Pedagogical evaluation of e-learning courses - Adapted pedagogical index

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Abstract:

E-learning is becoming an important part of education and it can provide new possibilities for disabled people. Critical evaluation is becoming indispensable, especially in e-learning systems supporting disabled people, as very little has been done in this area. This paper describes the development of adapted pedagogical index (AdaPI), which demonstrates the pedagogical effectiveness of different courses created and adapted for disabled.

1 Introduction

While only a few decades ago World Wide Web was considered a privilege, today it is a necessity. Everything went electronic; today we frequently encounter words like e-health, e-government, e-shopping, e-business and e-learning among others. Furthermore, the initiatives and policies of European Union emphasise improvement of quality of life and e-inclusion of citizens, supported by advances in development of information and communication technologies. New and improved technologies opened the world of endless possibilities, especially for people with disabilities. In project DISNET one of the main goals was to bring new technologies and at least some of the new possibilities to people with different disabilities.

What does e-learning stand for? How does it fit into this picture of brighter future for people with special needs? E-learning can be defined as training or instructions delivered on a computer by using different media (including CD-ROM, Internet, and intranet) [1]. E-learning courses are delivered via computer using multi-media materials – spoken or written text, sounds, pictures, animation or video [2-4]. Different teaching and learning methods can be employed [5]: (i) e-learning is blended with traditional methods (usually traditional classroom learning), (ii) distance learning, (iii) any face-to-face contact with tutors and/or other e-course participants, and (iv) degree of freedom (participants can choose place, pace and time). Selection of method depends on characteristics of the target group (e.g. young people, adults, older population, persons with disability). A combination of appropriate e-learning methods and assistive technologies can help persons with disabilities to overcome the barriers by offering them the possibility to learn at their own pace from their homes and almost about everything they can imagine.

While the quality of multi-media materials and methods used is essential for successful e-learning, the evaluation of this kind of learning is even more important. Various cultural, pragmatic and technological constraints affect the process of e-learning and therefore have influence on different aspects of the e-learning effectiveness and efficiency. Several models of evaluation from different perspectives (pedagogical and technical) exist, for example

Kirkpatrick's Four Levels of Evaluation [6], AHP approach by Colace et.al [7], Laurillard's conversational framework [8, 9], Viable System Model (VSM) [9, 10], and also Pedagogy Effectiveness Index (PEI) [11], upon which our adapted pedagogical index (AdaPI) was based.

2 Project DISNET

Phare 2003 project DISNET (e-learning net for unemployed people with special needs) joined different Slovenian partners, whose effort was oriented towards developing e-learning system that would help unemployed people become equipped with computer knowledge and skills in their search for a job. In project we in some way continued the research of pioneers in this field: VISIOCOM [12], and BITEMA [13]. DISNET was specialized in training of disabled persons. Disabled people often have fewer opportunities to get desired jobs than others; however this project's goal was to reduce these differences. Over 300 people were included in courses based on blended learning. E-learning materials were prepared according to ECDL (European Computer Drivers License) curriculum [14] and adapted for people with disabilities, especially for heard-of-hearing and deaf persons. All engaged institutions have gained the status of Assistance e-learning centre; they all have tutors and adapted equipment to work with disabled.

2.1 Special goals of the project

Due to the specificity of the target group involved in the project DISNET five different goal aspects were considered: conceptual, didactical, practical, knowledge transfer and technological aspect.

Conceptual aspect:

- Development and description of e-learning models with qualified mentors and informing unemployed disabled people.
- Development of e-learning platforms and didactical materials with help of several experts – teachers of computer science, ICT specialists and students, who tested the platform.

Didactical aspect:

- Presenting the platform to the mentors and tutors.
- Performing three test courses for each course and for each target group.

Practical aspect:

- Developing the network of institutions for helping unemployed disabled people getting ICT skills and enlarging their chances for employment.
- Planning Centres of e-learning support in remote parts of country.

Knowledge transfer:

- Access to e-learning materials is always available for disabled people.

Technological aspect:

- Upgrading technical equipment of institutions involved in project and therefore improving their educational offers.

2.2 Project target population

Primarily, unemployed persons with special needs were the target population for following reasons: there is an extremely high level of unemployment of disabled people, usually their special needs are ignored and they are excluded from the society. ICT offers possibilities to improve current situation and to mitigate problems mentioned above, for it can support their independence, alleviate communication and even offer possibilities to work at home. Secondarily, other unemployed persons without disabilities were given a chance to participate in the project.

ICT develops extremely fast and offers its users adapting technology to their personal needs. Naturally, disabled people have special needs when it comes to ICT technology and also learning itself. Therefore special attention and adaptation is necessary. Today several assistive technologies and access services are available to overcome social, geographical and psychological barriers, people with special needs might encounter. However, even the most advanced technologies are not useful, if the potential users are not aware of them or don't know how to use them. Additional problem represents the lack of qualified teachers for people with special needs that would have sufficient computer skills and knowledge on how to effectively apply accessible technology. Solution for this problem was a tutoring system used during project. Participants were learning at home (or at other suitable location) and had nonstop support of tutors. Tutors were qualified for working with disabled people, had appropriate computer skills and were familiar with the functionalities of e-learning platform used.

