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SYSTEMATIC REVIEW

Mobile-Based Virtual Reality and Augmented Reality Apps in Rehabilitation: A Systematic Review

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ABSTRACT

This systematic review aimed to identify the features and therapeutic content of mobile-based Virtual Reality (VR) and Augmented Reality (AR) rehabilitation apps and to examine the extent to which these apps are supported by scientific studies. A comprehensive search of the Apple App Store and Google Play Store was conducted using common rehabilitation-related keywords, specifically targeting English-language apps. Two reviewers independently screened and extracted data from eligible apps. Additionally, relevant scientific literature was reviewed to match qualitative and/or quantitative scientific studies with the selected apps. Out of 521 screened apps, 48 were directly related to rehabilitation. The most frequent app categories were health and fitness, education, and medical. Of the selected apps (N = 48), 35% were specifically designed for rehabilitation purposes. Additionally, 83.3% were VR-based, 6.25% were AR-based, and 10.4% included both VR and AR components. Fifteen studies were identified as related to the selected apps, including 7 Randomized Controlled Trials (RCTs). The findings suggest that despite the increasing availability of VR and AR apps in rehabilitation, only a small portion are supported by scientific evidence. These results may help individuals with disabilities and their caregivers make more informed decisions in selecting digital health tools for rehabilitation.

Keywords: Rehabilitation, Mobile Applications, Virtual Reality, Augmented Reality

INTRODUCTION

Currently, the demand for rehabilitation services is rising, particularly in low- and middle-income countries (1). The widespread introduction of mobile technology has significantly influenced how rehabilitation is delivered. A global survey reported that the number of smartphone users has increased from 4.44 billion to 6.34 billion between 2017 and 2021. The number of smartphone users is predicted to exceed 7.52 billion by 2026, and this number is expected to continue growing in the coming years (2, 3). With the rapid expansion of health-related app categories (4), there are now over 325,000 apps in the fields of health, medicine, and fitness available across major app stores. In 2017 alone, approximately 78,000 new health apps were released, and mobile health apps recorded 7.3 billion downloads, marking a substantial increase compared to previous years (1). In 2024, the Health & Fitness category accounted for more than 3.6 billion global downloads—representing approximately a 6% increase from the previous year (5, 6).

According to the World Health Organization (WHO), nearly 16% of the global population—equivalent to one in every six individuals—lives with some form of disability, with women, older adults, unemployed individuals, and those with low income being disproportionately affected (7). This phenomenon can lead to serious consequences such as unemployment, difficulties in establishing social relationships, loss of income, and psychological disorders. Globally, the prevalence of disability is on the rise (8). Many healthcare institutions have adopted mobile applications as a cost-effective approach for monitoring, diagnosing, and managing chronic conditions and diseases (4). In recent years, various apps in the field of interactive technology-based rehabilitation have been used to help patients recover from impairments, and these applications fall under the umbrella of traditional rehabilitation, virtual reality (VR), augmented reality (AR), game-based therapy, or a combination of any of these that enhance user engagement through immersive and interactive experiences (9, 10).

mobile-based VR apps fully immerse people in an artificial or simulated environment created by a computer. In contrast, mobile-based AR apps do not fully immerse people in the computer-generated environment but add the basic components of the rehabilitation process to a real-world environment (putting digital content into the physical environment). VR encourages patients to be involved in their therapy by incorporating games in the form of exercises (VR-assisted exergames) or through other interactive devices (10-12). Exergames are a subset of serious games that incorporate physical activity into their gameplay mechanics. There is a type of exergame designed to focus on the physiological, motor/physical, and cognitive aspects of recovery in rehabilitation (13). In cognitive rehabilitation (e.g., cardiac rehabilitation), virtual reality-based video games offer patients the opportunity to engage in enjoyable tasks with therapeutic purposes through physical interaction with the game (14). Therefore, game-based approaches do not face the challenges of traditional rehabilitation, such as the repetitive tasks that can lead to patients losing interest (15, 16).

Numerous studies have been conducted with the aim of applying and adapting VR and AR technology to support the rehabilitation process and adjust patients' conditions. In a study by Choi et al., the mobile game-based VR app MoU-Rehab was used for upper extremity rehabilitation of 24 patients with ischemic stroke. Patients in the intervention group (N = 12) received 30 minutes of conventional Occupational therapy (OT) plus 30 minutes of MoU-Rehab using a smartphone and a tablet. The patients' upper extremity movements were tracked by sensors built into the smartphone, and information about the movement was transferred to the tablet via Bluetooth. The controls (N=12) received conventional OT alone for one hour per day. The rehabilitation program consisted of 10 sessions of daily therapy, 5 days per week for 2 weeks. In the intervention group, the outcome measures — Fugl-Meyer Assessment of the upper extremity (FMA-UE), Brunnstrom stage (B-stage), and manual muscle testing (MMT) — showed greater improvement than the control group. There was no significant difference between groups in the modified Barthel index (MBI), EuroQol-5 Dimension (EQ-5D), and Beck Depression Inventory (BDI). Patients were generally satisfied with the MoU-Rehab program (17). Another study aimed to evaluate the effectiveness of using a gesture detection tool, MSSDK 1.8 version, to report human joint motion and develop an interactive AR rehabilitation system, mirrARbilitation. Kinect technology was utilized, and a novel motion recognition method was developed to detect and classify movements. In addition, the mirrARbilitation system provided exercise instructions and motivated the patient at the same time. The system was evaluated on a group of 33 patients, physiotherapists, and software developers while performing shoulder abduction therapy exercises. The findings showed that the percentage of correct exercises improved from 69.02% to 93.73% when users interacted with the Mirror Rehabilitation device. The number of exercise repetitions also improved from 34.06 to 66.09%, indicating increased motivation in users (18). In a study by Lee et al., the mobile application Puzzle

