TechReh: Technology for Rehabilitation

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Abstract: The TechReh ERASMUS+ project is focused on the development and implementation of: (i) a new formative program which train graduates, undergraduates, medical and technical professionals on the development and use of advanced ICT solutions in the field of rehabilitation, (ii) an Offices for Cooperation and Dissemination of Technology in Rehabilitation (OCDTR) in each Uzbekistan partner university, and (iii) the setup of strong relations with the industry/private sector by means of the developed ICT platform. The project was launched October 15, 2015. Duration: 36 months. The purpose of this article is to provide a brief description of: the background of the TechReh ERASMUS+ project, the needs analyses, its specific aims and objectives, the methodology, and its innovative character.

Аннотация: Проект ERASMUS+ TechReh ориентирован на разработку и реализацию: (I) новой формирующей учебной программы, которая готовит выпускников, студентов, медицинских и инженерно-технических работников по разработке и использованию передовых ИКТ-решений в области реабилитации, (б) Офиса для сотрудничества и распространения технологии в реабилитации (OCDTR) в каждом Узбекском вузе-партнере и (III) создания прочных связей с промышленностью и частным секторами посредством разработанной ИКТ-платформы. Проект был запущен 15 октября 2015 года. Продолжительность: 36 месяцев. Целью данной статьи является дать краткое описание: истории проекта ERASMUS+ TechReh, анализа потребностей, его конкретные цели и задачи, методологии и его инновационного характера.

Xulosa: ERASMUS+ TechReh loyihasi quyidagi ishlarni ishlab chiqish va joriy etishga mo'ljallangan.I) Bitiruvchilar, talabalar, tibbiyot xodimlari va muxandis-texnik xodimlarining reabilitatsiya sohasida zamonaviy AKT yechimlaridan foydalanish, ishlab chiqish ba qo'llash yangi o'quv dasturini shakllantirish. b) O'zbekiston Respublikasi hamkor oliy ta'lim muassasalarida (OCDTR) reabilitatsiya texnologiyalarni taqdim etish va hamkorlik uchun muassasalar va (III) Ishlab chiqilgan AKT-platformalar yordamida sanoat va xususiy sektor bilan mustahkam aloqalar o'rnatish. Loyiha 2015 yil 15 oktabrda ishga tushurilgan. Davomiyligi: 36 oy. Ushbu maqolaning maqsadi qisqacha tavsif berish: ERASMUS+ TechReh loyiha tarixi, talablar taxlili, uning aniq maqsadlari va vazifalari, uslubiyligi va innovatsion yondashuvligi.

1. Background

The TechReh ERASMUS+ project is financed by the European Union. The main objective of TechReh project is to define a learning environment to deliver more opportunities to access new competences related to the rehabilitation activities and jobs. These new competences refer, in particular, to the use of advanced ICT solutions for the rehabilitation. TechReh would fulfill the goal of optimization of the healthcare organizations network stated in the Welfare Improvement Strategy of the Republic of Uzbekistan for 2013-2015.

At the beginning of the program a state of art was realized and, then, needs-analysis was accomplished, followed by the development of some specific objectives of TechReh:

1) identification of technological needs for rehabilitation in Uzbekistan, their experiences in the field are essential to define the background and how EU experiences, polices, best practices can improve the current situation;
2) deploying of a Formative Programme in the field of Medical Rehabilitation on the use of advanced technological solutions in rehabilitation to train Doctors and Medical Operators on innovative;
3) setup of Offices for Cooperation and Dissemination of Technology in Rehabilitation (OCDTRs) in order to consolidate the technology adoption and development in rehabilitation fields;
4) setup of an ICP platform.

The overall Formative Program definition was discussed by all the Partners, and, in order to increase the number of participants to the course and to meet the Uzbekistan laws, and in accordance with EACEA Office, and the TechReh Steering Committee it was established the:

- modernization of the existing Master programmers in Medical Rehabilitation offered at the medical HEIs involved in the project (Nukus and Tashkent) by integrating to the curriculum technical and engineering aspects;
- development and implementation at the Tashkent University of Information Technologies a two-year Master "Computer Systems for Medicine". Indeed, due the national low, in Uzbekistan the master study should be at least 2 years, from which 1 year is dedicated to the Technology for Rehabilitation study unit;
- development of short courses for medical and technical professionals. During the research study of the project was recognized that in Uzbekistan there are huge demand for the short professional courses how to use technology in rehabilitation and overall in medicine. Thus, it was decided to develop short courses for medical professionals and technicians.

