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Mental Health Digital Interventions Technology: A Systematic Review

Ida Puteri Mahsan^{1,*}, Nurul 'Ain Mohd Daud², Mohd Yusof Zulkefli³, Norshahila Ibrahim⁴, Elis Syuhaila Mokhtar¹, Muliwati Mat Alim⁵

¹ Faculty of Art, Sustainability and Creative Industry, Universiti Pendidikan Sultan Idris, Perak, Malaysia

² Faculty of Human Development, Universiti Pendidikan Sultan Idris (UPSI), Tg. Malim, Perak, Malaysia

³ School of Communication and Media College of Computing, Informatics and Media, University Technology Mara (UITM) Shah Alam, Selangor, Malaysia

⁴ Faculty of Computing & Meta-Technology, Universiti Pendidikan Sultan Idris (UPSI), Tg. Malim, Perak, Malaysia

⁵ Faculty of Language and Communication, Universiti Pendidikan Sultan Idris (UPSI), Tg. Malim, Perak, Malaysia

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ABSTRACT

The well-being and quality of life of an individual are greatly influenced by their mental health. Regardless of these functional as well as emotional issues, relatively few individuals seek therapy because of obstacles including stigma and a lack of funds. Numerous mental health disorders and problems were found to benefit from digital interventions. A known standard practice for performing a systematic literature review, the research applies the pre-recording systematic reviews Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) technique. Two databases, PubMed as well as Scopus, from the years 2020 to 2022, were employed to analyze the study's approach. Therefore, this study proposed a thorough and systematic analysis of the intervention method and the efficacy of digital treatments applied to enhance mental health in a setting relevant to students and young adults. The research findings of this study revealed two main themes, namely intervention technology medium and the effectiveness of digital interventions implementation on mental health. The reviews will educate academics and those who offer digital interventions about how to leverage technology-based tactics to increase participation in such activities.

1. Introduction

Student mental health and wellbeing are critical topics in higher education. Having a good mental health enable the individuals to execute their potential and handle the normal stresses of life. The growing extents of mental health problems today are alarmingly high and becoming a global public health concern [1,2]. The present correlational research investigated 467 young adults' use of social media, as well as how important it was to them. Symptoms of general mental health, social anxiety, loneliness, suicidal ideation, as well as diminished empathy were among the outcomes that were taken into consideration. Additionally, the findings indicated that employing social media failed to foresee more severe mental health functioning [3]. To overcome the gaps that exist in mental health

* Corresponding author.

E-mail address: idaputeri@fskik.upsi.edu.my

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services prior to and following the worldwide pandemic, various research has urged an immediate necessity to create and adhere to the developing digital technologies. Although digital technologies have supported mental health services for 20 years, the pandemic provided a unique opportunity for increased usage and more data-driven evaluation of these systems. Digital technologies provide fast and efficient solutions that decentralize as well as scale-up health care across a broad range of platforms, from teletherapy to web-based interventions to mobile health (mHealth) applications [4-6]. Web- or computer-based interventions are one method for gaining access to treatment. With regard to a range of mental health disorders in various populations, these interventions can be beneficial [7]. The most prevalent technology typically found in this evaluation was web-based interventions, which suggests that more immersive digital interventions like a game- and virtual reality-based interventions were neglected and would be worth additional study [8]. Given the rising demand, it is crucial to give detailed suggestions for the implementation of digital mental health interventions in the future, both before and after public health crises [9]. This review of how digital health tools may help in lowering mental health problems is significant. Young people are more inclined to experience excessive levels of loneliness, which can have negative effects on their mental health. Preliminary research has indicated that digital platforms can be utilized to combat loneliness, which is a treatment target that is flexible [10]. It is also common knowledge that young adulthood is a time of transition and transformation. University students will struggle to acclimate to their new environment and create new peer groups [11]. Around the globe, mobile technologies are revolutionizing how we communicate, access resources, gather knowledge, and execute business. A new interdisciplinary subject termed mHealth has emerged as a result of the mobile technology used to assist global healthcare initiatives [12]. In Bangladesh, the prevalence with regard to mental health problems is the greatest in young adults and frequently affects university students. Although there is currently little research on mHealth applications utilization in Bangladesh to promote mental health or among university students, mHealth apps are beneficial there for chronic health issues [13]. Therefore, the goal of this research is to introduce a thorough and systematic analysis of the methods and efficacy with respect to digital interventions utilized to promote mental health in a setting relevant to young people drug users. The first section of this paper outlines the purpose of this study being conducted. Section two (2) explains the methods employed, while Section three (3) details the results and findings attained. Lastly, Section four (4) wraps up the conclusion of the paper and suggestions for further research.