AR/Puzzle Walk was used to increase physical activity among adults with autism. The researchers found that walking was the most frequently reported form of physical activity, and patients showed a strong interest in engaging with the app. The Puzzle AR app incorporated several behavior change techniques, including user education, self-monitoring, and personalized feedback (19). Similarly, findings from a study by Kahlon et al. demonstrated that a VR application could be an effective intervention for reducing public speaking anxiety (PSA) (20). A systematic review examining the use of VR and AR in hand rehabilitation highlighted several benefits and facilitators that support the successful implementation of these technologies. The findings suggest that patients are capable of effectively using VR and AR in rehabilitation contexts (9).

The American Physical Therapy Association and American Occupational Therapy Association have expressed their support for the use of Mobile Health (mHealth) apps in clinical settings (4). Despite the expansion of app stores and the growing popularity of mobile health applications, more than half of these apps have been developed primarily to provide general information to users. Concerns remain regarding the accuracy of their medical content and the reliability of their performance. Furthermore, validation studies are lacking for many apps that rely on external devices or sensors. Given the rising use of mobile health applications, it is important to evaluate their clinical usefulness and potential results in rehabilitation settings. Due to the considerable variation among apps in terms of purpose, functionality, and target population (4), the objective of this systematic review study was twofold: (a) to examine the therapeutic features and content of mobile-based VR and AR applications used in rehabilitation, and (b) to evaluate the scientific evidence supporting these applications.

METHODS

This systematic review was conducted in two phases, spanning from June 7, 2021, to September 9, 2021.

Phase 1: App Store Search (Apple App Store and Google Play)

The initial search for relevant applications was conducted in the Apple App Store (iOS system) and Google Play Store (Android system), following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The inclusion criteria were: (a) mobile-based VR or AR applications, (b) related to the field of rehabilitation, and (c) available in English. Also, the exclusion criteria were: (a) not free for download, (b) needed additional devices (VR/AR headset, Kinect, …), (c) Not available for a long time, (d) The app name does not match its content, (e) Their descriptions are not sufficient and their exact use is not clear, and (f) It is purely educational or simulation and has no clinical and practical use. The list of search keywords was developed based on a review of the literature in rehabilitation and finalized through consensus among the research team (the complete search strategy is presented in Table 1). After entering the keywords into the app stores and identifying relevant applications, data were extracted using a researcher-designed data extraction form.

Phase 2: Literature Review

Following the identification of applications in Phase 1, two authors (FS and SE) conducted a literature search using the terms [App name] AND [Smartphone OR mobile] across the databases IEEE, Google Scholar, MEDLINE/PubMed, and PsycINFO. The search aimed to identify studies that specifically mentioned the names of the extracted applications. In addition, the full texts of relevant articles were retrieved and independently reviewed by the two authors. The inclusion criteria were: all peer-reviewed research articles published in reputable journals, written in English, and employing either qualitative and/or quantitative study designs. (Table 1)

TABLE I. SEARCH STRATEGIES TABLE FOR VR/AR MOBILE APPS

The list of search terms includes:
(Rehabilitation OR physical therapy OR physiotherapy OR exercise therapy OR recovery of function OR improve OR functional activity OR muscle strength OR execution function OR motor skill OR compliance OR resistance training) AND (Virtual Reality) OR (Augmented Reality).

Ethical Statement

Since this study was not conducted on humans and relied on publicly available information, it did not require ethics approval.

RESULTS

Phase 1: Search in the Apple App Store and Google Play

A total of 521 applications were initially identified in the Google Play Store using the predefined search strategy. No relevant applications were found in the Apple App Store. Of the 521 apps, 20 (3.83%) were excluded due to duplication, 5 (0.95%) were excluded because they were not free or not available in English, and 444 (85.2%) were excluded for lacking rehabilitation-related content. From the remaining 50 apps, two were no longer available on Google Play at the time of final screening. As a result, 48 applications were included in the final analysis (Figure 1).

