonuse of real components is provided by the log data studies. Because they can show if users act as expected by the software designers and clinical development teams, these studies are an invaluable source of information. Despite these drawbacks, our most recent meta-analysis offers strong evidence supporting the effect of the online intervention in reducing the symptoms of depression.

4. Methodology

A novel psychotherapy platform made possible by web-based intervention has the potential to enhance current depression and anxiety treatment plans by expanding their therapeutic horizons, or it may be a good substitute for the plethora of current options.

MindSearch Application aims to provide the material and work related to developing an effective web-based intervention as an easy-to-use assistive tool for reducing mild and moderate symptoms of depression and anxiety among youth. To make an effective tool and to maintain the validity, and reliability of content the work is carried out in

association with Jnana Prabodhini Institute of Psychology (JPIP), Pune, India. The methodology is intended to design and test the application user interface on HCI principles and conduct usability studies.

4.1. Material

The intervention is based on the theory of REBT, which has garnered growing research attention and is most useful and applicable from a youth perspective. Youth is not at the level to think from a cognitive perspective.

The original form of CBT, known as REBT, formed the basis for CBT. The first version of REBT was first presented by Albert Ellis in 1957 under the name Rational Therapy (RT); Ellis later renamed it rational emotive behavior therapy in 1990 because behavioral factors are a key component and emotional results[12], [13]. REBT aims to replace maladaptive behaviors and dysfunctional emotions with adaptive ones by converting irrational beliefs into rational ones. The core focus of REBT is on evaluative beliefs[14], [15].

The fundamental tenet of REBT is that emotional and behavioral reactivity are caused by one's beliefs (B) about the events, not by the events themselves (A)[13][16], which would otherwise directly cause emotions and behaviors (C). For instance, using this ABC framework, REBT clients are urged to understand that their irrational beliefs (B)—rather than external events (A)—are what are causing their dysfunctional anxiety (C). As a result, irrational beliefs are confronted and challenged, and eventually, they are replaced with rational alternative beliefs. Reducing irrational beliefs in favor of rational ones, treating emotion dysfunction, and advancing psychological well-being are the main objectives of REBT[14].

Table 1. Outline of the intervention contents

<i>Session No.</i>	<i>Title of Session Content</i>
1	Why we get disturbed? Brain storming
2	Introduction to Self-talk
3	Self-talk examples and characteristics
4	Appropriate Inappropriate emotions
5	Appropriate Inappropriate emotions
6	Introduction to ABC model: Beliefs
7	3 core beliefs plus beliefs of anxiety & depression
8	Expectation demand
9	Feedback Evaluation
10	Fact Opinion
11	Disputation: Cognitive
12	Replacing Irrational Beliefs (IB) with Rational Beliefs (RB)
13	Disputation tips Emotional
14	Disputation tips Behavioural
15	Further Action plan

Based on this theory the web-based intervention application MindSearch is developed. The application contains 15 video-based sessions which give the idea about the major theme with multiple examples for better understanding of each session. Each Session contains a Question-and-Answer (QA) based on understanding of video sessions, containing varied types of questions like MCQs, matching the pairs, brainstorming, performing activities and many more in the form of open-ended questions to motivate users and change their emotional and behavioral patterns.

The content for video sessions is developed in association with psychologists as given in Table I and finally the script is prepared accordingly to record and edit the video sessions by the psychologists. The video sessions are of minimum 5mins to maximum 8 minutes in variation and by considering the span of focus of users that is youth.

The video shooting and editing is completed with the help of experts in the field of REBT and video editing professionals. REBT has been used by the professionals in offline counselling sessions in different corporate, social, and educational domains but this is also new for them to complete this in online mode in the form of videos with the help of ICT.

4.2. Tool Development

The MindSearch Application is developed as a responsive

web application. Designing and testing of an application user interface is completed through HCI principles[17] and by conducting usability studies based on intended goals. The proposed approach is user-friendly & persuasive to motivate and engage users to take intervention using a computer or a smartphone-based tool.