2. Material and Method

This research targets to examine and extensively explore the methods and efficiency of digital technology for interventions of mental health illness. From there, this section evaluates and synthesizes scientific literature in identifying, selecting, as well as assessing significant mental health awareness among young adults. The pre-recording systematic reviews, PRISMA approach is a well-known standard in performing a systematic literature review. Essentially, publishing standards were developed to facilitate authors in examining the accuracy with regard to a review by including significant and essential information. PRISMA emphasizes the randomized studies evaluation survey as a result since it may be a crucial component of systematic analysis reports with respect to different research forms [14]. PubMed and Scopus were two databases that were employed to look at the research's approach. This part also covers the four primary sub-sections that were previously mentioned: identification, screening, eligibility, and data abstraction [14].

2.1 Screening

Duplicate papers were rejected during the initial screening. 515 papers were discarded in the initial stage of the research, and 179 papers were assessed in the second stage using the scholars' diverse exclusion as well as inclusion criteria. Moreover, literature (research papers) denotes the first criterion utilized since it is the main source of useful guidance. In a comparable way, it covers conference proceedings, chapters, book series, books, reviews, and systematic reviews that were left out of the most recent research. In addition, the review was restricted to works published in English. Therefore, it is critical to keep in mind that the strategy was created for the previous two years (2020–2022). 15 papers in all were selected.

2.2 Eligibility

A total of 164 full text excluded since they are devoid of context, the title and abstract have little to do with the study's goal. 164 articles were incorporated in this third level, known as eligibility. In ensuring that the inclusion criteria were satisfied and the papers were relevant to the goals of the current research study, all article titles and crucial information were carefully examined at this stage. Finally, 15 articles have been made accessible for review (refer to Table 1). The following studies were included:

- (i) Studies reporting on the medium characteristic of digital intervention for mental health
- (ii) Studies on mental health modalities or intervention used by/ prepared for young adults in universities.
- (iii) Studies on the effectiveness of digital intervention technology implementation for mental health.

Table 1
The selection criterion in searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	Between 2020 – 2022	< 2020
Sources type	Journal (only research articles)	Conference proceeding
Document Type	Article	Review, Letter, Note, Conference
Research Area	Technology, Virtual intervention, mental health	Besides Technology, Virtual intervention, mental health

2.3 Data Abstraction and Analysis

In this research, a variety of research designs (qualitative, quantitative, along with mixed approaches) were examined and synthesized using an integrative analysis of the assessment procedures. The authors thoroughly reviewed 15 publications, as shown in Figure 1, in search of material or assertions pertinent to the subjects of the present research. Then, the authors evaluate intervention technology, mental health, the chosen medium, as well as efficacy. The two main themes that resulted from the technique are the influence of detection and classification. The authors proceeded with each established subject, along with any themes, notions, or ideas, from this point on. The researcher cooperated with other co-authors in developing themes relying on the information gathered in the context of this study. Moreover, a log was preserved throughout the entire data analysis process to note any analyses, views, riddles, or additional perspectives on the

data interpretation. In order to spot any irregularities in the theme design process, the scholars finally compared the outcomes. It is important to note that the authors address any differences in the concepts between themselves, if there are any. The generated themes were eventually adjusted to make sure they were consistent. To prove the validity of the issues, experts with one area of expertise—intervention technology medium characteristic—and the other—mental health—conducted the analysis. By confirming domain validity, the expert review phase guarantees each sub-theme's importance, clarity, as well as suitability. Figure 1 is the flow diagram with respect to the proposed search study and the list of research article results relying on the suggested searching criterion (refer Table 2).

