A Gamified Mobile Telerehabilitation Framework for Improving Exercise Adherence in Older Adults

Evi Triandini[1*], Thosporn Sangsawang[2], Djoko Kuswanto[3]

[1]Information Systems Department, Institute of Technology and Business STIKOM Bali, Denpasar, 80226, Indonesia, email: evi@stikom-bali.ac.id, ORCID: 0000-0001-7073-9829

[2]Educational Technology and Communications Division, Faculty of Technical Education, Rajamangala University of Technology Thanyaburi, Pathum Thani, 12110, Thailand, email: sthosporn@rmutt.ac.th, ORCID:0000-0002-7926-6949

[3]Medical Technology Department, Faculty of Medicine and Health, Institut Teknologi Sepuluh Nopember, Surabaya, 60111, Indonesia, email: djoko.kuswanto@its.ac.id, ORCID:0000-0003-4062-2237

Abstract

The efficacy of long-term rehabilitation programs is diminished by older persons' poor adherence to recommended rehabilitation exercises. Even though telerehabilitation has made rehabilitation services more accessible, many current systems still offer disjointed support, frequently handling clinical monitoring, exercise delivery, and motivation independently rather than in a single digital workflow. In order to improve exercise adherence, this study suggests a gamified mobile telerehabilitation framework for older persons that incorporates clinician-supervised monitoring, gamification, and rehabilitation management. The study uses the Design Science Research (DSR) methodology, emphasizing framework design, objective formulation, and problem identification. A centralized application server connects the patient, clinician, and system support modules that make up the suggested structure. This study's novelty innovation is the comprehensive fusion of gamification, adaptive rehabilitation, and ongoing clinical input into a unified telerehabilitation architecture created especially for senior citizens. A structured conceptual framework that links clinician decision-making, patient exercise activities, and motivational support systems into a single coordinated system is the main contribution. The problem formulation, design objectives, system architecture, use-case flow, and framework design serve as the basis for further prototype development, and the outcomes are currently conceptual rather than empirical. Consequently, this study does not report any empirical effectiveness outcomes. In order to assess the framework's potential to enhance exercise adherence, user engagement, and remote rehabilitation

monitoring, the next phases will involve UI/UX implementation, prototype development, demonstration, and evaluation.

Keywords: Telerehabilitation, Gamification, Older Adults, Exercise Adherence, Digital Health

Introduction

Healthcare systems are facing significant challenges as a result of the aging population, especially when it comes to delivering ongoing and efficient rehabilitation treatments. Chronic illnesses, functional decline, and mobility issues are increasingly common in older persons, all of which enhance the need for long-term rehabilitation to preserve independence and quality of life. Because it maintains functional capacity and encourages participation in daily life, rehabilitation is therefore a crucial part of good aging (WHO, 2021).

Over 29 million people in Indonesia are considered older adults, making up more than 10% of the country's overall population. The country's aging population is still growing (Central Bureau of Statistics of Indonesia, 2023). There is an increasing need for rehabilitation services since a significant section of this group suffers from functional impairments brought on by age-related decline, musculoskeletal problems, and chronic illness. Additionally, according to national health data, many older persons need ongoing therapy help due to limits in their everyday activities (Ministry of Health Indonesia, 2018). However, continuity of therapy is frequently challenging to maintain, and access to rehabilitation is still restricted, especially for older persons residing outside of major healthcare facilities.

Low adherence to recommended exercise regimens is one of the most enduring issues in rehabilitation. Due to poor motivation, inadequate supervision, and the repetitive nature of traditional therapy, many older persons do not regularly complete rehabilitation activities. Even though telerehabilitation has made rehabilitation more accessible by allowing it to take place outside of clinical settings, many current systems still provide insufficient assistance for long-term engagement, customized exercise adaption, and continuous clinician supervision. By converting monotonous rehabilitation chores into more engaging and fulfilling experiences, the incorporation of gamification into telerehabilitation

presents a viable approach to improve motivation, engagement, and adherence (Ambros-Antemate et al., 2023). Points, badges, challenges, and progress tracking are examples of gamification components that may promote continued engagement and make rehabilitation tasks less tedious for patients.

New chances to improve rehabilitation services through data-driven interventions, remote monitoring, and mobile applications have been made possible by recent developments in digital health technologies. Among these methods, gamification—which incorporates game-like elements including prizes, challenges, and progress indicators—has drawn more attention as a successful tactic to improve patient engagement (Edgardo, 2024). Additionally, prior research has demonstrated that by encouraging intrinsic motivation and offering prompt feedback, gamification might increase adherence to health interventions (Bai & Chen, 2025; Lopes et al., 2024).