The intervention application is designed from HCI principles with Schneiderman's 8 Golden Rules of Interface Design[18]. It offers a practical and concise synopsis of the fundamental ideas in interface design. The following eight guidelines apply: Aim for uniformity in the usage of commands, terminology, action sequences, layout, and other elements. Also, we used an UI/UX design tool Figma and AdobeXD. The following steps, methods and techniques are used:

1. User flow of intervention is generated with a flow diagram.
 2. User Persona for intervention is generated with a representation of our target audience-youth and their psychological characteristics. Along with that the five-factor analysis of ease of use, effectiveness from content perspective, personalization, interactive, and research evidence is generated.
 3. Focused on Credibility, User Experience, and Data Transparency as our three metrics.
 4. Decided on the intervention architecture modules.
 5. Developed Information architecture.
 6. Created low-fidelity wireframes.
 7. High-fidelity wireframes are generated and tested.
 8. Applied the ethical principles while designing and development the application as public interest, privacy, informed consent, honesty, accuracy, and property.
 9. Effectiveness, efficiency, and satisfaction are also connected to the theoretical base of the tool which is it is primarily taken care with time-to-time association with psychologist[19].
- After completing the above design process the web-based application is developed. The application user interface testing is done by HCI practitioner and professionals and accordingly changes are incorporated. We conducted in-person, remote or unmoderated, and Guerilla usability studies by asking the questions:
- How simple a design for users to use
 - Assess the users' ability to finish tasks independently and successfully.
 - See how much users enjoy using it.
 - Find a solution for identified problems as per severity.

The iterative process of usability testing is conducted and

- Defined what I want to test.
- Prioritized the most important tasks to meet objectives
- Moderated testing

Pilot study completed with 11 participants through a feedback form. After incorporating the suggestions and changes as per the feedback the MindSearch application is made available in the public domain for use and data collection. The URL <https://mindsearch.pythonanywhere.com> is available for reference of an application. Some of the screenshots of an application are given in the following figures.

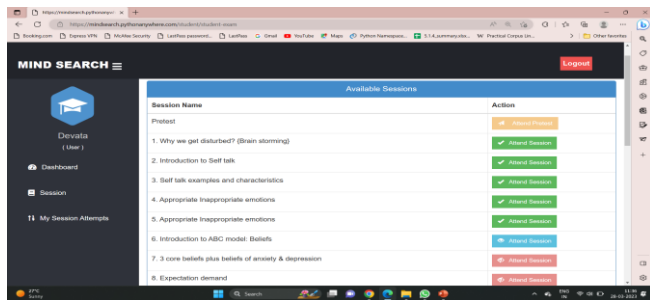


Fig 1. Screenshots of the intervention outline

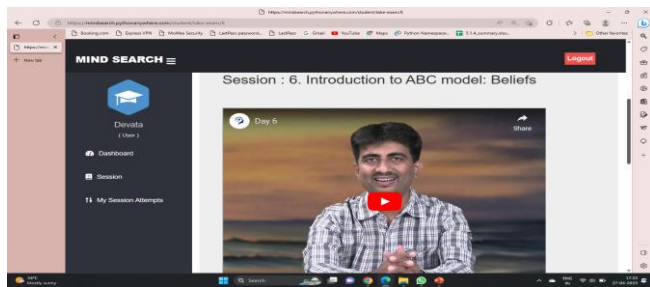


Fig 2. Screenshot of the video session

4.3. Measures

The application starts with a user registration followed by login and pretest measure. As it is the filtration criteria and for the scope of our application. The pretest is nothing but a test developed by JPIP with 51 questions on a Likert scale from 0 to 4. It contributes 8 different psychological major domains with 22 subdomains including depression and anxiety domains which are only considered in this paper. The further intervention module content as video sessions and QA part is in correlation with the major 8 domains so it is a very necessary and important part. The pretest and posttest are similar and we have not included the related details in this paper, it has been kept different in the scope of another article. We are focusing on depression and anxiety domains based on the pretest result.