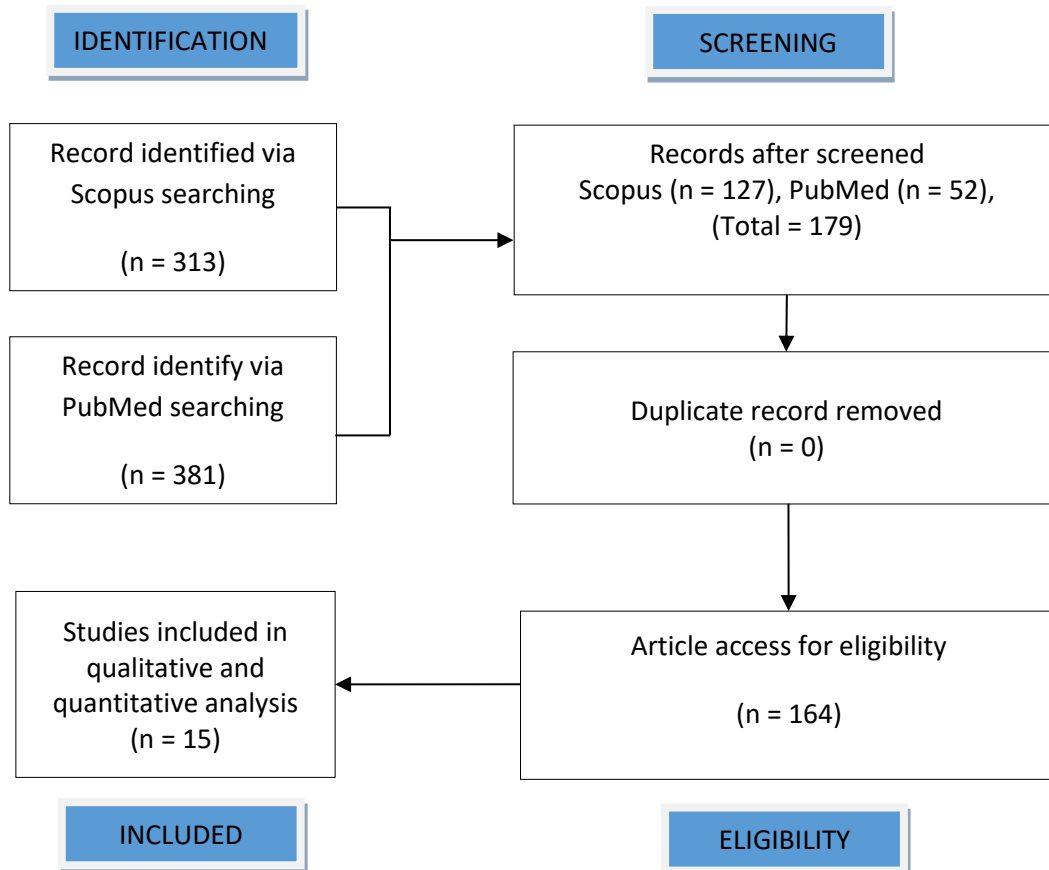


Fig. 1. Flow diagram with respect to the proposed searching study

Table 2
 The research findings relying on the proposed searching criterion

No.	Author	Title	Scopus	PubMed
1	Pavlacic <i>et al.</i> , [15]	Assessing the Effectiveness and Utility of a Mindfulness-Based Ecological Momentary Intervention in College Students	/	
2	Evans <i>et al.</i> , [16]	Developing a web-based system for coordinating school-based care for students with social, emotional, and behavioral problems	/	
	Lister <i>et al.</i> , [17]	Participatory digital approaches to embedding student wellbeing in higher education	/	
4	Toyama <i>et al.</i> , [18]	Participants' and Nurses' Experiences With a Digital Intervention for Patients With Depressive Symptoms and Comorbid Hypertension or Diabetes in Peru: Qualitative Post-Randomized Controlled Trial Study	/	
5	Alqahtani <i>et al.</i> , [19]	Personality-based approach for tailoring persuasive mental health applications	/	
6	Romano <i>et al.</i> , [4]	User Modeling and User-Adapted Interaction Person-Centered Clustering of mHealth Technology Perceptions and Usage Motivations, and Associations with Physical and Mental Health Correlates	/	
7	Troitskaya and Batkhina [20]	Mobile application for couple relationships: Results of a pilot effectiveness study	/	
8	Nicolaidou <i>et al.</i> , [21]	A gamified app on emotion recognition and anger management for pre-school children		
9	Andersen <i>et al.</i> , [22]	International Journal of Child-Computer Interaction The role of social technologies in community care – A realist evaluation of a Danish web-based citizen-to-citizen platform adopted in community care to promote belonging and mental health	/	
10	Carpenter-Song <i>et al.</i> , [23]	Health and Social Care in the Community Individualized Intervention to Support Mental Health Recovery Through Implementation of Digital Tools into Clinical Care: Feasibility Study	/	
11	Hvidt <i>et al.</i> , [24]	Translation and Validation of the System Usability Scale in a Danish Mental Health Setting Using Digital Technologies in Treatment Interventions	/	
12	Zeren <i>et al.</i> , [25]	The effectiveness of online counseling for university students in Turkey: A non-randomized controlled trial	/	
13	Purkayastha <i>et al.</i> , [26]	Engagement and usability of a cognitive behavioral therapy mobile app compared with web-based cognitive behavioral therapy among college students: Randomized heuristic trial	/	
14	He <i>et al.</i> , [27]	Mental Health Chatbot for Young Adults With Depressive Symptoms During the COVID-19 Pandemic: Single-Blind, Three-Arm Randomized Controlled Trial		/
15	Khan <i>et al.</i> , [28]	Protocol for the Process Evaluation of the Online Remote Behavioural Intervention for Tics (ORBIT) randomized controlled trial for children and young people		/