The curricula definition of each Formative Programme action will be followed by development of the learning materials by the Partners and of an ICT platform for the dissemination of the didactic materials, contents, and project results.

Moreover, since the early stage of the project, it was:
- established the TechReh official logo (Fig.1),
- developed and published the project website (http://www.techreh.unisannio.it/), (Fig.2.(a))
- developed and published the facebook page (https://www.facebook.com/techreh/?fref=ts), (Fig.2.(b))
- established the Steering Committee (http://www.techreh.unisannio.it/index.php/steeringcommitte),
- discussed and approved during the Kick Off meeting the Quality Plan,
- prepared the deliverable of WP1 about the state of the art in rehabilitation technologies.

Fig.1 TechReh official logo.

Moreover, according to the project event scheduling, the Kick Off meeting was held in Benevento the July 4-8 th, 2016. The next meeting will be in Uzbekistan the 14th -20th, November 2016. A draft schedule is reported in Fig.3

(a)

(b)

Fig.2 (a) TechReh website home page, (b) TechReh Facebook page.

Fig.3 Draft schedule of the Uzbekistan meetings.

It is worth to note that the presentation of TechReh project during the ceremony of the anniversary of the NUKPEMI branch will give high visibility to the project, boosting the dissemination activity.

2. Needs analysis

During last years, rehabilitation activities have been becoming very important both for care and for prevention because the number of persons with disabilities is growing, for many reasons like ageing of the population and increase of chronic diseases. Moreover, there is a widespread desire to improve the quality of life.

The introduction of leading-edge technologies in the treatment of disabilities is central in order to improve the efficiency of medical rehabilitation and the access to health-care related services. The conjunction Medicine and Engineering in the field of rehabilitation is the future for new effective methodologies and treatments.

Under these issues, the objectives of the project TechReh (Technology in Rehabilitation) are to build up the capacity of Universities and Medicine Centres in Uzbekistan towards the needs of innovative rehabilitation techniques which are spreading in the European Countries.

In Uzbekistan, according to the constitution, the citizens enjoy the right to free medical service rendered via the network of state medical establishments - polyclinics, first aid stations, and state hospitals. Healthcare is financed from the budget of the state and makes up 9.9 % of the total budget expenditures. However, due to the complications of the transitional period the real amount of the budgetary means allocated for healthcare has somewhat reduced, due to the advancing growth of prices on medicine, medical equipment, etc. In rehabilitation there is one physician per 295 people. Moreover, the average life span is a major index of population's health. It is 70.2 years in Uzbekistan. The index for towns and cities is 71.5 years, and for rural areas 69.1 years. The average life span of women is higher than men by about 4.8 - 4.9 years.

The project proposal called TechReh is motivated to solve some uncovered issues in the healthcare system in Uzbekistan:
   a) the lack of availability of a formative programme in the field of Medical Rehabilitation, in particular about the use of advanced technological solutions and robotics in rehabilitation activities;
   b) the lack of availability of one stable office for the management of the new methodologies and technologies in each Partner University/Medical Centre in Uzbekistan. These offices will play a crucial role in promoting the use of the new technological solution and University research in the field of rehabilitation;
   c) the low cooperation/promotion among Uzbekistan Universities/Medical Centres and the national industry/private sector in the fields of technological solutions in the field of rehabilitation.

Especially from academic point of view, few identified factors, which are responsible for the abowe issues, are:
a) missing resources such as qualified personnel or web portals or specific officies, involved in innovative technological transfer in the rehabilitation sector;
b) regional gaps in technological and economic growth of universities and companies working in health care sector;
c) lack of specific professional skills and qualified personnel, which needs to have abilities in the use of new technological solutions in rehabilitation.

All these factors affect the technological promotion and proper dissemination of the obtained scientific results within the public universities to the advantages of economical partnerships with industry/private sector in the rehabilitation sector.

TechReh will ensure harmonization of national and EU policies.