Characteristics of Included Applications (N = 48)

These apps were categorized into nine groups based on their primary focus, with Health & Fitness being the most prevalent category (47.9%, n=23), followed by Education (20.8%, n=10), Medical (14.5%, n=7), Game (6.25%, n=3), and other categories (Productivity, Communication, Personalization, Adventure, and Business) each representing 2.08% (n=1). This distribution highlights the predominance of health-oriented applications, reflecting the growing interest in mobile health (mHealth) solutions for rehabilitation.

The therapeutic focus of the 48 apps varied widely, aligning with diverse rehabilitation needs. Specifically, 35% (n=17) were explicitly designed for rehabilitation purposes, targeting conditions such as vertigo, stroke, phantom limb pain, and autism. Other apps addressed specific therapeutic goals: 10.4% (n=5) focused on physical therapy, 14.5% (n=7) on physiotherapy, 16.6% (n=8) on exercise therapy, 6.25% (n=3) on motor skill improvement, and 16.6% (n=8) on enhancing muscle strength and functional activity. Only 2.08% (n = 1) targeted executive function and functional recovery, indicating a gap in apps that comprehensively address cognitive rehabilitation.

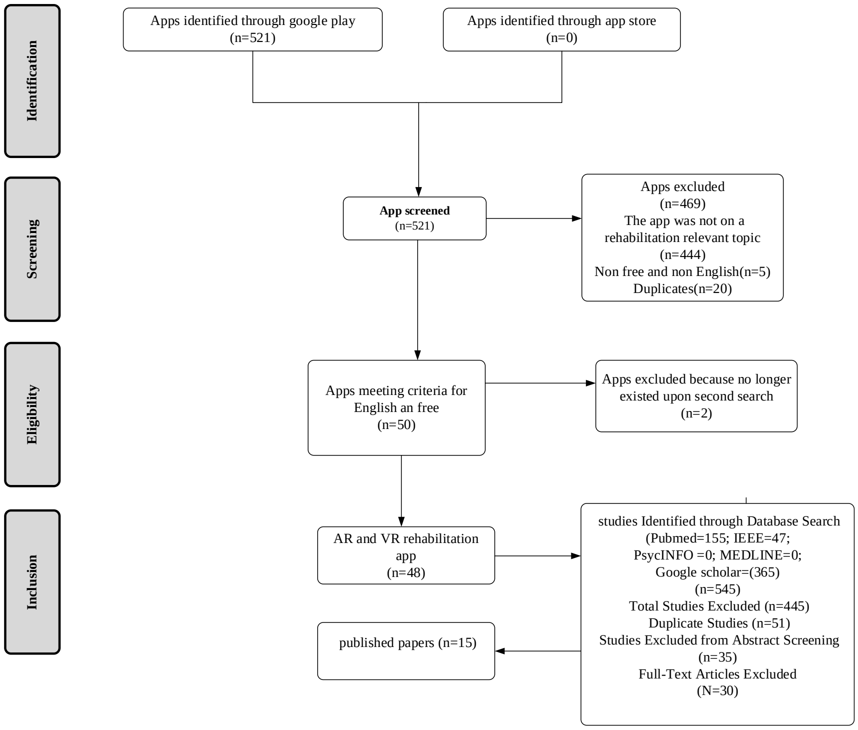

FIGURE I. PRISMA FLOW CHART FOR THE SCREENING PROCESS OF APPLICATIONS AND STUDIES

In terms of technology, 83.3% (n = 40) of the apps were VR-based, 6.25% (n = 3) were AR-based, and 10.4% (n = 5) incorporated both VR and AR components. This predominance of VR-based apps reflects the immersive nature of VR, which is particularly suited for engaging users in therapeutic exercises through simulated environments. AR-based apps, while less common, offer unique benefits by overlaying digital content onto the physical world, enhancing real-world rehabilitation tasks. The integration of both technologies in some apps indicates a trend toward hybrid approaches that combine immersive and contextual elements to support rehabilitation.

Pricing and user reception further characterize these apps. The majority (89.5%, n = 43) were freely available, while 10.5% (n = 5) followed a freemium model, offering basic features for free with additional paid functionalities. This high proportion of free apps enhances accessibility for users, particularly in resource-constrained settings. User ratings, a proxy for user satisfaction, showed that 89.5% (n=43) of the apps received a rating of 3 or higher out of 5, with 4.16% (n=2) rated above 12 out of 20, and 2.08% (n=1) above 7 out of 10. These ratings suggest generally positive user experiences, though the variability in rating scales across apps complicates direct comparisons. (See supplementary Table S1 for more details)

Phase 2: Literature Review

Following the identification of apps in Phase 1, a literature review was conducted to locate studies that referenced these applications. A total of 545 articles were retrieved using the predefined search criteria, of which 15 met the inclusion criteria after screening (Figure 1).

Characteristics of Included studies (N= 15)

To evaluate the scientific evidence supporting the identified apps, a literature search was conducted, yielding 545 articles, of which 15 met the inclusion criteria (Figure 1). These studies, published between 2015 and 2020, provided evidence for 31.25% (n=15) of the apps identified in Phase 1, specifically referencing apps such as Puzzle AR, Exposure VR – Public Speaking, Mirror Box VR, Virtual Training, and Cube AR. The studies comprised seven randomized controlled trials (RCTs), seven developmental studies, and one cross-sectional study, with sample sizes ranging from 6 to 50 participants. The study populations primarily included individuals with autism spectrum disorder (ASD), public speaking anxiety (PSA), cerebral palsy, or stroke, reflecting a focus on specific rehabilitation contexts.