3. Results and Findings

The research findings of this study revealed two main themes, namely intervention technology medium and the effectiveness of digital interventions implementation on mental health.

3.1 Intervention Technology Medium

Students in college and universities frequently struggle with mental health issues. Regardless of these emotional and functional issues, few students seek treatment because of obstacles, including stigma and a lack of funds. The physical and mental health of students are important subjects in higher education. There exist demands for universities to adopt a more comprehensive as well as proactive strategy, collaborating in cooperation with students to integrate mental wellbeing across learning, tuition, as well as curriculum in accordance with larger social trends in thinking about mental health and wellbeing [17]. Among the most common mental disorders as well as a major contributor to disability, depression disproportionately affects some populations, which includes those with non-communicable diseases. Using social technology in mental health interventions is becoming more and more prevalent as a result. Social technology usage may promote mental health and a sense of belonging, according to the study [30]. Digital interventions have been created over the previous ten years to treat these individuals. Other than that, mHealth interventions can be a popular, practical, and easily available alternative since college students also favor Web-based services over in-person ones [15]. The results are ambiguous, which emphasizes the necessity to define the procedures and methods through which this technology can have advantageous influences [21]. Ecological momentary interventions (EMIs), which are often and successfully used for a variety of psychological issues, use technology to provide interventions. College students' psychological discomfort is reduced, and their psychological well-being is enhanced by mindfulness-based therapy. [21].

The study looked at the usefulness and efficacy of an EMI that included mindfulness-based messaging. On an overall basis, the research considered the messages about mindfulness informative and beneficial. As per research by Evans *et al.*, [16], the Beacon System denotes a web-based tool designed to improve the quality of service delivery for students with emotional, social, as well as behavioral problems by supporting continuous progress monitoring, assisting educators in determining which services are probable to be beneficial with regard to a specific student depending on their age and the nature of their problems, as well as providing school mental health professionals as well as educators with information to assist them in implementing unfamiliar and familiar intervention strategies. The Beacon system will also improve teachers' capacity to collaborate with a student's complete intervention team and provide continuity even when a student switches schools, teachers, or grades [16]. In higher education institutions, research by Lister *et al.*, [17] shows two participatory projects from various regions of the United Kingdom. Both of these projects utilized online as well as technology-based approaches to take a holistic, pro-active, as well as inclusive approach to support students' mental wellbeing. The initial project was the digital "Wellbeing Pedagogies Library" at the University of Warwick. It is known as a digital repository co-designed with students that promote the exchange of pedagogical practices supporting student wellbeing as well as providing a useful resource for students and faculty who wish to establish and/or maintain environments that promote wellbeing in their teaching and learning. On the other hand, the second project is called "Mental Wellbeing in Distance Learning" at the Open University. It piloted five digital subprojects, conducted by various practitioners in collaboration with students, with the goal of addressing wellbeing obstacles in various facets of distance learning. It looks at several participatory methods that may be utilized in various settings and how concepts like "proactive," "holistic," as well as "inclusive" might be used effectively. Based on the results, it suggests that when developing digital resources, interventions, including solutions to enhance student mental wellness, participatory techniques, and collaborations with students, should be given primary consideration [17]. Mobile applications for mental health have increased significantly in recent years. Only a small number of