In order to deal with the above quoted problems, the Uzbekistan Higher Educational Institutions (HEI) need:
(1) to retrieve the best practices available in EU partners HEI in the field of research and innovation in rehabilitation and new technologies in rehabilitation;
(2) a specialized training course for the qualification of human resources working or intending to work in this sector;
(3) to improve the relations with the industry/private sector by creating a standalone office in each partner university, in order to raise the capabilities to use new technologies in the field of rehabilitation;
(4) a cross-country web based ICT platform providing:
   a. promotional and dissemination services,
   b. a database of the rehabilitation needs and university available knowledge,
   c. a support for the educational activities and e-learning modules of the FP,
   d. the document management for the officies,
   e. a communication medium for internationalization.

3. Specific aims and objectives

On the basis of the Uzbekistan national needs, the aim of TechReh proposal is to define a learning environment to deliver more opportunities to access new competences related to the rehabilitation activities and jobs. These new competences refer in particular to the use of advanced ICT solutions for the rehabilitation that may go a long way towards the goals and priorities in terms of optimization of the healthcare organizations' network and development of ICT, that have already been stated in the Welfare Improvement Strategy of the Republic of Uzbekistan for 2013-2015. Technologies making home rehabilitation a reality should play a central role in the process of ICT pervasion in medical context as a considerable part of Uzbek population is rural and has to put up with, sometimes long, commutes to receive treatment on regular basis. Home rehabilitation may offer the chance of effective evaluation of the patients'condition/progress, monitoring their performance at distance, reducing the travel hassles, thus motivating the patient and limiting the costs due to rehospitalisation rate. More in details, the proposal aims to define new technological skills for: (i) rehabilitation professionals using specific ICT solutions (last generation sensors and apparatus) to be integrated in rehabilitation protocols; and (ii) figures with background in technical sciences (e.g., engineers, computer scientists) who face the challenge to innovate rehabilitation treatment working in tight collaboration with medical operators.

The first type of skills concerns the aims to provide the rehabilitation professionals with specific technological skills about the use of last generation sensor-based and robotic systems, aided by solution for remote monitoring, to improve the quality and effectiveness of the rehabilitation protocols. The second type of skills are related to the acquisition of advanced competences in order to propose innovative ICT solutions and take the national research on sensors and robotics for rehabilitation (intended to occur either at medical facility or at home) to the next level. The main

objective of the TechReh project is to provide higher education institutions in Uzbekistan with effective and efficient instruments to setup: (i) a Formative Programme (FP) in the fields of transfer of innovation and intellectual property promotion; and (ii) availability of an OCDTR in each Uzbekistan university. Moreover, the project aims at realizing an innovative ICT-based infrastructure employing enhanced technologies and methodologies allowing all the partners from Uzbekistan to create a network for technological transfer by sharing educational contents and databases. Such infrastructure will be used as a base to design educational programmes on technological and scientific transfer. The EU partners are transferring their know-how and expertise for the achievement of the TechReh objectives.

4. Methodology

The aims and objective of TechReh project are pursued by developing of: (i) a Formative Programme (FP) which train graduates, undergraduates, medical and technical professionals on the use and development of advanced ICT solutions in the field of rehabilitation; (ii) an OCDTR in each Uzbekistan partner university; and (iii) the setup of strong relations with the industry/private sector by means of an ICT platform.

The main didactic aims of TechReh project are focused in designing and developing the FP modules providing advanced knowledge concerning to the main areas of: (i) technology for rehabilitation promotion, (ii) management of innovation, (iii) research and development, (iv) project management. Besides these, the FP includes specific content related to the Uzbekistan needs. According to the needs analysis, the first FP (pilot) is composed by modules detailed according to the specific audience of the (i) Master programmers in Medical Rehabilitation; (ii) Computer Systems for Medicine two years Master; (iii) Short course for Medical and Technical Professionals. Each learning module is managed by one teacher selected among the consortium staff: 2 teachers from each EU partner university, and 4 teachers from the Uzbek partners. The learning modules is composed of the following didactical elements: (i) frontal lessons; (ii) e-learning lessons; (iii) home work; (iv) internships; (v) visits; (vi) team projects; (vii) intermediate evaluations; and (viii) examinations. The FP wants to build the awareness of the importance of technological innovation in the field of rehabilitation in a knowledge-based economy and aims to train professionals capable of enhancing the collaboration of universities within private enterprises.