The findings from these studies demonstrated positive outcomes, with apps contributing to improvements in motor and cognitive impairments. For instance, RCTs evaluating Exposure VR – Public Speaking showed significant reductions in PSA, while Puzzle AR was associated with enhanced physical activity and cognitive skills in people with ASD. Similarly, Mirror Box VR improved motor function in patients with upper limb impairments, and Virtual Training supported physical rehabilitation through interactive exercises. These results directly address the research question by confirming that a subset of VR and AR apps is supported by scientific evidence, particularly for cognitive and motor rehabilitation. However, the limited number of apps with published studies (31.25%) underscores a gap in the scientific validation of most mobile-based rehabilitation apps (See supplementary Table S2 for more details).

The integration of Phase 1 and Phase 2 findings reveals a complex landscape for mobile-based VR and AR apps in rehabilitation. The 48 apps identified in Phase 1 offer diverse therapeutic features, with a strong focus on health and fitness, physical therapy, and exercise therapy, supported by VR and AR technologies. However, only 15 apps were linked to scientific studies, indicating that while the availability of such apps is increasing, their clinical validation remains limited. The studies that do exist highlight the potential of these apps to improve motor and cognitive outcomes, particularly for conditions like ASD, PSA, and stroke. For example, apps like Puzzle AR and Exposure VR – Public Speaking not only provide therapeutic content but also demonstrate measurable clinical benefits, as evidenced by RCTs and developmental studies. The predominance of Health & Fitness apps aligns with the growing demand for accessible, user-friendly rehabilitation tools, while the high proportion of free apps enhances their potential reach, particularly in low- and middle-income settings. However, the disconnect between the app analysis and literature review, as noted by the reviewer, is addressed by emphasizing the overlap between app features and their scientific validation. For instance, apps targeting motor skills (e.g., Virtual Training) and cognitive rehabilitation (e.g., Exposure VR) are supported by studies that validate their therapeutic efficacy, reinforcing their alignment with the review's objectives. The limited number of AR-based apps and their associated studies suggests an area for future development, as AR's potential to enhance real-world rehabilitation tasks remains underexplored.

DISCUSSION

This systematic review aimed to examine the therapeutic features and content of mobile-based virtual reality (VR) and augmented reality (AR) applications in rehabilitation. It also sought to evaluate the extent of their scientific validation, addressing the research questions outlined in the study. The findings, as reported in the Results section, provide a comprehensive overview of the current landscape of these applications and highlight both their potential and limitations in rehabilitation contexts.

A total of 48 applications were identified on Google Play and categorized into nine groups. The Education category had the highest number of related studies, while the medical category had the fewest. Only five apps—Puzzle AR, Exposure VR – Public Speaking, Mirror Box VR, Virtual Training, and Cube AR—were mentioned in the literature. Among them, Exposure VR – Public Speaking and Puzzle AR had the greatest number of published studies.

Most studies reported positive clinical outcomes, indicating that these apps improved functional performance, enhanced user experience, alleviated symptoms, and demonstrated overall therapeutic benefits. Supporting these findings, a systematic review by Laver et al. reported significant improvements in motor function with VR-based stroke rehabilitation (35). Moreover, a 2015 study confirmed the effectiveness of the evidence-based mobile app Better Personal Health Assistant in standard cardiac rehabilitation (36).

Although a considerable number of mobile applications are freely available, only a limited number have been implemented in rehabilitation interventions (37). Most mHealth intervention studies in rehabilitation report positive outcomes from telephone-based or two-way patient-therapist communication via videoconferencing rather than the use of mobile apps (36). Therefore, recommending mobile app usage in rehabilitation should take into account cultural factors, patient readiness and acceptance, technological literacy, internet accessibility, smartphone availability, and related considerations.

Almost half of the reviewed studies were not RCTs and did not assess the clinical effectiveness of the applications in rehabilitation. Despite the rapid growth of app stores, many people who are seeking self-care may not have access to evidence-based interventions (37). Research on mobile apps for blood pressure and blood glucose monitoring revealed that none of these apps complied with current Apple guidelines or Section 408 of the Rehabilitation Act. Moreover, there is a lack of scientific evidence supporting the sustained effectiveness of most mobile health applications. While thousands of mobile health apps are available, fewer than 1% are evidence-based (36).

Objective results from mHealth interventions designed and conducted in formal research settings are rarely accessible to the public. Despite technological advances, a significant lack of RCTs evaluating the effectiveness of VR and AR applications in rehabilitation persists (38, 39). This issue is particularly evident in developing countries with limited research infrastructure. Therefore, further studies with larger sample sizes and more rigorous methodologies are essential to scientifically validate these applications.