applications are being created to address interpersonal concerns, and the majority of them are focused on treating anxiety, depression, as well as stress disorders utilizing cognitive behavioral therapy techniques. The latest study in mHealth signified that apps might occasionally be a valuable tool for elevating the delivery of healthcare. Applications for persuasive mental health are potent tools for encouraging behavior modification. Apps for mHealth are being utilized more often to address issues with both physical and mental health, and they may be especially helpful for underprivileged groups. Mobile technology-based health interventions have shown to be affordable as well as practical. Lately, CBT therapies offered online also had a substantial advantage on patients with depression as well as anxiety [26].

The purpose of the research was to assess the usability of MoodTrainer, a mobile CBT software, and MoodGYM, an evidence-based website. App-based CBT has potential since, at least in our brief experiment, it was more engaging and useful. The research was only able to assess the usability of the app, not its clinical efficacy [26]. A smartphone app is used to provide the 18-session psychoeducational digital intervention CONEMO (Emotional Control), which has just minimum nursing assistance. In a randomized controlled trial (RCT) conducted in Lima, Peru, among individuals with hypertension, diabetes, or both, CONEMO showed the potential to lower depressed symptoms [18]. Nevertheless, it is crucial to investigate user experiences, satisfaction, as well as perceptions of usability and acceptability in conjunction with clinical results since these factors may influence how engaged users are with the intervention. The experiences gained by the participants with the smartphone and the CONEMO app show that even those without much technical experience can utilize them. The research also found ways to make the CONEMO intervention better before it is scaled up in subsequent years. Online counseling uses computers or cellphones to facilitate a mental health intervention between the counselor as well as the counselee. ANOVA with a mixed design (split-plot) was utilized to compare the efficacy of online counseling to that of physical counseling along with a control group. According to the mixed ANOVA results, there was an insignificant interaction impact on the participants' subjective well-being across the three groups (post-test, pre-test, as well as follow-up), signifying that the three groups did not vary in terms of these scores.

However, the primary impact on the group was substantial, showing a significant change in the participants' ratings for negative and positive affect in the group receiving face-to-face counseling [25]. The iCognito Relationship Program is a chatbot-based self-help program for relationships between the couple. A test group's members indicated an outstanding degree of satisfaction with having the technology as well as a commonly favorable opinion of the notion of seeing a "virtual psychologist"-chatbot about their individual problems. Regardless of the necessity to replicate the research findings, the iCognito program shows that chatbot and mobile application technologies may effectively boost satisfaction [20]. They can both be used to educate people's communication abilities. Technology is increasingly being used to address mental health issues. A frequently employed standardized test for evaluating the perceived usability of technology is the System Usability Scale (SUS). There have been no Danish translations or validations in Europe. The scale was translated into Danish (SUS-DK), and the study's objectives were to look at the psychometric qualities in a sample of people with mental illnesses utilizing digital technologies as treatment interventions. 138 users of a Danish mental health service that included apps, video chats, computer programs, as well as virtual reality. As per guidance from the International Society for Pharmacoeconomics and Outcomes Research (ISPOR), the original SUS was translated. The psychometric examination discovered robust internal consistency (Cronbach's alpha = 0.87), and the language adaption produced a conceptually identical Danish version of SUS. For evaluating perceived technology usability in a Danish treatment environment, the SUS-DK is advised [24]. Digital chatbots for mental health can offer totally automated interventions for depression symptoms. For young

adults with depressive symptoms, a CBT-based chatbot is an interesting as well as practical digital therapeutic technique that enables simple accessibility along with self-guided mental health support. This research has built a method for evaluating nonclinical parameters for a chatbot with regard to mental health. Furthermore, future investigation on the mechanism through which mental health chatbots affect patients will need to focus on both nonclinical measures as well as clinical results. The long-term efficacy with regard to the mental health chatbot has to be supported by trials repeated with a higher dose and examination of its higher efficiency in contrast to other active controls [27]. Even though there are several digital tools available to assist mental health, implementing them in everyday medical practice is complicated by a number of factors. In their research from 2022, Carpenter-Song *et al.*, [23] sought to determine if it would be feasible to implement an intervention that incorporated a support role to facilitate the clinical team in identifying and utilizing technology to aid recovery. Note that the intervention by a technology specialist lasts for three months and is split into four stages: goal-setting, tool research and evaluation, tool demonstration and tool selection, as well as ongoing support. Working with eight clients and their case managers, they carried out the intervention at a community mental health facility along with a dual diagnosis treatment program. Case managers and clients actively participated in the intervention with the technology specialist and saw its value. The use of the technology specialist in these practical contexts was enabled by collaboration and integration with the care team. Besides, according to clients, the intervention made it simple to test a digital tool. Here, six out of the eight participants said they had created important strides toward their objectives. A promising new position for the delivery with regard to mental health care that will supplement existing services and improve personalised rehabilitation is the technology specialist [23].