The majority of telerehabilitation systems currently in use, however, handle exercise delivery, motivation, or clinical monitoring independently rather than combining these elements into a unified framework specifically designed for older persons, indicating a glaring research gap. Because of this, there is currently no organized framework for mobile telerehabilitation that integrates gamification, adaptive rehabilitation planning, and ongoing clinician-supervised monitoring into a single, cohesive system. Current digital rehabilitation options are less able to provide sustained patient engagement and long-term adherence as a result of this constraint. In order to incorporate clinical feedback, adaptive exercise management, and motivational techniques into a cohesive rehabilitation workflow, an integrated framework is required (Daniels et al., 2024).

In order to close this gap, this study proposes a gamified mobile telerehabilitation framework for senior citizens that combines clinical monitoring, gamification, and rehabilitation management into a single digital platform. The goal of the suggested framework is to facilitate adaptive rehabilitation, enhance patient motivation, support structured exercise delivery, and improve communication between patients, therapists, and doctors. In order to assure both theoretical relevance and practical applicability, this study employs a Design Science Research strategy to direct the methodical development of the framework.

The objectives of this study are as follows:

- To develop a gamified mobile telerehabilitation framework that integrates patient functions, clinical functions, and system support modules.

Three levels of contribution are made by this study. By offering an integrated conceptual framework that integrates gamification, adaptive therapy, and clinician-supervised monitoring for older adults—an area that has not been sufficiently united in other studies—it theoretically expands the telerehabilitation and digital health literature. In practical terms, the framework offers researchers, healthcare professionals, and rehabilitation providers an organized resource for creating rehabilitation workflows that can enhance patient involvement, increase exercise adherence, and facilitate remote clinical supervision. In terms of technology, the study offers a system architecture that links clinical, patient, and system support modules via a centralized application server. This provides a basis for further UI/UX design, prototype creation, and future deployment of scalable mobile telerehabilitation solutions.

Related Work

1. Telerehabilitation for Older Adults

Telerehabilitation is becoming more widely acknowledged as a viable approach to increase older persons' access to rehabilitation, particularly for those with musculoskeletal problems, chronic cardiac conditions, or mobility constraints. Physiotherapist-led, exercise-based telerehabilitation is typically safe, well-adhered to, and non-inferior to in-person rehabilitation for a number of functional outcomes in older persons, according to recent research. According to systematic evaluations, real-time telerehabilitation can achieve efficacy comparable to traditional rehabilitation while lowering travel barriers, and supervised telerehabilitation can enhance functional performance in older persons living in the community. The justification for scalable digital rehabilitation models is strengthened by the fact that telerehabilitation and telemedicine have demonstrated comparable clinical efficacy to in-person care in musculoskeletal care more generally and may also lower expenses (Wicks et al., 2023b).

2. Exercise Adherence as a Core Challenge

Exercise adherence is still one of the biggest obstacles to optimal rehabilitation outcomes for older persons and those with chronic diseases, despite advancements in rehabilitation technologies. A variety of elements, such as motivation, self-efficacy, feedback, program simplicity, supervision, and personalization, consistently influence adherence, according to umbrella and systematic reviews. This means that an effective telerehabilitation intervention must actively address behavioral engagement and sustained participation; technology delivery alone is insufficient. The importance of adherence to long-term recovery and functional reintegration is demonstrated by the identical treatment of adherence as a primary outcome in studies on stroke telerehabilitation (Collado-Mateo et al., 2021).

3. Gamification and Exergames in Rehabilitation

Gamification has been extensively researched as a way to boost perseverance, enjoyment, and involvement in health interventions. According to a basic comprehensive review, gamification can have a favourable impact on health-related behaviors, however the results differ according on behavioral processes and design quality. Reviews in the field of rehabilitation have demonstrated that gamified strategies and exergames can enhance motivation, engagement linked to adherence, and certain functional outcomes, such as balance, fall-associated metrics, and frailty-related indicators in older persons. Exergames have been shown to improve balance performance, balance self-efficacy, and fall prevention in older groups, including in long-term care facilities. These results imply that when gamification is incorporated into rehabilitation processes, it can serve as a potentially significant adherence-support mechanism rather than just an entertainment layer (Johnson et al., 2016).

