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The Use of Mobile Tools when Implementing the Master's Degree Program "Adaptive Physical Rehabilitation" to Improve the Quality of Students' Professional Training

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Abstract

Training of professionals capable of carrying out activities in physical rehabilitation involves acquisition of knowledge and practical skills in the field of using sports and pedagogical technologies for active formation of health of individuals with special needs. New digital educational services allow creating additional conditions for optimizing financial resources, reducing the time for training and retraining of specialists. The purpose of the study is to identify the possibilities of using mobile tools when implementing the master's degree program "Adaptive Physical Rehabilitation" to improve the quality of students' professional training.

The methodology is based on the analysis of the potential of mobile tools for implementing initiatives and government programs for development of inclusive education, support for physical rehabilitation. The authors developed testing which consists of two blocks "Digital tools of professional activities", "Theory and methods of physical education".

Research results. Groups of mobile applications which help to create additional conditions for improving the quality of student training were identified: for training at home and for fitness, for optimizing nutrition, assessing the state of the body, organizing a system of physical exercises for children, dosing loads.

In conclusion, the features of preparing students of the master's degree program are described: creating and maintaining a high level of motivation by means of mobile technologies; consistency and alternation of intellectual work with software and motor activities; social orientation of classes, etc.

Keywords: inclusive education, physical rehabilitation, adaptive sports, digital technology, mobile learning, professional activities.

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1. Introduction

According to UNESCO research, mobile technologies can significantly expand and enrich the range of tools for learning, development, maintaining a healthy lifestyle in different socio-demographic groups ([Rekomendacii YUNESKO..., 2023](#)). Experts from international organizations are developing draft recommendations that will help digital school educators understand what m-learning is and how to use the unique capabilities of mobile applications to implement the fundamental principles of inclusive education ([Becker et al., 2020](#)). These recommendations can be applied at various levels of education and in its various forms: at universities, cultural and sports centers, institutions of technical and vocational education.

In addition, there are a number of fundamental international legal documents that ensure the introduction of inclusive education in Russia ([Inklyuzivnoe vysshee..., 2023](#)): the Universal Declaration of Human Rights, the Convention on the Protection and Promotion of the Diversity of Cultural Expressions; Convention on the Rights of Persons with Disabilities, etc.

The legislation of the Russian Federation develops and concretizes the norms of international law concerning the realization of the right to receive education by disabled people and persons with disabilities. Thus, the provisions of the Federal Law "On Education in the Russian Federation" introduce the concept of an adapted educational program, substantiate the need to develop and apply special pedagogical approaches, methods, and technical means ([Federal'nyj zakon..., 2023](#)).

Within the framework of the existing regulatory framework, I. V. Mikhailova, A. I. Seselkin, A.S. Makhov, M.V. Eremin propose to diversify the content of training the master's degree students in adaptive physical culture as an option for the introduction of innovative technologies for additional professional education, which allows not only to significantly save financial resources, but and reduce the time for training new specialists ([Mikhailova et al., 2015](#)).

According to the Federal State Educational Standard of Higher Education, the main types of professional activities for students of the training program "Physical culture for persons with health limitation (adaptive physical culture)" are: pedagogical; educational; developing; rehabilitation (recovery); compensatory; preventive; research; organizational and managerial ([Federal'nyj gosudarstvennyj..., 2023](#)).

To achieve the set goals professionally-oriented events are held at universities using modern interactive educational technologies. For example, the Nizhny Novgorod Pedagogical University named after K. Minin held an inclusive event "Healthy lifestyle – the eighth wonder of the world!". It was organized in the format of a quest aimed at manifesting sociability, responsibility, independence and team interaction among students in adaptive physical culture. As part of the quest, students with disabilities received the opportunity for intellectual and creative self-realization. An inclusive bus trip "Memory Road from Moscow to Brest" was organized at the Russian State Social University ([Inklyuzivnoe vysshee..., 2023](#)).

V.M. Kirillina et al. note that the practice of Russian universities in the preparation of professionals capable of carrying out activities in the field of adaptive culture is characterized by:

- developing of complexes of special physical exercises (adaptive physical culture and therapeutic physical culture);
- using modern sports equipment;
- bringing the information educational space in line with the requirements of accessibility, reliability, strength, convenience and principles of creating a barrier-free environment for various categories of students with limited health capacities ([Kirillina et al., 2017](#)).

However, as E.I. Sheenko, N. N. Ryzhkova note that future and current specialists in adaptive physical culture experience certain methodological difficulties in the implementation of professional activities in inclusive conditions in the following situations ([Sheenko, Ryzhkova, 2021](#)):

- 1) when developing electronic didactic materials for independent work of students;
- 2) when implementing adapted means (computer games, interactive exercises, etc.) in the classroom;
- 3) when selecting and/or developing the content of tasks of a research and creative nature in the digital environment.

The hypothesis of the study is that the use of mobile tools when teaching master's degree students of the training program "Adaptive Physical Rehabilitation" will improve the quality of their professional training.