Internet-delivered psychological treatment (IDPT) systems are software programs that provide psychological therapies through the internet, according to research by Mukhiya *et al.*, [31]. One of the most often used and extensively investigated types of psychotherapy is the IDPT system. There is evidence that using IDPT systems to give psychological therapy can be a successful method with respect to treating mental health morbidities. Nevertheless, existing IDPT systems possess limited user adherence as well as significant dropout rates. The main cause is that the tunnel-based treatment architecture used by the present IDPT systems prevents them from being flexible, adaptive, or individualized. No matter the patient's situation, choices, or wants, a fixed tunnel-based design administers predetermined, sequential treatment content to each one of them. Additionally, the interoperability of existing IDPT systems is subpar, which makes it challenging to reuse and exchange treatment materials. For such IDPT systems, there are no recognized (clinical) guidelines, conceptual frameworks, or development and documentation standards. As an outcome, there are multiple ad hoc IDPT model variations. As a result, researchers and developers frequently create new iterations of IDPT systems, increasing their complexity and decreasing their interoperability [31]. Gamified applications can provide youngsters with mental health interventions in terms of gamification. Results indicated that preschoolers could understand the narrative. Only seven out of twenty (7/20) of the children could name or show a strategy that may be used in an edgy scenario in real life, whereas eleven out of the twenty kids could recollect at least one anger management approach. For youngsters to interact with more than one method of controlling their anger and to prevent misunderstandings, extra scaffolding, prompts, or motivating rewards must be incorporated. Gamified applications have the potential to be efficient behavioral intervention tools for educating young children about their emotions in a fun, cost-effective, as well as accessible way [21]. Based on the reviews, study found a few internet applications and web technology has been utilized in the process of interventions to discover mental disorder. Table 3 shows the medium used and the purpose in digital based interventions.

Table 3
 Medium and Purpose of Digital Interventions

Medium	Purpose
Ecological momentary interventions (EMIs)	incorporating mindfulness-based messages
Beacon System	web-based tool formed to improve the service provision quality for students having emotional, social, as well as behavioral problems by supporting continuous progress monitoring
Mental Wellbeing in Distance Learning Wellbeing Pedagogies Library	supporting student mental wellbeing in higher education, utilizing technology and online-based approaches.
Cognitive Behavioral Therapy (CBT) interventions	CBT mobile app is known as MoodTrainer with an evidence-based website known as MoodGYM
CONEMO (Emotional Control in Spanish)	18-session psychoeducational digital intervention delivered via a smartphone app
iCognito Relationship Program	virtual psychologist application for relationships relying on the chatbot technology
System Usability Scale (SUS)	investigate the psychometric properties in a mental health sample employing digital technologies in treatment interventions
Internet-delivered psychological treatment (IDPT)	software applications that provide psychological treatments through the internet

3.2 Effectiveness of Digital Interventions Implementation on Mental Health

It is possible to increase the effectiveness of persuasive intervention by customizing it. As per a study, personality factors and an individual's sensitivity to some elements with respect to a persuasive app are related [19]. The findings of the in-depth research demonstrate that personality types of individuals have a major impact on how persuasively various elements of apps are considered to be by different users. Neurotic people are inclined to use apps that provide some relaxation audio and exercises, social support, as well as apps with a clear privacy policy [32]. Besides, people who are prone to experience are more likely to use relaxation exercises and audio, self-monitoring, as well as social support. Conscientious individuals are prone to be driven by apps that give encouragement, suggestions, relaxation audios, as well as trusted information, and reach out for help. Research by Romano *et al.*, [4] sought to ascertain if categorization into separate subgroups is related to mental and physical health corresponds, as well as whether various mHealth technology views and usage reasons diversely gather within a discrete group of people. The current analyses discovered three separate participant subgroups that varied depending on the distinctive patterning of their perceptions of mHealth technology as well as motivational traits, for instance, how participants' assessed enjoyment of using mHealth technology and their perceived ability to utilize these platforms effectively for health-related purposes clustered with each other. These subgroups also showed complex associations with many indicators of mental (but not physical) health. Thus, the properties of mHealth are depicted in Figure 2.