4. Usability, Acceptance, and Older-Adult-Centered Design

Digital rehabilitation systems' acceptability, usefulness, and accessibility are critical to their effectiveness with older persons. Studies on exergame-based telerehabilitation for senior citizens have demonstrated that when these systems are straightforward, easily understood, customized, and bolstered by human interaction, both senior citizens and medical professionals are willing to interact with them. Focus-group studies also show that older persons are concerned about fall risk, technological

complexity, and social isolation, but they also value low cognitive strain, motivating variation, and relevance to health goals. Studies on the use and acceptability of more recent exergame-based telerehabilitation systems have shown promising outcomes, but they also demonstrate that context and implementation quality have a significant impact on perceived utility and enjoyment. These results underline the necessity of a user-centered framework as opposed to a platform that prioritizes technology (Seinsche et al., 2022).

5. Gap in the Current Literature

The research still demonstrates a fragmentation issue despite the encouraging data for telerehabilitation and the expanding potential of gamification. While some research emphasize gamified interaction without strong clinical monitoring, personalization, or interdisciplinary workflow integration, many others concentrate on clinical effectiveness without strong engagement design. Furthermore, discrepancies in digital literacy, access, and implementation in older-adult telerehabilitation have been brought to light by ethics and equity assessments, suggesting that technology viability on its own is insufficient. Thus, an integrated framework that concurrently integrates patient-facing mobile rehabilitation, clinician supervision, adaptive exercise planning, structured feedback loops, and gamification mechanisms specifically targeted at improving adherence is still required. The suggested structure targets this niche (Veras et al., 2025).

According to recent research, telerehabilitation for older persons is clinically feasible. Physiotherapist-led and guided programs provide non-inferior outcomes to in-person therapy for a number of functional measures, while also increasing accessibility and, in certain situations, lowering costs. However, the evidence repeatedly shows that motivation, self-efficacy, feedback, program simplicity, and personalization are the main obstacles to adherence. Simultaneously, research on gamification and exergames indicates that some rehabilitation outcomes, including balance, fall-related metrics, and frailty-related indicators in older populations, can be improved by gaming components. However, research on telerehabilitation for older adults also demonstrates that physician assistance, safety, usability, and simplicity are still essential for acceptability and long-term use. When considered collectively, the research demonstrates the potential of telerehabilitation and gamification, but it also highlights a lack of integrated frameworks

that integrate clinician monitoring, adherence-oriented gamification, adaptive rehabilitation planning, and older adult-centered usability into a single mobile telerehabilitation ecosystem (Wicks et al., 2023a).

Methodology

The framework development follows the Design Science Research (DSR) methodology, starting from problem identification and objective definition, followed by the design and development stage. The design phase includes requirement analysis, conceptual framework modeling, system architecture design, functional mapping, gamification integration, and prototype development. The resulting framework integrates rehabilitation management, gamification, and clinical monitoring into a unified telerehabilitation system. The DSR method is shown in Figure 1.

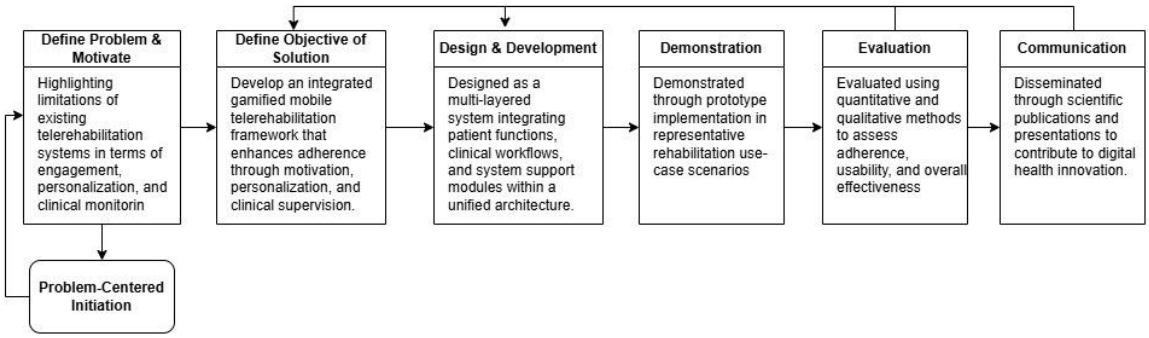

Figure 1. Design Science Research Methodoly (K. Peffers et al., 2007)