2. Relevance

2.1. Literature review

The analysis of literary sources and scientific and methodological materials was carried out in the following areas:

- potential of mobile technologies for inclusive education;
- foreign and domestic experience in the use of mobile tools for physical rehabilitation;
- problems and prospects for the inclusion of mobile tools in the training of specialists in adaptive physical culture and sports.

2.1.1. Analysis of Russian scientific and pedagogical literature

L.N. Eidelman considers modern problems of social rehabilitation of the disabled, active involvement in socially useful activities of people with health limitations (Eidelman, 2022). The author notes that they cannot be solved without their physical rehabilitation, adaptive physical education and other available activities. Using innovative methods and technologies, it is possible and necessary to increase the motivation of students, to reveal their creative abilities (Soboleva, Karavaev, 2020). It confirms the relevance of the problem of improving the master's program in adaptive physical culture.

The work of A.V. Aksenov, E.B. Ladygina, I.G. Kryukov, A.A. Grachikov explores the possibility of using mobile applications for organizing testing (Aksenov et al., 2023). Testing tools are used in the format of the All-Russian physical culture and sports complex "Ready for Labor and Defense".

The authors substantiate the need to strengthen the scientific and methodological work to increase the level of motivation of the disabled to systematically engage in adaptive physical culture and adaptive sports and come to the conclusion that adaptive physical culture is a relatively new direction in social practice. The authors conclude that the problem of developing and implementing health-saving technologies for training and education is one of the most relevant in modern science and practice.

A. M. Kononov, S. K. Kononova, T. K. Davydova and others note that one of the most important requirements of today is the development of methodological foundations of adaptive physical culture, the fundamentalization of education in this area (Kononov et al., 2020). The main problem here is not the accumulation and integration of knowledge in physical culture, medicine, correctional pedagogy and a large number of previously listed educational and scientific disciplines. The problem lies in the scientifically based and methodically verified introduction of innovative technologies for inclusion, which allow optimizing financial resources, reducing the time of training and retraining of specialists.

A.I. Laskova, M.Yu. Frolov, Yu.A. Orlova, Yu.M. Lopatin present the results of the study according to which mobile applications help create a more accessible development environment for people with reduced capabilities (Laskova et al., 2022). For example, after an injury, stroke.

B.E. Gornyy, A.S. Bunova, D.V. Kushunina et al. conduct the expert assessment of mobile applications for smoking cessation using a methodology recognized in the international scientific community (Gornyy et al., 2022). The authors note that most applications are characterized by high functionality. Aesthetics, which is more of a technical aspect of app development, also got pretty high marks. At the same time, such important parameters as the involvement of students and the information content of the mobile application received the lowest scores.

The digitalization of modern society, the variety of electronic learning and development tools available in the inclusive educational environment, give rise to the need to revise approaches to the implementation of master's degree training programs 49.04.02 Physical culture for people with health limitations (adaptive physical culture).

So, according to I.V. Mikhailova, A.I. Seselkin, A.S. Makhov, M.V. Eremin, teachers of higher education do not pay due attention to the problems of improving the training of highly qualified specialists in the new socio-economic conditions and a transformation of the set of studied in academic disciplines is required (Mikhailova et al., 2015).

Thus, to date, the system of higher education has developed a certain approach to the design and implementation of the master's training program "Physical education for persons with health limitations (adaptive physical education)", which is characterized by the following aspects:

1) the educational content of the master's degree program subjects should not contain isolated information from various fields (physical culture, medicine, etc.), but a systematized material formed in the course of implementing the integrative approach to the study of various

subjects and focused on preparing students for professional activities in accordance with Federal Educational Standard of Higher Education;

2) the program belongs to the academic magistracy, it is a logical continuation of the bachelor's degree program and is aimed at deeper training by expanding professional competences.

The analysis of the above scientific papers reveals the problem associated with the need for additional study of the use of mobile tools and applications when implementing the master's degree program to improve the quality of students' professional training.

2.1.2. Analysis of foreign studies

The processes associated with the formation and development of the digital economy, according to S. Bećirović, M. Dervić, inevitably affect the development of educational systems around the world (Dervić, Bećirović, 2019). Diffusion of digital technologies into all spheres of human activity, including inclusive education and upbringing, is observed everywhere.

Y. Qiu, G. Zhang note that the goal of the youth physical education is not only mastering a complex of sports knowledge and skills (Qiu, Zhang, 2020). The most important thing, according to the authors, is the creation of conditions for self-realization of the future specialist, self-development and manifestation of creative skills. Such an understanding of the goals of physical education is of particular relevance in the context of inclusive education. The indicated goals can be achieved through the use of such innovative means of adaptive physical culture as specialized mobile applications (Levinet al., 2022). A number of studies have been conducted that testify to their effectiveness in conducting classes for people with health limitations, including Down syndrome, autism, and spina bifida.

S. Amez, S. Baert determine that modern education based on mobile learning is becoming not just a part of social life, but the result of significant transformations and changes that have taken place in the society (Amez, Baert, 2020). Digital technology is a systematic set and procedure for the functioning of all personal, instrumental and methodological means used to achieve pedagogical goals.