While many rehabilitation areas are impacted by mHealth technologies, increased involvement of qualified healthcare professionals throughout product development is critical to ensure user-centered design and content oversight. Evidence shows that active participation of end-users and health experts during the design process enhances both user satisfaction and app effectiveness (40). Additionally, employing evidence-based strategies in app features and content is crucial to enable informed user choices (37). Moreover, protecting patient privacy and data security is paramount, as failure to do so can erode user trust and reduce app adoption (41).

Limitations and Strengths

This study has several limitations. First, most participants in the reviewed articles were individuals with specific conditions such as ASD, post-stroke aphasia, cerebral palsy, and stroke, which limits the generalizability of the findings to other rehabilitation populations. Second, the app search was restricted to the Google Play Store, with no apps found in the Apple App Store, potentially overlooking relevant applications on other platforms. Furthermore, the evaluation of app performance relied solely on descriptive data and existing literature, without direct clinical testing.

Despite these limitations, this study offers several strengths. The systematic search of app stores, data extraction, integration with a structured literature review, and thematic categorization of apps provide a comprehensive overview of the current state and gaps in the use of mobile VR and AR apps for rehabilitation. This mixed-method approach lays a solid foundation for the development of evidence-based, user-centered rehabilitation applications in the future.

CONCLUSION

This study's findings reveal that only a small fraction of mobile applications utilizing VR and AR in rehabilitation are supported by scientific evidence and adhere to evidence-based strategies. In most cases, there is insufficient proof of their clinical effectiveness. This highlights the need for more rigorous research, including interventional studies and RCTs, to assess app components, educational content, user-centered design, and accessibility, as well as their impact on enhancing self-care and supporting individuals with disabilities. Expanding the use of these applications to less-explored rehabilitation areas could further increase their effectiveness. The insights from this study provide a foundation for researchers, developers, and rehabilitation specialists to design innovative interventions, ultimately improving care quality and user access to digital health tools.

Declaration of the Use of Artificial Intelligence Tools

We utilized AI-powered tools to enhance the academic quality of the text, which was primarily written by the authors.

Contributorship Statement

Conceptualization: FS, Data curation: FS, SE, Formal Analysis: FS, ZZ, SE, Methodology: FS, ZZ, Project administration: FS, Software: FS, Supervision: FS, Validation: FS, Writing original draft: FS, ZZ, SE, Writing, review & editing: FS, ZZ, SE. All authors read and approved the submitted manuscript and agree to be accountable for all aspects of the work.

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Declaration Of Conflicting Interests

The authors declared there are no conflicts of interest regarding the research, authorship, and publication of this article.

Data Availability Statements

All data are presented in the supplementary section in Tables S1 and S2.

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SUPPLEMENTARY MATERIAL

TABLE SI. CHARACTERISTICS OF MOBILE-BASED VR AND AR REHABILITATION APPS (N=48)

Subject	App name	Store description	XR		Category	Rating and reviews	Version	Updated on	Downloads	Download size (Mb)	Released on	Price
			AR	VR								
	VertiGo Exercise (AR).	Vertigo management App (recover from vertigo), include vestibular rehabilitation exercise.	*		Health and fitness	+3	1.1	2017-06-30	+10000	69.30	2016-02-18	free
	AR – Dysphagia Diet.	Stroke rehabilitation, Nutrition educational platform.	*		education	+3	0.2	2021-02-14	+10	64.64	2021-02-14	free
	Mirror Box VR.	Alleviate phantom limb pain after limb amputation.		*	medical	+3	1.0.2	2020-02-09	+5000	14.43	2019-01-30	free
	Tengo Baja Vision – simulator.	Low vision		*	education	+3	2.1.5	2020-04-16	+10000	6.55	2017-11-20	free
	Reha Metrics Clinic.	To treat physical and cognitive impairments.		*	medical	+3	1.3.784.1026	2021-03-04	+100	317	2018-01-30	free
Rehabilitation	i Bloom VR for Autism.	For managing Autism, to develop social, behavioral, and cognitive skills.		*	education	+3	1.8	2020-01-17	+100	141	2020-01-19	free
	Visuo Prime Home VR.	Vision therapy for wide range of eye problem.		*	medical	+3	2020.6.7.1	2020-06-07	+10	129	2020-04-16	free
	Living Free VR.	For feel of a "rehab community".		*	productivity	+3	1.2	2020-05-22	+5	3.48	2020-05-17	free
	Reha Metrics Home.	To treat physical and cognitive impairments.		*	medical	+3	1.3.784.1026	2021-03-04	+100	316	2018-01-30	free
	Virtual Training.	For rehabilitation training.		*	Health and fitness	+3	3.5	2021-05-17	+500	16.72	2019-05-03	free
	Strength Training by Muscle and Motion.	Advanced anatomy and exercise App.		*	Health and fitness	+3	2.3.1	2021-07-19	+500000	60.19	2017-11-17	Free and pay money for more capabilities.