Teaching methods are based on efficient learning and accurate time management. E-learning activities of the FP are made available through the Learning Management System (LMS), which are available from the TechReh website. Specific attention is furthermore focused upon the involvement of participants and a real interaction with teaching staff. A section of the TechReh LMS is furthermore made available to participants, including forum and chat facilities, FAQ pages, contents, research and sharing of documents. A constant monitoring of the learning achievements through ongoing assessment completes the teaching strategy. In order to provide common procedures to guarantee the academic recognition of the FP three actions ((i) Master programmers in Medical Rehabilitation; (ii) Computer Systems for Medicine two years Master; (iii) Short course for Medical and Technical Professionals), it will be designed following the European Credit Transfer and Accumulation System (ECTS). The recognition of the credits will be based on the student workload required to achieve the objectives of each course of the FP actions, in terms of the learning outcomes and competences to be acquired, in relation to the total quantity of work necessary to complete the courses successfully. A Diploma Supplement is designed to provide a standardized description of the nature, level, context, content and status of the FP actions. The Uzbekistan institutions will give their contributions in the design and implementation of the didactic methodologies, as well as in the organization and deployment of the educational contents necessary for ICT platform. The dissemination and exploitation of the obtained results from first FP activities edition is available through the TechReh web platform.

The target participants are both medical-backgrounded individuals intending to be given an insight into the effective application of new sensor-based technologies for treatment of neural and physical

dysfunctions and engineering graduates intending to be provided with skills and competencies for design and development of innovative systems aimed at supporting the rehabilitation process. Research activities are carried out in order to discover the competences and resources in order to support and facilitate the process of innovation, in Uzbekistan. A main issue is to identify some basic possibilities to improve innovation in industry/private sectors related to the actual state of Uzbekistan Economy. All the TechReh partners are involved in identifying the sectors of intervention and the methodologies to be transferred from the EU experiences. Two initial workshops are organized in the Uzbek universities to disseminate the importance of technology in rehabilitation, to share information and to analyze the strategic policy orientation. A part of the FP activities attenders are involved in the development of an OCDTR, part of TechReh, seminal for the future raise of local units, specialized in application, design and development of technological solutions in medical rehabilitation, in accordance with the directives in the Program for Developing the Infrastructure of Higher Education Institutions of the Welfare Improvement Strategy of the Republic of Uzbekistan 2013-2015: indeed, those directives dictate the introduction of modern laboratories on promising directions for the development of the sciences and innovation technologies equipped with modern research tools in line with international standards. Fig.4 shows some of the cutting edge tools for rehabilitation: assisting finger movement (Fig.4 (a),(b)); walk and gait (Fig.4 (c),(d),(e)), hand functionalities (Fig.4 (f)).