In the course of the systematic analysis of the literature, scientists come to the conclusion that the introduction of mobile devices in the educational process is accompanied by problems of a didactic and informational nature. For example, there is a possibility of a user becoming addicted to a mobile phone. Also S. Amez, S. Baert point out the objective difficulties associated with the allocation of the main components of mobile learning tools; determining the content and types of cognitive activity offered by its applications (Amez, Baert, 2020).

However, as S. Amez, S. Baert conclude, researchers and practitioners must constantly search for the most advanced and modern methods and technologies of mobile learning (Amez, Baert, 2020).

J. Hanus et al. explore the possibilities of using modern digital technologies in the physical education of students in the educational environment of the university (Hanus et al., 2013). According to their conclusions, a mobile device in the capable hands of a specialist, including a physical education teacher, becomes an effective teaching tool. Thus, the use of mobile applications in the field of physical culture and sports is becoming a new trend in the field of education, including inclusive education (Slot et al., 2019).

P. Strojny, N. Dużmańska-Misiarczyk substantiate that in the modern information space, mobile devices (phones, tablet computers, AR/VR devices, smart watches) can act as innovative learning tools that generate new didactic possibilities of the digital educational environment built on their basis (Strojny, Dużmańska-Misiarczyk, 2023).

S. Becker, P. Klein, A. Gössling, J. Kuhn indicate that technological advances in the digital society open up new opportunities for using mobile devices to enrich the learning environment with interactive multimedia content (Becker et al., 2020). The authors suggest using tablets to study various features of movements of the human body using a mobile application that provides the opportunity to take measurements and record their results in several data sets.

In addition, according to Ch. Liu et al., mobile educational applications act as a tool for increasing motivation, the emergence of new ways of presenting and transmitting information, activating cognitive interest, intensifying feedback, improving the educational process and managing it using innovative technologies (Liu et al., 2021).

C. Foissey et al., studying the medical aspects of the use of mobile applications for planning and monitoring physical activity by people with health limitations, note that this helps prevent injuries during training and prevent aggravation of disability (Foissey et al., 2021).

T. Hees et al. substantiate that the advent of mobile ultrasound scanners makes it possible to perform ultrasound on a patient with an injury both in a medical institution and in the place of primary care (Hees et al., 2020). Therefore, familiarity with such portable devices should be included in the master's degree training programs.

So, the analysis of foreign literature allows us to objectively state that mobile applications in the field of adaptive physical culture and sports have the following didactic potential: support for physical rehabilitation processes, motivation support, socialization of students with special educational needs, etc.

The use of mobile applications when implementing the master's degree program can help create additional conditions for improving the quality of students' professional training.

2.2. Purposes and objectives of the study

The purpose of the work is determined from the need to study the possibilities of using mobile tools when implementing the master's degree program "Adaptive Physical Rehabilitation" to improve the quality of students' professional training.

The following were identified as the main objectives:

- substantiate the content of the discipline "Digital tools of professional activities" and the means of its implementation in the form of mobile applications, within which graduate students will gain experience in using digital tools, including mobile applications, in their professional activities;
- identify and characterize the main thematic sections of the discipline;
- describe the stages of work on the use of mobile tools to promote the principles of a healthy lifestyle and the values of inclusion;
- experimentally test the effectiveness of the proposed option to improve the content of the master's program.

3. Materials and methods

3.1. Theoretical and empirical methods

To achieve the purpose and the objectives of the study, the following methods were used:

- theoretical: analysis and generalization of normative legal acts, scientific and methodological literature on the issues of training teachers of physical culture, as well as inclusion; comparative analysis of the curricula of master's degree programs in various universities.
- empirical: observation of the information interaction of participants in the educational process, pedagogical experiment, testing;
- methods of mathematical statistics.

Studying and using mobile applications when implementing the master's degree program "Adaptive Physical Rehabilitation" is carried out within the framework of the discipline "Digital tools of professional activities".

In the course of the pedagogical experiment the analysis of the activities and generalization of the experience of students working with mobile applications was carried out for the following groups: for training at home and fitness, for optimizing nutrition, assessing the state of the body, organizing a system of physical exercises for children, dosing loads.

To process the results of the experiment questionnaire-diagnostic methods (observation, conversation, generalization, testing, and assessment) were used.

Testing which consists of two blocks was developed: "Digital tools of professional activities" (30 questions), "Theory and methods of physical culture" (30 questions).

The same teacher used mobile educational tools when implementing the master's degree program to comply with the rules of probabilistic selection of subjects.

The study involved 42 students of the Vyatka State University of the training program 49.04.02 Physical culture for people with health limitations (adaptive physical culture) training program specialization "Adaptive physical rehabilitation".

At the stage of statistical processing of the changes that have occurred in the pedagogical system the Pearson's chi-square coefficient – χ^2 was used.

3.2. The base of research

The main purpose of the experiment was to test the didactic potential of mobile devices when implementing the master's degree program "Physical culture for people with health limitations

(Adaptive physical culture)", training program specialization "Adaptive physical rehabilitation" to improve the quality of students' professional training.