1. Problem-Centered Initiation

Problem-centered initiation is the first step in the Design Science Research method and acts as the study's entrance point. The main issue found in this study is older persons' poor adherence to recommended rehabilitation exercises, which has a substantial impact on long-term functional independence and recovery results. In addition to being identified through a review of the literature, this issue is also confirmed by insights from important stakeholders, such as medical technology lecturers, rehabilitation therapists who specialize in elder care, and medical technology students who have finished clinical internships in hospital rehabilitation departments. Rehabilitation therapists stressed that a lack of desire and inadequate supervision outside of clinical

settings are the main reasons why many older patients do not regularly adhere to exercise regimens. While students reported real-world observations of patient non-compliance during their hospital training, lecturers emphasized the gap between technological promise and its practical implementation in rehabilitation services. The significance of the highlighted issue is reinforced by these united viewpoints, which also support the necessity of an integrated digital solution.

Purposive sampling was used to choose stakeholders, who comprised medical technology instructors, rehabilitation therapists, and medical technology students who had completed clinical internships in hospital rehabilitation departments. They ensured that the suggested system is clinically relevant, technically possible, and in line with actual rehabilitation procedures by participating in problem identification, requirement analysis, and framework design.

2. Define Problem and Motivate

The highlighted issue is further examined and supported in the second step using both theoretical and empirical viewpoints. Existing telerehabilitation systems frequently lack engagement mechanisms, customisation features, and ongoing clinical monitoring, according to a thorough study of the literature. Stakeholder input supports these conclusions. According to rehabilitation specialists, the procedures in place do not enable customized exercise regimens or offer enough feedback to keep patients motivated. In order to close the gap between clinical needs and technical capabilities, medical technology lecturers stressed the significance of incorporating digital innovation, such as gamification and adaptive systems, into rehabilitation frameworks. Furthermore, students who interned in hospital rehabilitation units noted that the lack of interactive and interesting components caused many patients to lose interest in repetitious activities. In order to increase adherence and patient involvement, a novel framework that incorporates gamification, adaptive rehabilitation, and clinical monitoring is being developed.

3. Define Objectives of a Solution

The third step concentrates on identifying the goals of the suggested solution based on the problem analysis. The main goal is to create a gamified mobile telerehabilitation framework that improves older individuals' exercise adherence. The

selected stakeholders' feedback is incorporated into the formulation of this goal. The necessity of a system that enables ongoing monitoring and adaptable modification of exercise regimens based on patient performance was underlined by rehabilitation therapists. In order to enable scalable and sustainable healthcare solutions, lecturers offered insights on the integration of emerging technologies, such as intelligent systems and mobile health platforms. In the meantime, students emphasized the significance of simplicity and usability in system design, particularly for older persons with low levels of technical literacy. In order to boost motivation, the framework is built with gamification components including challenges, incentives, and progress tracking in addition to adaptive mechanisms that allow rehabilitation programs to be customized. The system also seeks to enable smooth communication and cooperation between physicians, therapists, and patients in a single digital setting.

4. Design and Development

Building the suggested artifact—the gamified mobile telerehabilitation framework—is the main goal of the design and development phase. Requirements gleaned from stakeholder input and literature serve as the basis for this step. Clinical requirements, including suitable workout structures, safety considerations, and monitoring parameters, are contributed by rehabilitation therapists. Medical technology lecturers offer advice on digital health technology integration, system architecture, and current research trends. During their hospital internships, students provide useful ideas about usability, interface design, and real-world workflow. These inputs are used to create a multi-layered architecture that includes a cloud-based backend system, a web-based dashboard for medical professionals, and a mobile application for patients. A monitoring module for tracking patient progress and facilitating feedback, a gamification engine for increasing engagement, and a rehabilitation engine for overseeing exercise regimens are examples of core modules. Additionally, the system includes adaptive mechanisms that enable rehabilitation regimens to be dynamically adjusted based on performance data. Iterative prototyping is used in the development process to ensure that the system design is continuously improved. This cooperative and multidisciplinary design process guarantees that the final framework is technologically sound, therapeutically applicable, and easy to use for senior citizens.