	In The Rooms.	For addiction recovery community.		*	communication	+12	1.5	2020-12-10	+50000	11.59	2020-03-31	free
	OPT Virtual Wellness Studio.	Physical therapy for pelvic health and recovery-based fitness.		*	Health and fitness	+3	7.9.0	2021-06-28	+10	54.34	2020-03-13	free
	Train your Brain – Visuo spatial Games.	To improve visual ability and train viso – spatial skills (improve cognitive function).		*	game	+3	1.3.1	2021-04-13	+100000	30.97	2019-02-28	Free and pay money for more capabilities.
	Bodify Virtual PT.	Include corrective exercise/rehabilitation and more.		*	Health and fitness	+3	6.9.14	2020-07-12	+50	99.36	2018-02-20	free
	reco VRy.	For mental health challenges.		*	education	+12	1.2.1	2020-01-26	+10	58.58	2019-11-06	free
	Posture by Muscle & Motion.	For diagnose and treat posture defects. Include effective exercise.	*		Health and fitness	+3	2.3.3	2021-07-20	+100000	25.27	2017-02-23	free
Physical Therapy	Reality Hacker VR.	For colorblindness	*	*	personalize	+3	0.9	2015-01-08	+100000	1.01	2014-09-18	free
	VR Health Exercise Tracker.	For muscle activation		*	Health and fitness	+3	1.0.83	2020-10-16	+5000	24.82	2019-10-08	free
	VR Bug phobia Horror – Virtual Reality.	For recover from phobia of bug (insectophobia).		*	medical	+3	2.0	2018-12-03	+1000	37.48	2018-11-28	free
	Painalog-fix pain easy!	To treat complex sport and occupational injureis.		*	Health and fitness	+3	1.9.5	2020-06-14	+1000	52.94	2018-10-28	Free and pay money for more capabilities
	Posture Fix Yoga 180- Straight Posture Correction.	Improve posture correction (strength, flexibility and balance).		*	Health and fitness	+3	4.0	2021-05-08	50000+	56.62	2020-12-04	free
Physiotherapy	Exposure VR – public speaking.	For improve speech		*	education	+7	5	2020-04-07	+100	361	2019-10-09	free
	Back pain Relief Treatment – Yoga Exercise at Home.	Exercise for relief back pain.		*	Health and fitness	+3	3.6	2020-10-28	+100000	21.43	2020-04-30	free

	Public speaking simulator VR.	For boost public speaking confidence.	*	education	+3	0.5	2015-03-14	+10000	30.27	2015-03-14	free
	Knee pain Relief Yoga – Home Exercise Physiotherapy.	Knee pain treatment and improve body posture.	*	Health and fitness	+3	1.0.4	2021-05-11	+1000	60.31	2021-03-09	free
	Knee pain Relief by Physiotherapy Exercise at Home.	Knee pain exercise	*	Health and fitness	+3	1.0.2	2021-04-06	+100	35.13	2021-04-20	free
	Med Bridge Go for patients.	Include complex exercise as prescribed by your therapist.	*	Health and fitness	+3	3.1.0	2021-07-19	+100000	43013	2017-05-15	free
	Dr paul Academic Institute Advanced Physiotherapy.	Physiotherapy course.	*	education	+3	1.0.1	2020-07-02	+10	5.49	2020-07-02	free
Exercise Therapy	Kapbis VR Free.	helps to make the "lazy" eye work	*	medical	+3	1.0	2018-01-02	+1000	28.89	2017-04-06	free
	Beyond VR public speaking VR Cardboard App.	Improve public speaking	*	Education	+3	1.91	2019-12-29	+10000	103	2017-02-19	Free
	Depression Treatment help by Yoga, Exercise & Diet.	Relief exercise for treat depression	*	Health and fitness	+3	4.0	2021-05-08	+1000	56.36	2020-04-30	free
	Diabetes Yoga Exercise Therapy – low sugar Diet.	Diabetes management Exercise	*	Health and fitness	+3	4.0	2021-05-07	+5000	31.50	2020-04-30	free
	Tick Fitness and Physiotherapy.	Fitness and physiotherapy exercise.	*	Health and fitness	+3	9.6.8	2021-05-19	+50	30.01	2019-06-07	free
	Migraine Relief Yoga – Sinus & Headache Relief Home.	Include Migraine relief exercise.	*	Health and fitness	+3	4.0	2021-05-07	+10000	53.83	2020-04-08	free
	Heart Disease Yoga & Diet – Cardio Yoga workout 3 D.	Heart health management.	*	Health and fitness	+3	4.0	2021-05-07	+10000	55.66	2020-04-30	free