The experimental and search work was carried out on the basis of the Vyatka State University (Faculty of Physical Culture and Sports). Students of the program have work experience in educational institutions of general, professional, additional education; in sports and recreation and rehabilitation centers; medical and preventive organizations, fitness clubs.

The experiment involved 42 master's degree students (52 % male, 48 % female). The average age of the respondents is 25.

The sample size is determined by the specifics of the training program.

As a rule, those students who are aware of the importance of rehabilitation activities for people with health limitations start the master's degree. Before and after the experiment, the assessment of the level of professional training of graduate students, according to the principles and materials stated in 4.3.1, was made.

The test questions were developed in accordance with the Federal State Educational Standard of Higher Education in the field of study, included in the fund of assessment tools of the relevant disciplines, agreed and approved as part of the work program of the discipline.

3.3. Stages of research

At the first stage of the study, the analysis and generalization of normative legal acts, scientific and methodological literature on the issues of training PE teachers, as well as inclusive education was carried out. The comparative analysis of curricula of educational programs of universities regarding the use of mobile technologies in sports, medicine, and education was carried out.

Further testing of 42 master's degree students of the Vyatka State University (Faculty of Physical Culture and Sports) of the training program: 49.04.02 Physical culture for people with health limitations (adaptive physical culture) was carried out.

The total number of questions in the test bank is 60, out of them 30 questions are related to "Digital tools of professional activities" and the other 30 questions are related to "Theory and Methods of Physical Culture". Their examples are presented in 4.3.1.

Each task of the test in case of correct answer is estimated at one point. Thus, as a result of the initial diagnosis, each student scored from 0 to 60 points. The levels "low" (from 0 to 29 points (inclusive)), "average" (from 30 to 50 points (inclusive)), "high" (more than or equal to 51 points) were introduced to determine the level of professional training. Interpretation by levels of professional training is presented in 4.3.1.

Thus, it was possible to collect data on 42 students of the training program adaptive physical culture and sports. The control (21 graduate students) and experimental (21 graduate students) groups were formed based on the materials of the conducted testing.

At the second stage of the study, the theoretical and accumulated empirical experience was systematized in terms of the problem stated. The selection of mobile applications for various systems of physical culture and rehabilitation was also carried out. When analyzing services, intellectual, emotional and social components were also taken into account.

At the third stage of the study the main conclusions and recommendations on the use of digital technologies (including mobile applications) for the scientific and methodological support of the learning process in adaptive physical culture, rehabilitation activities of people with health limitations were formulated.

4. Results

4.1. Key concepts of mobile learning for master's degree students in the field of adaptive physical culture and sports

In the course of analytical activities the authors found that the state gives great attention to the problems of rehabilitation of people with health limitations, including by the means of adaptive physical culture. For example, in 2021 Russia adopted the Concept for the Development of the Comprehensive Rehabilitation and Habilitation System, designed for a period up to 2025. Its goals are the development of inclusion and social adaptation of people with health limitations in various areas of life, as well as support for adaptive sports ([Rasporyazhenie Pravitel'stva..., 2021](#)).

Directions of the state policy in the field of medical, social and psychological-pedagogical services are:

- formation of an active lifestyle of citizens with health limitations, their inclusion in social life;
- improvement of the medical and social expertise service and the procedure for developing and implementing an individual rehabilitation or habilitation program (IPRA).

In addition, the analysis of the literature revealed that the software for monitoring health and rehabilitation indicators is also being modified. For example, Big Data and cloud computing are used.

To implement these initiatives the society needs highly qualified specialists who are able to work not only with healthy athletes, but also with those who have health limitations (diseases, injuries, etc.).

Universities train specialists of this level within the framework of the master's degree program "Physical Education for Persons with Health Limitations (Adaptive Physical Education)", training program specialization "Adaptive Physical Rehabilitation". The program is aimed at mastering the system of improving sports culture and mastering modern methods of rehabilitation and training of people with various forms of pathology.

It is stated that the specific labor functions of a specialist in adaptive physical culture include: conducting physical education classes for people with health limitations or for the prevention of various health disorders; training and preparing competitions of Paralympic athletes – professionally involved in sports with the disabled; organization of leisure, correctional, health-improving and rehabilitation activities for persons with health limitations; carrying out research work.

It is determined that the work of a specialist in adaptive physical culture and sports involves using motor activities to correct health disorders and social adaptation of people with various severe pathologies.

As part of the master's degree program the following skills and competences are formed:

- implementation of rehabilitation activities and development of physical rehabilitation programs;
- possession of body recovery technologies and methods of teaching people with health problems;
- scientific, methodological and informational support of the learning process for the main activities in the field of adaptive physical culture;
- assessment of the applicability and effectiveness of software tools, identification of problems of their use for adaptive physical culture;
- conducting scientific research to resolve problem situations in the field of adaptive physical culture using modern digital technologies, including mobile applications.