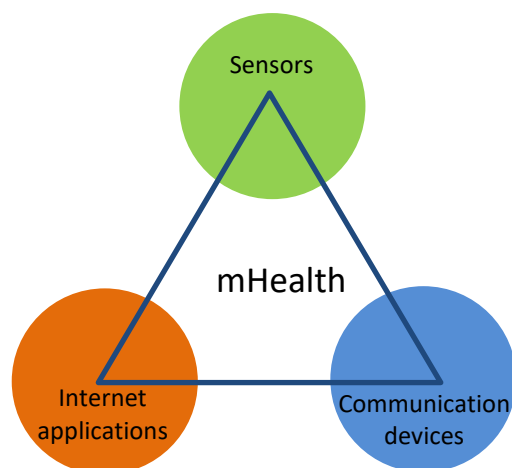


Fig. 2. The characteristics of mHealth

The current results offer significant light on the extent of health-related symptoms in people with various motivational and perceptual mHealth technology traits. These findings may be important to take into account in initiatives attempting to enhance the design of and boost participation in mHealth interventions [4]. Nicolaidou *et al.*'s [21] study is a realistic assessment of a web-based platform for citizen-to-citizen communication employed in community care in a Danish Municipality. According to research, websites that assist individuals in finding friends and activity partners may be useful tools in community interventions aimed at promoting mental health because they help people satisfy a desire for belonging. The effectiveness of these instruments, though, mostly depends on how well a person can utilize their initiative to build connections that are good enough to meet these demands. Those who have previously had relationship problems, those who have battled to feel like they belong, and people with low computer literacy levels may require assistance in realizing the social benefits that new technologies provide [21]. This issue may also affect the younger generation. The interpretation and comprehension of trial results depend heavily on process assessments.

A randomized controlled trial comparing the efficacy of an Internet-delivered behavioral intervention (referred to as BIP TIC) and an Internet-delivered education program for young people and children with tics is being conducted as part of the Online Remote Behavioural Intervention for Tics (ORBIT) project. Alongside the primary trial, a process assessment will be conducted to discover the specific workings of the behavioral intervention and to evaluate whether and, if so, how it may be effectively applied in routine clinical practice. Here, the rationale, objectives, and methods of the ORBIT trial process evaluation are described in this protocol document. This process study will look at how a challenging online intervention affected supervisors, therapists, participants, as well as referring clinicians. Understanding how and whether the intervention functioned and what might be needed to maintain the adoption of the treatment over time can be made easier by contextualizing trial effectiveness outcomes. The results will also help us better understand the variables that might influence how effective complicated interventions are. This will make it possible for subsequent researchers creating online behavioral therapies for young people and children with neurological and mental health conditions to learn priceless information from this process assessment [28]. According to reviews, the use of various technologies in online interventions offers efficient and possibly economic models for enhancing health outcomes because they deliver widely disseminated, private, and adaptable health information and services. Digital treatments have been utilized well for long-term condition self-management, mental health, and health promotion. Nevertheless, due to low usage rates and the difficulty in getting users to participate, their efficacy is constrained.

4. Conclusions

There are a variety of issues and questions that have not been studied about the digital interventions medium and its' effectiveness on mental health among young adults. Technology will undoubtedly change in unpredictable ways, there is a vital need to conduct a research on the current trends and medium of technology usage on the process of mental health intervention. The findings from the fifteen (15) papers selected highlighted two (2) main components which are types of medium used and the effectiveness of digital or else online interventions on mental health. This review mostly focusing the mental health issues among young adults and students. Currently, schools have used a variety of techniques, for instance, functional behavioral assessment, teacher or student nominations, as well as systematic screening, to find students who might benefit from interventions. In assessing the requirement with regard to mental health in schools, a lot of professionals who communicate with children support the application of a multiple-gated screening technique. The review's conclusions will educate academics and those who offer digital interventions about how to leverage technology-based tactics to increase participation in such activities.

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