5. Demonstration, Evaluation, And Communication

After the UI/UX design phase is finished, the next phases of Design Science Research will be conducted, including development, demonstration, evaluation, and communication. Creating a working prototype of the gamified mobile telerehabilitation system from the planned framework and user interface will be the main goal of the development stage. Following the prototype's implementation, the system will be used in representative use-case scenarios involving patients, therapists, and physicians to demonstrate its practical operation. The system's efficacy, usability, and influence on exercise adherence will next be evaluated using both quantitative measures, such adherence rates and usability scores, and qualitative input from stakeholders. In order to provide accessibility and contribute to the advancement of digital health innovation, the communication stage will finally distribute the study findings and generated artifact through scientific papers and conferences.

After the UI/UX design and prototype are finished, empirical evaluation will be carried out in subsequent work. At that stage, the prototype will be tested with representative users, including older adults and relevant stakeholders. The System Usability Scale (SUS) will be used to evaluate the system's usability and user experience, including input from users to help make improvements.

Result

The proposed framework integrates clinician supervision, patient interaction, and digital health technology into a single system to address the serious problem of low exercise adherence among older persons in rehabilitation programs. This methodology integrates patient-centered mobile engagement with clinician-driven monitoring and adaptive decision-making, building on the Design Science Research approach and drawing from earlier research on telerehabilitation, gamification, and user-centered design. By incorporating motivational techniques like gamification into an organized rehabilitation workflow that is backed by real-time feedback and data-driven modifications, it seeks to close the gap between accessibility and engagement. The gamified mobile telerehabilitation framework's general architecture and interaction flow are depicted in the accompanying

picture (Figure 2), which also highlights the connections between patient activities, clinical procedures, and system-level support modules.

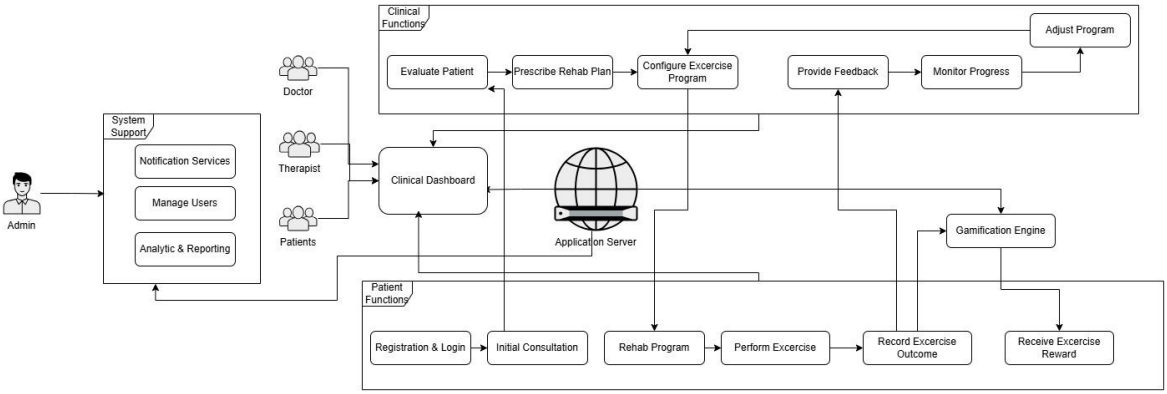

Figure 2. Gamified Rehabilitation and Telehealth Framework (GReaT Framework)

The proposed framework integrates clinician-facing decision support, administrator-managed system services, and patient-facing rehabilitation functions into a single digital platform to create a multi-user gamified mobile telerehabilitation environment for senior citizens. The framework is broadly divided into three main layers: system support, clinical functions, and patient functions, all of which are managed by an application server. This design is in line with earlier telerehabilitation research demonstrating that a strong digital backend to support continuity of care, clinician supervision, communication channels, and an exercise delivery interface are all necessary for successful remote rehabilitation for senior citizens. Recent research on exergame-based systems and telerehabilitation for older adults has demonstrated that when a platform integrates monitoring, guided at-home exercise, and basic user interaction into an integrated architecture, acceptance and feasibility increase (Seinsche et al., 2023).

The framework starts at the patient level with the Registration and Login module, which offers safe access to the system prior to the commencement of the rehabilitation process. Because digital rehabilitation for senior citizens must strike a balance between usability, access restriction, and individualized data keeping, this feature is crucial. Following authentication, patients move on to the Initial Consultation phase, during which their functional limitations, clinical condition, and rehabilitation requirements are determined. Access to the Rehab Program module, where recommended exercises are

presented in an organized and comprehensible manner, comes next. After that, the patient completes Exercise and Record Exercise Outcome, which enables the system to record symptoms, perceived effort, completion status, and other pertinent rehabilitative information. The practical requirement for home-based rehabilitation systems to enable exercise delivery as well as result reporting and adherence monitoring was noted in earlier research, and this sequence reflects that need. Prescribed exercise is beneficial, according to numerous studies on exercise adherence in older persons; nevertheless, adherence may be low unless the intervention is structured, observable, and sensitive to the patient's experience (Shaw et al., 2022).