The mobile application in the presented study is a program installed on a platform that has functionality in terms of physical development and education. It allows performing various types of actions (exercises, tasks, games, etc.). Mobile applications are considered by the authors as a multifactorial socio-cultural synthesis of science, art, communication and sports.

4.2. Practical work on the use of mobile tools to promote the principles of healthy lifestyles and the values of inclusion

The study and use of mobile devices was carried out by students during classes of the discipline "Digital tools of professional activities". The teacher created additional conditions which help the formation of digital literacy of future specialists, the development of digital skills that are most in demand in inclusive education.

The main sections of the discipline were aimed at the study and application by future specialists in adaptive physical culture: hardware and software systems used in the field of sports and recreational educational practices; information and communication technologies; digital services and mobile applications.

The work program of the discipline includes the following topics:

- 1) hardware and software complex (hereinafter referred to as HSC): purpose and types;
- 2) principles of work of HSC, collection, storage and analysis of the results;
- 3) devices with biofeedback, the principles of their use;
- 4) HSC for studying the nervous system and higher nervous activity;
- 5) HSC for studying the musculoskeletal system;
- 6) HSC for studying the cardio-respiratory system;
- 7) analysis of the application of HSC and biofeedback devices;
- 8) digital applications for physical culture;
- 9) the concept and classification of mobile applications;

- 9.1) home workout applications;
- 9.2) fitness applications;
- 9.3) nutritional optimization applications;
- 9.4) applications for assessing the state of the organism;
- 9.5) applications for training children;
- 9.6) applications for building workouts and dosing loads;

10) digital support services for inclusive education. In particular, it was determined that for people with health limitations it is advisable to use applications for relatively "easy" sports; applications with workouts for pilates, stretching and yoga are popular.

Master's degree students of the experimental group analyzed several types of innovations in the field of mobile technologies.

I group. Applications for training at home ("Workouts for home", Fitness Online, My coach, FitStart, Fitness for girls).

II group. Fitness applications (Woman, Slimming Fitness; 30 Days Fitness at Home; Adidas Training; FitProSport).

III group. Nutrition optimization applications (FatSecret Calorie Counter; Lifesum: Healthy Eating; PEP: Eating Plan & Diary; Lifesum; YAZIO).

IV group. Applications for assessing the state of the body (Yandex.Health – online doctor, Welltory: My health and pulse; My Health: Lifestyle; Cardio Journal). Nutrition optimization was also performed using text and spreadsheet applications on smartphones and tablets.

In general, the optimal diet problem was formulated as follows: "There are N types of food that contain T types of nutrients (proteins, fats, carbohydrates). One weight unit of the product of the i -th type contains a_{ij} units of the j -th type of nutrient. The minimum daily requirement b_j of a person for each type of nutrient is known. The calorific value c_i of one weight unit of the i -th product is given. It is required to determine the optimal composition of the diet of products, such that each nutrient is contained in it in the required amount that provides the daily human need, and at the same time the total caloric content of the diet is minimal".

Group V. Workout applications for kids (SpinMe Alarm Clock, Morning Exercise for Kids, Lil Fitness, Kids Fitness - Daily Yoga).

VI group. Applications for building workouts and dosing loads (Jefit, Gym Boom, Pocket Trainer, WODster).

Let us present the results of the analytical activities of the master's degree students with the methodological recommendations developed by them.

1. Application "FatSecret". The service allows the user to select the daily need for calories, has a built-in recipe book, which can be supplemented if desired.

The application has "flexible" filters (calories per serving, macronutrient content). They allow you to find and choose the recipe for the best dish.

The built-in calendar helps you track your daily calorie intake (breakfast, lunch, dinner, snack) and keep a food diary.

The application provides the possibility to track sleep time and time spent exercising. However, according to the students of the experimental group, the disadvantage of this mobile application is that this information must be entered manually.

In order to start using the application you must enter your date of birth, weight, height, gender, and your physical activity, then indicate the goal (gain weight, lose weight or maintain it at the current level).

Another disadvantage of this application, according to the students, is that Premium access is required to use all the functions. Only it gives the possibility to track not only the main meals, but also water consumption.

2. Application "Yazio". To use "Yazio" you must enter the following information: date of birth, weight, height, gender, physical activity, goal.

The application offers to keep a diary. Yazio automatically calculates the number of calories (breakfast, lunch, dinner, snack) needed to reach your goal. The amount of drunk water (entered manually) can also be tracked. Filters (vitamins, minerals macro and micronutrients) allow choosing the optimal type of nutrition. The application takes into account the preferences of the user (whether the user is a vegetarian or follows a classic diet). "Yazio" has features that allow tracking the number of steps taken. The user can also enter this data manually.

A significant advantage, according to the students, is that it is proposed to indicate intermediate and short-term goals in the application. This has a positive effect on motivation.

3. Application "My Health – Lifestyle". The service contains a calendar that allows adding events. The following indicators can be tracked: sugar, pressure, heart rate, height, temperature and weight. Or a new indicator can be added, the changes of which should be monitored further.