	Yoga for Immunity Boost at Home – Diet & Exercise.	Immunity builds up exercise.		*	Health and fitness	3+	4.0	2021-05-08	+10000	61.50	2020-04-09	free
Recovery of function	Look – eyes gymnastics.	prevention of amblyopia		*	Health and fitness	+3	2.6	2021-03-09	+1000	87.02	2020-05-07	Free and pay money for more capabilities
Improve	Cube AR: 3D& AR Labyrinths & Maze.	it develops logical thinking, memory, and reaction	*	*	Games	+3	1.5.2	2021-05-12	+50000	146	2019-09-02	Free and pay money for more capabilities
	Puzzle AR/ Puzzle walk.	developing creativity and logical thinking	*	*	education	+3	2.1	2021-07-08	+5000	61.80	2019-01-18	free
Functional activity	Health club – Home workouts & Fitness – calorie tracker.	Improve cardiovascular health and fitness.		*	Health and fitness	+3	3.0.2	2021-06-30	+50000	38.45	2020-05-21	free
	Visual schedules and social stories.	Improve socially appropriate behaviors in children with autism.		*	education	+3	1.34	2018-10-24	+10000	24.96	2018-02-15	free
Muscle strength	VR Fitness Insider.	Improve overall health.	*	*	Health and fitness	+3	1.4	2019-12-16	+500	8.41	2016-12-01	free
	Neck exercise – pain relief workout at home.	Practice neck shoulder workout for stretches daily for the prevention and treatment of osteochondrosis.		*	Health and fitness	+3	1.0.4	2021-02-06	+100000	22.18	2020-04-07	free
Execution function	Corpus VR Headset	A platform for ergo, fysio and neurotherapy.		*	Medical	+3	1.11.2	2021-07-16	+100	293	2017-10-23	Free
Motor skill	Speaker VR – public speaking App.	A solution for become a professional speaker.		*	business	+3	1.05	2019-12-29	+500	101	2019-06-08	free
	Puzzle cars 1.	Improve brain performance (cognitive skills).		*	game	+3	5.10.35	2020-11-26	+1000000	15.73	2015-07-10	free
	Neural Motor AR.	Developing and stimulating fine motor skills.	*	*	Adventure	+3	0.1	2021-04-18	+10	92.63	2021-03-09	free

TABLE SII. CHARACTERISTICS OF SUBSET OF APPS WITH RESEARCH SUPPORT (N= 15)

Author [Year]	Study type	Objective	Study population	Sample size	Country	Type of rehabilitation	Tools	Findings
Yadav, et al.[2019] (21)	RCT	Use of bio behavioral indices captured from wearable devices and VR interfaces to quantify PSA.	People with Public Speaking Anxiety (PSA).	33	USA	Cognitive rehabilitation.	Hardware: Oculus Rift headset. Actiwave Cardio Monitor. wrist-mounted Empatica E4. Microphone, Mobile. Software: Presentation Simulator software, Trait-Scale of the Trait Anxiety Inventory (STAI), Communication Anxiety Inventory (CAI), Personal Report of Public Speaking Anxiety (PRPSA), Big Five Inventory (BFI), Brief Fear of Negative Evaluation (BFNE), Reticence Willingness to Communicate (RWTC), State-Anxiety Enthusiasm (SAE), Body Sensations Questionnaire (BSQ), Presentation Preparation Performance (PPP) survey, Ledalab Software. Opensmile software,BioSPPy toolbox.	VR can alleviate PSA.
WILSDON, et al.[2017] (22)	RCT	Determine Three virtual small teaching classroom with an audience with higher graphical fidelity (Immersion) can improve PSA?	People with Public Speaking Anxiety (PSA).	40	UK	Cognitive rehabilitation.	Hardware: Tepoinn 3D glasses, Samsung Galaxy S7 Edge Smartphone. Software: iGroup Presence Questionnaire (IPQ), Personal Report of Public Speaking, Anxiety (PRPSA), UWIST Mood Adjective Checklist, VR environment.	Dimensions of presence significantly differed between conditions. Immersion increased. Public speaking anxiety did not improve, Participants in all conditions experienced a positive mood.
Salkevicius, et al.[2018] (23)	RCT	Designing A VR software for Fear of Public Speaking.	People with Public Speaking Anxiety (PSA).	6	Lithuania	Cognitive rehabilitation.	Hardware: Gear VR headsets, Mobile phone, Bio feedback sensors (Empatica E4 wristband), computer.	created 3D VRET environments can induces stress as in daily life public speaking scenarios.