The Gamification Engine, which is directly linked to the patient exercise workflow, is a key component of the suggested system. Exercise rewards, such as points, badges, progress markers, streaks, or challenges, provide the patient with reinforcement following exercise completion and outcome tracking. This design is based on the larger body of research on gamification, which shows that it can have a good impact on health-related behaviors, particularly when it boosts motivation, validates advancement, and offers quick feedback. Previous assessments, however, also warn that gamification is not always successful and that its effectiveness depends on closely aligning with the objectives and context of the user as well as theoretically informed design. Gamification is therefore viewed in this framework as an adherence-support tool that is integrated right into the rehabilitation cycle rather than as a stand-alone entertainment feature. This strategy is also in line with suggestions that gamified health systems be linked to actual behavior change goals and implemented through iterative co-development (Johnson et al., 2016).

The Clinical Dashboard, which serves as the primary professional interface for rehabilitation planning and monitoring, allows physicians and therapists to access the system at the clinical level. Evaluate Patient is the first step in the clinical workflow, where the doctor evaluates the patient's condition and preparedness for rehabilitation. The therapist or clinician can then Configure Exercise Program by converting the rehabilitation goals into practical exercise routines after the doctor utilizes Prescribe Rehab Plan to define the general therapeutic direction. Because previous research indicates that effective telerehabilitation systems must connect medical decision-making and practical day-to-day exercise delivery, this division between rehabilitation prescription

and exercise configuration is crucial. Clinicians use the Provide Feedback and Monitor Progress modules to assess workout results, monitor adherence, and pinpoint obstacles or safety concerns after the patient starts training. The physician can then modify the program as necessary, establishing an iterative feedback loop between program improvement and patient performance. The direction of recent telerehabilitation studies, which highlight that older-adult rehabilitation systems become more meaningful when they support clinician supervision, personalization, and timely adjustment rather than static exercise assignment alone, is reflected in this type of adaptive and monitored structure (Seinsche et al., 2023).

The admin role is the primary entry point to the system support layer that is part of the framework. Analytics and Reporting, Manage Users, and Notification Services are all included in this tier. Since organized cues and follow-up are frequently necessary for sustained involvement in older-adult adherence support, notification systems are crucial for providing reminders, progress prompts, and communication alerts. User management ensures that the system maintains proper authorization and workflow separation by controlling access roles for patients, physicians, therapists, and administrators. In the meantime, the analytics and reporting module compiles usage and rehabilitation data into summaries that system managers and clinicians can use. The addition of these support modules is in line with research demonstrating that telerehabilitation platforms require operational services that make the system scalable, maintainable, and clinically beneficial over time, in addition to a front-end exercise interface (Shaw et al., 2022).

The framework's integration core, the application server, links system-level services, gamification responses, clinical decisions, and patient actions. The framework facilitates an ongoing rehabilitation loop through this centralized orchestration: the patient completes exercises, results are documented, the gamification engine encourages involvement, clinicians assess progress and offer feedback, and the rehabilitation plan is modified as necessary. The primary gap found in related work is directly addressed by this cyclical approach. Few studies offer a cohesive model that integrates older-adult-centered access, clinician-supervised rehabilitation planning, structured exercise reporting, adaptive feedback, and adherence-oriented gamification within a single mobile telerehabilitation architecture. Existing studies support telerehabilitation, while other

studies separately support gamification or exergame-based rehabilitation. By combining these previously dispersed components into a single, well-coordinated system, the suggested framework aims to close that gap (Seinsche et al., 2023).