The checking of the pretest scores and then finding the vulnerable sample having mild and moderate symptoms. The person with no symptoms of depression and anxiety

will not require any further intervention as per the scope. The person with severe depression and anxiety symptoms is given a message to consult psychiatrists as per the scope and suggestion by psychologists. We are collecting the frequency and intensity of depression and anxiety as our final measure. As per the study it has been observed that the symptoms of depression and anxiety are related to frequency and intensity. For example, some of the feelings are coming regularly in our mind but not with such strong feelings, it means frequency is high but intensity is low or accordingly. So, we are considering these factors as an important measure. The pretest measures and selection criteria for the vulnerable sample are given in Table 2. The participants are nothing but vulnerable samples who are eligible to attend the video sessions and complete the intervention contents within 15 days. After completing all sessions, the posttest needs to be given by all participants, who are involved in intervention. The pretest and posttest measures are useful to find the effect, and significance of an intervention application.

Table 2. Pretest measures and selection criteria for intervention

Symptoms	No Signs	Mild	Moderate	Severe
Depression Frequency Score/Cond.1	5 & below	6 to 9	10 to 14	15 & above
Depression Intensity score/Cond.2	5 & below	6 to 8	9 to 13	14 and above
Anxiety Frequency Score/Cond.3	6 & below	7 to 10	11 to 15	16 & above
Anxiety Intensity score/Cond.4	6 & below	7 to 9	10 to 14	15 and above
Criteria	Cond. 1 and 2 and 3 and 4	Cond. 1 or 2 or 3 or 4		Cond. 1 and 2 and 3 and 4
Message through MindSearch	Mental health is good.	Please attend the further sessions.		Please consult to psychiatrist.

4.4. Data Collection

As per the HCI and psychology study, we are going to consider a controlled group and an experimental group to

complete data collection and accordingly the effect of an intervention. Between September 27 and October 30, 200 participants' data were gathered via the link that was sent to students at our college and another nearby university through email contacts and a student WhatsApp group.

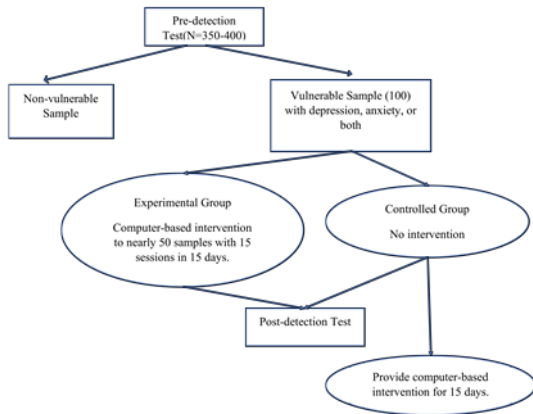


Fig 3. Data collection methodology

The data collection methodology is given in Fig. 3 and accordingly the data is collected from college students in which near to 200 students registered in this application. Out of that, 165 students completed the pretest successfully. As per the criteria for vulnerable samples we found 105 participants are vulnerable and they have been provided the appropriate message through application to attend the sessions by enabling the next session 1. Non vulnerable samples contain 56 participants and 4 with severe symptoms. Out of the vulnerable samples the 70 participants started with session1 but finally 44 participants completed all sessions along with posttest. The pretest and posttest analysis are considered for experimental group.

As per the application requirement, the next session gets enabled after completion of the current session along with the QA part where every question's answer is a required field from the data collection perspective to monitor emotional and behavioral cues. After completing experimental group data collection and analysis, we found that 61 participants have not taken intervention completely or partially. So, we communicated with them through email after November 1 to complete the sessions or give posttest which will be enabled for them if they are interested in giving through admin privilege. After this effort, we have received 32 positive responses who are interested in giving posttest only. Accordingly, we received the 32 participants as a controlled group, who have given pretest and posttest without intervention.