In the diary it is possible to fill in a table of taking certain drugs. This allows controlling their intake (name, form of release, dosage, duration of the course). In addition, this application allows displaying notifications about the need for a timely intake of the drug.

Recommendations of the students: it can be used as an alternative or addition to a paper health diary.

4. Application "Cardio Journal". This application is designed to view blood pressure values, track medications in the form of a list or graphs. It has an additional function, it can remind when you need to measure the pressure or take this or that drug.

The "Indications" section allows viewing and adding data on blood pressure and drug courses. With the help of filters the user can choose to view individual indicators (morning, afternoon, evening, night).

The "Graphics" section allows building a graph based on the data from the previous section, studying changes in blood pressure for a given time.

The "Reminders" section gives an opportunity to create notifications: when you need to measure pressure or take a particular drug.

Recommendations of the students: the mobile application "Cardio Journal" can be used as an alternative to a paper health diary.

5. The application "PEP: Diet – Diet Diary", according to one of the students of the experimental group, is a unique assistant in changing the diet. The application will make it relatively easy to achieve the goal (weight loss, maintenance or weight gain). The user needs to select one of the nutrition programs. Then the user receives a personalized diet with guidance and recipes for each day.

The application has tools that allow choosing an individual diet program for weight loss or weight gain.

For example, intermittent fasting, ketogenic diet, high protein diet, Mediterranean diet, DASH and MIND diets, chia detox, proper healthy eating, vegetarianism, veganism and raw foodism.

Body parameters can also be tracked – mark own parameters, weight and monitor results and progress.

One of the students began to use this application to restore physical fitness and normalize weight after an illness.

6. Application "Adidas Training: fitness at home." After registration the user needs to complete a survey: the purpose of the classes, the frequency of exercises, indicate the reasons for accessing this application. Also it is needed to clarify the purpose of using the application, height, weight and days of training for the next week. Further, "Adidas Training: fitness at home" automatically plans a set of exercises for each day (exercises are presented in English). The advantages of the application, according to the students of the experimental group, include the fact that it reminds when to start training. There are ready-made standard programs. Progress can also be tracked. The results can be shared with other users. There are various tasks to test yourself. In addition to training, the application offers to create own individual diet.

The master's degree students also recommended it to support a healthy lifestyle.

4.3. Experimental assessment

4.3.1. The ascertaining stage of the experiment

To assess the input conditions (the level of professional training of the master's degree student in the field of adaptive physical culture and sports), the author's testing was developed. The total number of questions in the test bank is 60. Out of them 30 questions are related to "Digital tools of professional activities" and the other 30 questions are related to "Theory and Methods of Physical Culture".

Sample questions from the first block.

1.1. Which of the mobile applications is used in the field of adaptive physical education and sports: "Ostrovok", "Dexterity", "Edadil", "Family Locator".

1.2. Based on a generalization of own experience, indicate the disadvantages of using electronic educational resources in training. Answer options: information overload of the educational process; the possibility of choosing an educational trajectory; some resources require expensive new electronic devices; availability of multimedia content; the complexity of assessing the quality of an electronic educational resource posted on the Internet.

1.3. Select digital services that are used for adaptive physical education events. Answer options: Russian Sports Encyclopedia, Artifex.ru resource, Coaching on-line program, Sigma platform.

Sample questions from the second block

2.1. Name the method based on determining the functional state of the human body systems by measuring the electrical conductivity at the biologically active points corresponding to these functional systems. Answer options: load tests; thermal imaging diagnostics; electropuncture diagnostics; gas discharge imaging.

2.2. Determine the factor that must be taken into account when designing educational results in the academic discipline "Physical Education" for persons assigned to a special medical group. Answer options: nosological group; the age of those involved; restrictions and contraindications to physical activity; all answers are correct.

2.3. A teenager spends most of the day sitting in front of the computer, in the evening there are pains in the back, in the area of the wrist joint, a violation of posture is visible. What recommendations can help reduce pain and improve posture? Answer options: reduce the time spent at the computer; do exercises; do self-massage; observe hygienic requirements when working at a computer, strengthen back muscles, conduct physical exercises.

Each task of the test in case of the correct answer is estimated at one point. Thus, as a result of the initial diagnosis, each student scored from 0 to 60 points. To determine the level of professional training, the levels "low" (from 0 to 29 points (inclusive)), "average" (from 30 to 50 points (inclusive)), "high" (more than or equal to 51 points) were introduced.

The following levels were introduced to interpret the results: "high", "low", "average". Let us describe the essence of the levels in order to evaluate the results of the experimental work later.

Level "High" – the student actively uses digital technologies (including mobile applications) in the scientific and methodological support of the learning process in adaptive physical culture; able to carry out rehabilitation activities and develop physical rehabilitation programs based on sports and pedagogical technologies; evaluates the effectiveness and identifies problems when using digital tools in the implementation of professional activities.