The study's findings demonstrate the originality of the suggested framework, which combines clinician-supervised monitoring, gamification, and adaptive rehabilitation into a single mobile telerehabilitation system for senior citizens. Prior research has demonstrated that telerehabilitation can enhance functional performance and be a viable substitute for in-person rehabilitation for older persons; nevertheless, these systems frequently prioritize distant delivery over adherence-oriented integration (Gamble et al., 2024; Johnson et al., 2016). Similarly, studies on exergame-based telerehabilitation have shown usability and technology acceptance among older users, and earlier work on gamification has reported positive effects on health-related behaviors; however, these approaches are typically implemented as separate or partially connected components (Gamble et al., 2024). The suggested framework, on the other hand, creates a continuous feedback loop that connects patient exercise activities, gamified motivation, and clinical decision-making. This approach tackles the well-known problem that behavioral, program-related, and supervision-related factors have a significant impact on adherence in older adults. Because it offers a structured basis for creating scalable, user-centered digital rehabilitation systems that are not only technologically feasible but also clinically relevant and better matched with the long-term adherence requirements of aging populations, this integrated design has significant implications for both research and practice (Edgardo, 2024; Seinsche et al., 2023).

Discussion

The suggested gamified mobile telerehabilitation framework integrates clinician-supervised monitoring, adaptive rehabilitation, and motivating mechanisms into a single solution to address the ongoing problem of low exercise adherence among older persons. The results of this study highlight the significance of integrating clinical procedures with behavioral engagement techniques rather than treating them as distinct elements. Along with practical suggestions, this part addresses the consequences of the suggested framework for research, clinical practice, and technology advancement.

a. Research Implications

This study emphasizes the necessity for more integrated approaches in digital rehabilitation systems from a research standpoint. Future studies should concentrate on multi-component frameworks that integrate engagement, personalization, and clinical monitoring rather than separate assessments of gamification or telerehabilitation. To assess how such frameworks affect exercise adherence and clinical outcomes, researchers are urged to carry out empirical validation studies, such as randomized controlled trials or longitudinal studies. In order to improve the design of gamification components and gain a deeper understanding of user motivation, future research should also investigate behavioral theories like the Health Belief Model and Self-Determination Theory. The creation of standardized evaluation criteria, such as adherence rate, engagement index, and usability scores, is another crucial avenue for benchmarking and cross-study comparability.

b. Clinical Implications

The suggested framework offers a structured methodology for incorporating telerehabilitation into regular care for senior citizens in clinical settings. It is advised that healthcare professionals use hybrid rehabilitation approaches that integrate digital exercise delivery, remote monitoring, and in-person assessment. To guarantee patient safety and maximize rehabilitation results, clinicians should actively utilize system features like real-time monitoring dashboards, feedback systems, and adaptive program adjustments. To increase patient engagement and commitment, rehabilitation therapists should also use motivating techniques like gamified rewards and progress tracking. To guarantee the efficient use of digital rehabilitation platforms and to facilitate the shift from traditional to technology-assisted rehabilitation services, training programs for healthcare workers are also required.

C. Technological Implications

The proposed framework provides a methodical approach for integrating telerehabilitation into routine clinical care for senior persons. Healthcare practitioners are recommended to employ hybrid rehabilitation techniques that include in-person evaluation, remote monitoring, and digital exercise delivery. Clinicians should actively use system features including real-time monitoring dashboards, feedback systems, and adaptive

program adjustments to ensure patient safety and optimize rehabilitation outcomes. Rehabilitation therapists should also employ motivating strategies like gamified rewards and progress tracking to boost patient commitment and involvement. Training programs for healthcare professionals are also necessary to ensure the effective use of digital rehabilitation platforms and to ease the transition from traditional to technology-assisted rehabilitation services.

Conclusion

This study proposes a gamified mobile telerehabilitation framework that combines clinical monitoring, gamification techniques, and rehabilitation delivery into a single digital system to enhance exercise adherence among older persons. The framework, which was created utilizing the Design Science Research (DSR) methodology, tackles the main shortcomings of current telerehabilitation methods, especially with regard to engagement, customization, and ongoing supervision. A mobile application for patients and a clinical dashboard for medical professionals support the system's essential elements, which include a rehabilitation engine, gamification engine, and monitoring module. The framework increases user motivation and encourages regular involvement by incorporating gamification features like challenges, prizes, and progress tracking. Adaptive mechanisms allow rehabilitation programs to be dynamically adjusted based on patient performance. This research is new because it integrates clinical workflows, gamified engagement, and adaptive rehabilitation into a coherent system that facilitates ongoing patient and physician feedback. After the UI/UX design and system prototype are implemented, the next phases of development, demonstration, and evaluation will be carried out. Future research will concentrate on empirical validation and the incorporation of cutting-edge technologies like wearable sensors and AI-based personalization to further improve system efficacy and scalability.

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