4.5. Result and Discussion

The result analysis for both experimental and controlled groups is based on a four-factor analysis containing depression frequency, depression intensity, anxiety frequency, and anxiety intensity.

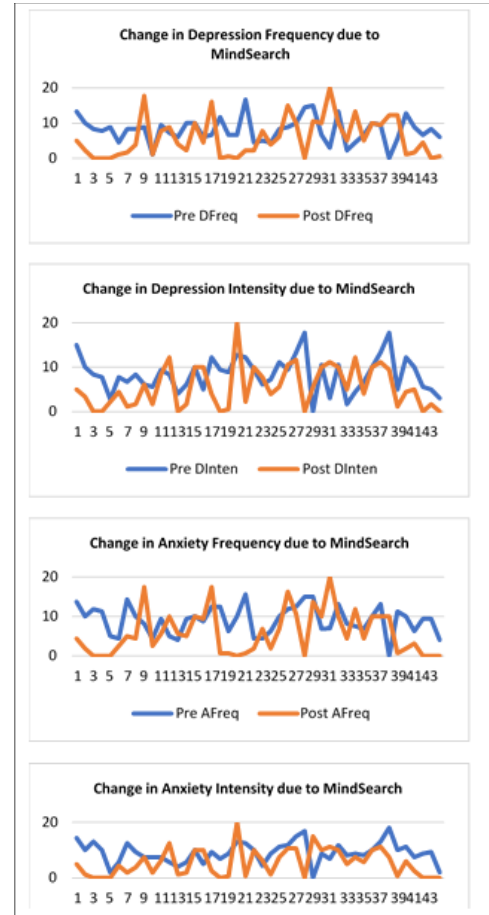


Fig 4. Effect of MindSearch on frequency and intensity of depression and anxiety

Table 3. Descriptive statistics with experimental and controlled groups for the main outcomes

Group	Experimental Group (N=44)				Controlled Group (N=32)		
	DF	DI	AF	AI	DF	DI	AF
Mean(M)	2.08	2.85	3.21	3.66	0.90	0.44	0.41
Std. Dev. (SD)	6.92	5.38	6.47	5.99	3.75	5.39	4.31
t-value	1.99	3.52	3.29	4.06	1.36	0.46	0.54
p-value	.02629	0.0005	.001	.0001	0.09	.32	0.30

Table 4. Comparison of results of the o papers with MindSearch

Paper	Trial	Theory	Population	Diagnostic Tool	Sample size	Symptoms	Interventi Period
Our methodology	Randomized Trail	REBT	18-25 age group	MindSearch Web App	N=44	Anxiety or depression	15 days
McCloud T (2020)[Randomized Controlled Trial (RCT)	CBT	University Students	Feel Stress-Free Mobile App	N=84	Anxiety or depression	6 weeks
Venkatesan	Study	CBT	Adults with	Mobile App	N=146	Anxiety or	12 weeks

For the experimental group with N=44, the changes in the four factors are analyzed through the graphical representation as shown in Fig.4. The graph shows that there are measurable reductions in the symptoms and parameters.

Compared to depression, anxiety score is more significantly reduced.

For every study variable [20] std. dev., means, p-values, t-values, and effect size d are computed as shown in Table 3 to determine whether the MindSearch intervention was successful in reducing symptoms of anxiety and depression in young people.

Cohen's d formula to find effect size,

$$d = \frac{\text{mean1} - \text{mean2}}{SD}$$

Where mean1 and mean2 are the pretest and posttest average, SD is the std. dev. from each domain variable's pretest data, as our measures design includes the pretest as a repeated measure of posttest. Based on the d value the effect size is considered.

The effect sizes for depression and anxiety are large for the experimental group while small, and medium for the control group.