Adequate attention must be paid to information management: pervading a consolidated context with
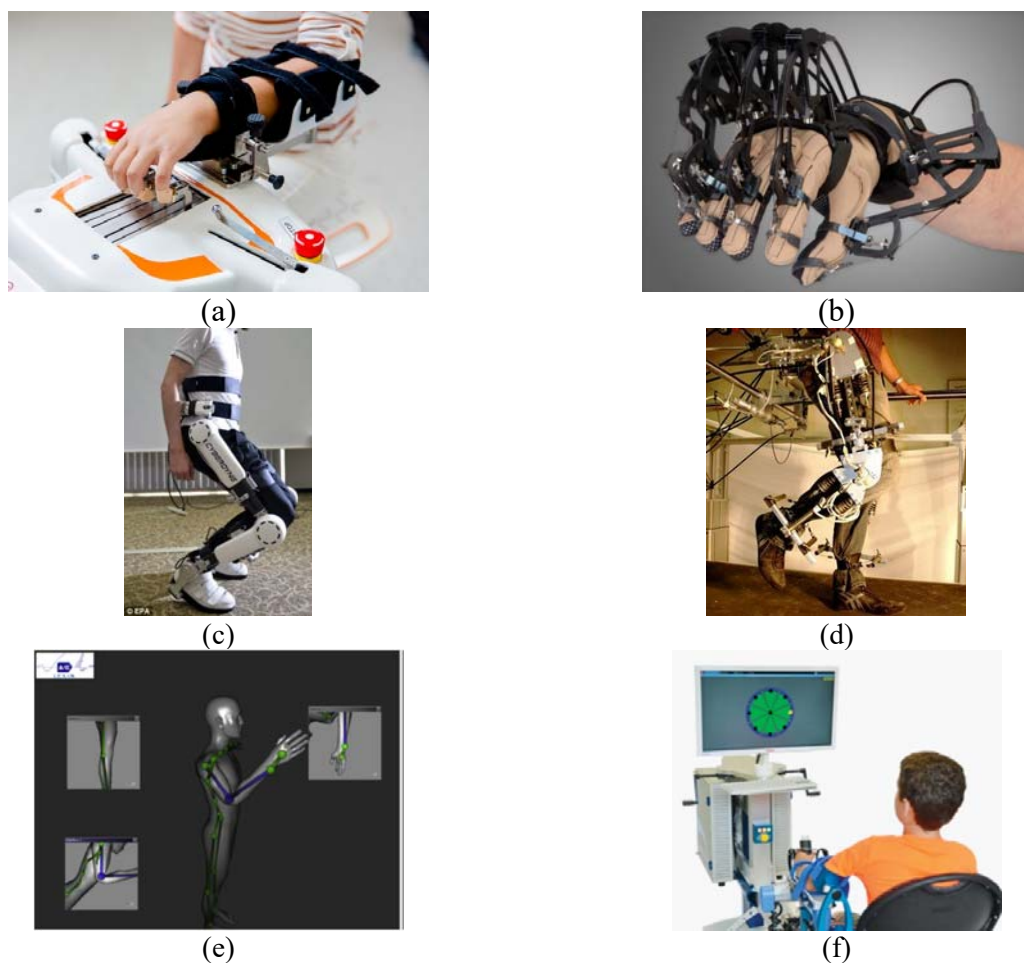

(a)

(b)

(c)

(d)

(e)

(f)

Fig.4 Example of possible tools equipping OCDTR offices. (a) Amadeo Robotic System [1], (b) CyberGrasp glove [2], (c) Hal3 device [3]; (d) Lopes device [4], (e) Body sensor network for rehabilitation developed at University of Sannio [5-10], (f) Mit-Manus WRIST device [11].

proper technical culture is a long-term process, therefore information on rehabilitation applications, proposed protocols and procedures, therapeutic results and innovative solutions needs to be collected, organized and maintained. The ICT platform will provide specific tools (databases, forums, chat, file transfer, etc.) using a learning management system (LMS) for the development of a national (among universities and enterprises in Uzbekistan) and international (among the EU partners and the PC) network. The LMS will act as a web platform for regular dialogue, dissemination, internationalization and exploitation of education-innovation-research synergies.

Then, a section of the portal is devoted as project web site to highlight the objectives of the TecReh project and to include the most important outputs (methodologies, results, reports and recommendations produced by the project WPs) as soon as they are produced to make them immediately visible. Finally, the platform will have a role to create the network among the OCDTRs, which will be set up in each Uzbekistan university partner. Then, it will be used for information management purposes to share documents, procedures and protocols. Each EU and PC partner are exploring ways to disseminate the findings from the TecReh project and related research via the more traditional means of conference papers, workshops, a project website and regular electronic alerts.

5. Innovative Character

In order to support the even more increasing requests for healthcare services and qualified professionals having new specific skills, the proposal aims to facilitate the access to professional training and updating for increasing the number of rehabilitation experts, not enough for Uzbekistan needs, and to create new specific competencies in using and managing modern ICT solutions for rehabilitation. TechReh project implementation will lead to many innovations both from the technological and the methodological point of view. Moreover, all contents will be designed and implemented ex novo in order to allow workers and professionals learning how to use new specific ICT solutions, as well as to create new competencies for such tools and improve the effectiveness of the rehabilitation protocol. The teaching methodology will be defined taking into account both the specific user needs and the constraints deriving from the new context. In particular, these constraints will determine the choice of new and specific educational solutions to create new theoretical and experimental training activities. Moreover, the establishment of Uzbek OCDTR will take part of a stable national and international framework to raise common actions supporting the spread of technology for medical treatment, in line with what has been stated in the Public Health Strategy of the Republic of Uzbekistan for the period 2010-2020.

6. Acknowledgements

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