							Software: WebGL app, Gear VR app, VR app.	
Yeves-Lite, et al.[2020] (24)	RCT	Compare the effects of Conventional MT and Virtual Reality MT on children with upper Obstetric Brachial Palsy.	People with Upper Obstetric Brachial Palsy.	12	Spain	Motor rehabilitation.	Hardware: Smartphone, VR glass, Mirror box, bottle with beads, chickpeas, lentils, or grains of rice, chopsticks, plasticine balls, tennis ball, doughnuts, Software: Hand-use Experience Questionnaire(CHEQ), Pediatric Quality of Life Inventory Generic Core (PedsQL). Scales (PedsQL TM 4.0), EPIDAT, Virtual Reality MT app.	Virtual Reality MT Was more effective than conventional MT.
Lee, et al.[2018] (19)	Developmental Research	Develop am mobile app to increase physical activity in adults with ASD.	People with Autism Spectrum Disorder(ASD).	34	India	Motor and cognitive rehabilitation.	Hardware: Mobile, Software: Puzzle AR app, Online questionnaire.	Walking is the most common form of PA, users have an affinity to using technology, Puzzle Walk provides users with daily and weekly progress information, including walking steps, distance, time spent for PA, burned calories, puzzle score, and visualized tracking.
Kim, et al. [2016] (25)	Developmental Research	Develop an AR language-learning device that is applicable to English education.	Preschooler who wants learn English language.	Has not been stated.	Korea	Cognitive and motor rehabilitation.	Hardware: Mobile, Puzzle -based language-learning device AR Puzzle. Software: Puzzle AR app, Wireless communication.	Has not been stated.
Paula, et al.[2017] (26)	Cross-sectional study.	Explore for improvements in the performance of individuals with CP with practice in the use of a virtual game on a mobile phone and to compare their performance with control group.	People with Cerebral Palsy(CP).	50	Brazil.	Motor rehabilitation.	Hardware: Nokia 500 smartphone, Software: the game Marble Maze Classic.	VR game offers new possibilities for use to improve function.
Koller, et al [2019]. (27)	RCT	Explores a system that enables the therapists to richly interact verbally and non-verbally	Healthy people.	24	German.	Cognitive rehabilitation (for PSA).	Hardware: Microsoft Kinect v2, Microphone, HTC Vive headset, mouse, Keyboard, Computer, ,mobile	direct verbal interaction between an orchestrator outside the VR and an immersed presenter enhances the presenter's experience.

		with immersed people with PSA disorder.					Software: Wireless connection, self-rated Mini-SPIN questionnaire, Virtual class.	
Lindner, et al.[2020] (28)	RCT	Examines the effectiveness of a VR-assisted treatment protocol for PSA with demonstrated efficacy, in routine care, using affordable VR hardware.	People with Public Speaking Anxiety (PSA)	23	Sweden	Cognitive rehabilitation.	Hardware: Mobile, Oculus Go headset. Software: Internet, Public Speaking Anxiety Scale (PSAS), Liebowitz Social Anxiety Scale Self- Rated (LSAS-SR), Patient Health Questionnaire 9-item (PHQ-9), Generalized Anxiety Disorder 7-item (GAD-7), Brief Quality of life scale (BBQ), Brief Fear of Negative Evaluation Scale (BFNE), subjective units of distress(SUD), self-rated quality of performance, VR app.	Significant decrease in PSA was observed.
Scheveneels, et al.[2019] (29)	RCT	Examined the role of expectancy violation and retrospective reasoning about the absence of feared outcomes in virtual reality exposure therapy (VRET) for PSA.	People with Public Speaking Anxiety (PSA)	43	Belgium	Cognitive rehabilitation	Hardware: Polar RS800CX, chest-strap, Samsung Gear VR headset, Samsung S7 smartphone, Samsung Gear 360_camera. Software: Personal report of confidence as a speaker (PRCS), Self-statements during public speaking scale (SSPS), Subjective Units of Distress (SUDS), ARTiiFACT software, 360_ movie clips.	PSA decreased.
Jae Oh, et al.[2016] (30)	Developmental Research	Designs the block puzzle education system based on augmented reality to educate creativity, growth of small muscles, cognition of things, and English simultaneously.	Infants or children.	Has not been stated.	Korea	Cognitive and motor rehabilitation	Hardware: mobile Software: Puzzle AR app, N-screen app.	This is the AR based block puzzle education that infants or children are able to build creativity, fine motor skills, perception of objects, and language education at the same time.
Yanpanyanon, et al.[2019] (31)	Developmental Research	Develop Puzzle AR app helps assemble actual cube puzzle.	tester	30	Japan	Cognitive and motor rehabilitation	Hardware: Smartphone. Software: Puzzle AR app	This study of the AR application will help to assembly with the people who have different experience and knowledge.

Yanpanyanon, et al.[2020] (32)	Developmental Research	Develop Puzzle AR app helps in reducing the errors and difficulties of assembling.g	tester	30	japan	Cognitive and motor rehabilitation	Hardware: Smartphone. Software: Puzzle AR app	All testers did not mistake while assemble the Cube Puzzle.
Gamito, et al .[2015] (33)	Developmental Research	To assesses the effectiveness of a VR-based intervention for the cognitive training and rehabilitation of stroke patients.	Stroke patient	20	Portugal	Cognitive rehabilitation	Hardware: Computer, mobile, ASUS M60V laptop. Software: Mini-Mental State Examination – MMSE, VR cognitive training app	In the intervention group, significant improvements observed in attention and memory tasks.
Ali, et al.[2017] (34)	Developmental Research	Use VR for physical training	our country's military.	15	Pakistan	Motor rehabilitation	Hardware: Samsung Galaxy S7, Samsung Gear VR, PS4 Controller, Software: VR training app, Google Cardboard API.	Users said that VR when integrated with physical training can bring fruitful results by implementing it in different fields .