Level "Average" – the student uses digital technologies (including mobile applications) in the scientific and methodological support of the learning process on the main types of motor activities in adaptive physical culture; understands, but does not always take into account the advantages and disadvantages of new digital media; able to carry out rehabilitation activities and develop physical rehabilitation programs based on sports and pedagogical technologies only according to instruction; not in all cases evaluates the effectiveness and problems of using digital tools in professional activities.

Level "Low" – the student is aware of the potential of digital technologies (including mobile applications) to accompany the learning process in the main types of motor activities in adaptive physical culture, however, does not use their capabilities in practice; in most cases, the student does not take into account the advantages and disadvantages of new digital tools; able to carry out rehabilitation activities and develop physical rehabilitation programs based on sports and pedagogical technologies only under the guidance of a mentor; does not think about the problems of using digital tools in professional activities.

Thus, taking into account the results of processing materials, it was possible to collect data on 42 master's degree students in the field of adaptive physical culture and sports, out of them the experimental and control groups were formed.

4.3.2. Forming stage of the experiment

Thus, the content of the educational program of the master's degree program "Adaptive physical rehabilitation" for the discipline "Digital tools of professional activities" included the practical activities of master's degree students in the use of various groups of mobile applications: for training at home and fitness, optimizing nutrition, assessing the state of the body, organizing a system of physical exercises for children, dosing loads.

The students of the experimental group explore the features of the work of these groups of mobile applications, they also evaluate the researched applications according to the following criteria:

- the availability of training materials, the visibility and accessibility of lessons, the possibility to participate in live trainings;
- accessibility in development;
- independence from the place and inventory;
- intelligent recommendation algorithms, individual programs taking into account the characteristics of the body, dynamic adaptive content, personal activity tracker;
- interface design, developers' creativity, flexibility of training mode settings, the presence of a motivational component and aesthetic accompaniment.

So, the master's degree students of the experimental group were involved in information interaction aimed at improving the skills in the use of modern educational, health and sports-oriented technologies for their application in professional activities.

Based on the results of working with mobile applications, the students were asked to complete the following independent task: to characterize each of the mobile tools (applications) according to the following criteria: target audience; the possibility of refinement (adjustment) in the process of use; multilingualism; the difficulty of self-administration. The students presented the results of the work in the form of a table.

The participants in the control group also studied electronic and digital services for physical culture and sports. The social networks used in the country, video hosting, specialized sites, online services for joint training were analyzed.

For example, the digital platform "Sport for me" (<https://sportforme.ru/>). The platform presents the first steps in choosing a sports facility, sports section, sports event, scientific conferences. However, information is still insufficient. The service has a total of 308 sports facilities. However, for some regions (for example, in the Perm Territory), the mobile application "Sports for Me" was also developed.

Also, the master's degree students of the control group studied the possibilities of digital technologies for gymnastic exercises and games, for the development of the musculoskeletal system. Or registered and interacted with each other through the resources of the digital platform for the field of sports "My Sport." It is an online-platform for athletes and their parents, coaches, sports federations, sports organizations and authorities. As part of their independent work, students developed game control and measuring materials (crosswords, tests, etc.).

However, the students from the control group were not involved in practical work with mobile applications.

4.3. 3. Control stage of the experiment

At the fixing stage of the experiment re-testing consisting of 60 tasks was carried out according to the two blocks described above. Information about the level of professional training before and after the experiment is presented in [Table 1](#).

Table 1. The results of the use of mobile means when implementing the master's degree program "Adaptive physical rehabilitation" to improve the quality of training

Level	Groups			
	Experimental group (21 students)		Control group (21 students)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
«High»	1 (4.76 %)	7 (33.34 %)	1 (4.76 %)	2 (9.52 %)
«Average»	11 (52.38 %)	12 (57.14 %)	12 (57.14 %)	11 (52.38 %)
«Low»	9 (42.86 %)	2 (9.52 %)	8 (38.10 %)	8 (38.10 %)

Hypotheses were accepted: H_0 : the level of professional training of the students in the experimental group is statistically equal to the level in the control group; H_1 : The level in the experimental group is higher than the level of the control group. For $\alpha = 0.05$, χ^2_{crit} is 5.991. Further, $\chi^2_{obs.1}$ (before) and $\chi^2_{obs.}$ (after) the experiment. Thus, we get: $\chi^2_{obs.1} < \chi^2_{crit}$ ($0.102 < 5.991$), and $\chi^2_{obs. 2} > \chi^2_{crit}$ ($6.421 > 5.991$). Therefore, improving the quality of professional

training of the students of the training program "Physical culture for people with health limitations (adaptive physical culture)" can be considered not accidental.

At seminars the difficulties of practical exploitation digital (including mobile) technologies in adaptive physical culture and sports were also identified: the need to adapt devices to a specific type of health disorder; significant cost of HSC and biofeedback devices; it is advisable to take into account the individual qualities of users (sociability/shyness, aggressiveness/friendliness, focused attention/distractibility, etc.).