We have employed a dependent test type for analysis, the correlated t-test (paired t-test), which is used when the samples are matched pairs of comparable units or when there are instances of repeated measures as indicated by the following formula. The same participants are tested repeatedly as part of our methodology, both before and after receiving an intervention and without receiving one. Each participant is being used as a control sample against themselves and accordingly the other participants.

Formula to calculate t-value

$$t = \frac{\text{mean1} - \text{mean2}}{\frac{s(\text{diff})}{\sqrt{n}}}$$

Where mean1 and mean2 are the pretest and posttest averages, s(diff) is the standard deviation of the difference between pretest and posttest, and n is the participant size.

A statistical test yields a p-value, which is a number that indicates the likelihood of discovering a specific set of observations if the null hypothesis is true. To determine whether to reject the null hypothesis, P values are used in hypothesis testing. You are more

likely to reject the null hypothesis if the p-value is smaller. As in Table 3, the significance level of p is checked with 0.01 and p-value < 0.01 for the experimental group except for depression frequency and higher for the controlled group. It shows the variance between the p-value of the two collections and tells us that MindSearch intervention is significantly reducing the symptoms of depression and anxiety.

The user interface of an application is evaluated based on the feedback form in an application. It contains ratings for

four questions along with suggestions that check and improve the effectiveness, efficiency, interaction, and satisfaction of an application from an HCI design perspective. The feedback analysis of 53 users tells that 87% of users gave the highest rating for effectiveness, 85% gave the highest rating for efficiency, 90% were satisfied with the task completion with the highest rating and 99% of users recommended this application due to its interactive nature.

Very few users gave their minor suggestions for improvement mostly regarding reduction in number of questions in the pretest and posttest.

The results of the papers [21][22][23][24] that have recently conducted some of the trials and studies regarding depression and or anxiety in their work are as given in Table 4 as a comparative along with our methodology of MindSearch. As per the study in psychology, the results are different due to the multiple factor assessment and condition in every study and trial so the effectiveness comparison becomes difficult. Our study shows effectiveness and for the population of local context in India which is a developing country where much more awareness is required regarding mental health.

5. Conclusion

The literature on e-psychological health treatments has only a limited amount of design information, according to our analysis of the available research. This is particularly concerning because an e-psychological health intervention study cannot be replicated without complete design information. Furthermore, this is important for confirming the efficacy, quality, and patient security of the therapies developed and recommended for the online intervention of depression and anxiety.

The MindSearch application development is effective and significant for the reduction of symptoms in youth due to its nature of REBT, which is a very useful and practical technique to change the beliefs of users, and through that, it will automatically improve the mental health of the user. The results will be more effective after increasing the sample size of an experiment. It needs to increase the awareness among users and motivation to take the intervention. The retention and engagement analysis needs to be done for better results.

Despite the tool's potentially fruitful applications, it does not yet come close to meeting the requirements for domains. The findings of this application provide credence to the claim that developing many intervention modules is necessary to increase the variety of web-based intervention tactics. To give users practical support, future developments in the field should be methodologically rigorous while yet applying to everyday life.

6. References and Footnotes

Acknowledgments

We thank Dr. Anagha Lavalekar, Dipak Gupte, Anya Nisal, Dr. Sucharita Gadre from [Jnana Prabodhini Institute of Psychology (JPIP), Pune, India] who provided vision and knowledge in the REBT domain that greatly assisted the research. They have played a major role in finalizing the video and content till the finalization of videos with shooting, recording, and uploading. We thank Vishwakarma University, Pune for assisting with video recording and editing facilities with their equipped labs and domain experts.

Author contributions

Devata Anekar: Design of an application, Development of an application, Data collection and analysis **Yogesh Deshpande:** Application design investigation from HCI perspective, Software, Validation., Data Validation **Ranjeetsingh Suryawanshi:** Reviewing and Editing of the article.

Conflicts of interest

The authors declare no conflicts of interest.

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