It should be noted that after performing the qualitative assessment of the test results it was found out that the level "High" in relation to the quality of professional training was determined in 33.34 % of the master's degree students of the experimental group. Initially, this value was equal to 4.76 %. The number of students who have the level "Low" decreased from 42.86 % to 9.52 %. The changes were recorded at the level "Average": 52.38% before practical activities and information interaction by means of mobile technologies and 57.14% after. The dynamics of results in the control group is not so significant. The level of professional training "High" was recorded in 9.52% of the students. It was 4.76 % initially. For other levels of positive changes were not recorded.

5. Discussion

The materials of the study correspond to the priority areas of activity of UNESCO and the system of Russian education in terms of the development of inclusive education ([Rekomendacii YUNESKO..., 2023](#)). Also, the participants of the experiment identified the following advantages of using mobile technologies for inclusive education:

- expansion of opportunities for socialization of the disabled;
- the emergence of additional opportunities for variable transformation of the content of educational material;
- transformation of one type of information into another and strengthening it to ensure information compatibility (for example, the visual representation of the text compensates for hearing deficiencies);
- expanding the range of exercises used in physical education classes and applied by the HSC;
- formation of students' readiness for self-control, rehabilitation at home.

The perspective, in the opinion of the participants of the experiment, is the use of mobile applications that can transform physical education into participation in a computer game.

The obtained conclusions about the potential of mobile technologies for adaptive physical culture and sports complement the results of the work of J. Levin, E. Khokhlovich, A. Vyshedskiy, who summarize innovative international experience ([Levin et al., 2022](#)). A significant result of the study is the description of the structure of the discipline "Digital tools of professional activities", which expands the ideas of I.V. Mikhailova, A.I. Seselkin, A.S. Makhov, M.V. Eremin about the need to diversify the content of training master's degree students in adaptive physical culture ([Mikhailova et al., 2015](#)).

So, within the framework of the presented study, specialists in the field of adaptive physical culture actively used mobile tools for academic and professional interaction (including in a foreign language).

The master's degree students (for the future) proposed to study another group of mobile applications that support "wearable" technologies in the field of adaptive sports. Such devices are the result of a worldwide trend towards equipment miniaturization. They are effectively used to measure various indicators of movement, physiological signals and parameters. The proposed direction is relevant due to the fact that people with health limitations are increasingly using such assistive devices in everyday life. In addition to fitness trackers and fitness bracelets, electrochemical sensors, microfluids, painless microneedles are actively used.

6. Limitations

Let's pay attention to the possible limitations for the study:

1. The sample of students was not random, therefore, experimental data cannot be generalized for the entire students population.

2. Formation of questions for the authors' testing in accordance with the Federal State Educational Standard of Higher Education in the field of study, the content of the fund of assessment tools of the relevant disciplines and the work program of the discipline. As a rule, those students who are aware of the importance of rehabilitation activities for people with health

limitations start a master's degree. The students of the program have experience of working in children's and youth sports-adaptive schools, adaptive youth clubs of physical training; structural units for adaptive sports in educational institutions; sports and recreation and rehabilitation centers, medical institutions, sanatoriums.

3. An important condition is that throughout the experiment, the same teacher supervised the study and use of mobile devices when implementing the master's degree program "Adaptive Physical Rehabilitation".

7. Conclusion

In the present research the study and use of mobile devices when implementing the master's degree program "Adaptive Physical Rehabilitation" was carried out by students within the discipline "Digital tools of professional activities".

The use of mobile devices in the activities of specialists in adaptive physical culture and sports makes it possible to create additional conditions that provide:

– changing the nature of information interaction between participants in the didactic process in inclusive education;

– social integration for those groups that usually receive little attention in the professional and academic sphere;

– personal development of students, which is manifested in: activities related to the development of academic disciplines; participation in physical culture and rehabilitation activities; improving the structure of professional orientation, professional competence.

The distinctive features of training master's degree students of the training program "Physical culture for persons with health limitations (adaptive physical culture)", training program specialization "Adaptive physical rehabilitation", in the digital society, according to the authors, should include:

1) creation and maintenance of a high level of motivation by means of digital (including mobile) technologies;

2) consistency of intellectual and motor activities;

3) continuity of the processes of self-development and self-education of the future specialist (for example, mastering of innovations in the direction of virtual reality and augmented reality for physical rehabilitation);

4) social orientation of classes.

A significant advantage of mobile applications is the possibility to increase motivation for sports. Individuals with special educational needs, being limited in access to various types of motor activities, often lose interest in sports. The inability to access the relevant infrastructure also affects motivation. These problems can be solved through the use of sports mobile applications.

Currently, there is no single database of mobile applications to stimulate the physical activity of users. However, the promotion of a healthy lifestyle, physical culture and sports in the inclusive educational environment should be carried out not only within the classroom, but also in extracurricular activities.

Thus, practical activities and interaction through mobile applications in the presented study allows master's degree students to reach the innovative level of using information technologies in inclusive education: transformation/creation. In the future, specialists will be able not only to apply ready-made software solutions in practice, but also to modify them in accordance with the characteristics of their own professional activities, and develop new digital services.

The obtained results can be used in the training of various specialists in the field of physical culture, sports and fitness.

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