2.2.1 Disabled people and their special needs

People with disabilities have very specific needs and concerns; therefore they are very special users of e-learning. Their needs and inclusiveness in the society depends on the type of the disability. There are many types of disabilities such as physical (difficulties with movement or self-care), sensory (blind and or partially sighted, deaf and hard-of-hearing) cognitive (learning problems, communication problems), psychiatric (behaviour and personality disorders), and health-related (chronically diseased).

Persons with special needs and characteristics as described above need adapted performance of regular educational programs, extra help by learning or even special educational programs. In Slovenia, the problem of disabled people integration is still being solved. Although in the last years a great deal has been done in this area, it is still not enough. The problem of successful integration of deaf and hard-of-hearing in ICT environment still remains – statistical research show the lowest integration results with this particular group.

In project DISNET we focused mainly on deaf and hard-of-hearing, blind and partially sighted and physically challenged people. All mentioned groups can nowadays, due to the advances in ICT, equally participate in education. However, we have to be aware that there are also differences between these groups and there are also differences even within individual group. Each group requires technology adapted to its specific needs in order to have equal conditions for learning.

2.3 ECDL content and LMS system

Some people with special needs are familiar with the assistive technologies available on an average personal computer – however, they still need at least basic level of ICT skills to be able to use the computer and the technologies. Many e-learning courses on the topic of ICT are available online [15-18], some of them are free, others require a fee to enrol, but very few of them are accessible.
We decided to create our e-learning course materials according to ECDL curriculum and use an open-source learning management system to manage e-learning courses, users and user activities.

2.3.1 ECDL contents

The ECDL foundation is the global governing body in world-wide acknowledged computer skills certification programme European Computer Driving License (ECDL), also known as International Computer Driving License (ICDL) outside Europe [14]. This organization is dedicated to help raising the level of computer skills in society and they are setting and maintaining a reliable standard for ECDL computer skill certification programme. This was the reason to use ECDL syllabus 4.0 as a basis of e-learning materials developed for the participants in the DISNET project. Furthermore, materials have been adapted to meet special needs of the target population.
When creating and adapting materials we followed several guidelines for designing and implementing e-learning systems for persons with disabilities [19-22]. We tried to consider as much guidelines as possible; however it was impossible to include all of them.

2.3.2 LMS system

Moodle, the open source system, was used as a learning management system (LMS) for managing e-materials. Moodle's advantages over other LMSs were its user-friendliness, compatibility with different platforms and variety of integrated e-learning tools. Its main advantage was the fact that its developers endeavour to implement accessibility guidelines in the system. Moodle is also very suitable for managing multimedia contents and has a good and relatively simple mechanism for tracking participants' activities. E-mentors were advised to use all Moodle tools such as forums, chat rooms, tests, mailing lists, notifications etc.

3 Evaluation of project DISNET

Evaluation of e-learning system is necessary to assess the effectiveness, efficiency and after all a general success of e-learning implementation in the selected environment. Several aspects need to be included in the complete and thorough evaluation of e-learning courses – e.g. quality of software (platform), contents, and user-system interaction, level of accessibility, usability etc. In this paper we focused on pedagogical evaluation of the e-learning courses used in the project DISNET.

3.1 Methods of evaluation

Choosing the right method of evaluation is the key for successful usage of educational system. However, not many methods are available when it comes to evaluating e-learning courses [23]. We have chosen some currently present methods from experts such as Squires and Preece [24, 25], Ardito et al [26], Dringus and Cohen [27], Holzinger [28], Sonwalkar [11] and Achtemeier [29]. Different views of project were being evaluated and methods have been adapted for individual aspect of the evaluation. Areas that were evaluated were: evaluation of user friendliness of e-materials, estimation of general opinion of participants about course and its adaptation to disabled people, evaluating of pedagogical effectiveness and effectiveness of entire course. Table 1 presents methods of evaluation and the way they were used. This paper will mainly focus on presenting pedagogical effectiveness of project.

Table 1: Evaluation methods

	SUMI evaluation	**Pedagogical effectiveness**	**Course effectiveness**	**Automatically evaluating with tools**
Purpose	Users testing	Test of pedagogical variables	Test of pedagogical variables	E-materials accessibility
Phase of the project	Final phase	Final phase	Final phase	Planning
Object of testing	E-materials	Complete course	Individual courses	HTML code
Target population	Users	Users	Users	Users
Number of users	10 deaf people + 65 individuals without disabilities	116	116	-
Number of evaluators	2	3	3	1

3.2 Pedagogical evaluation of the project

The basic pedagogical process can be defined as a systematic transfer of knowledge or skills from a mentor to a learner. However, the process is more complicated than it seems. It comprehends variety of different factors, such as motivation, individual's needs, learning materials, learners learning style, instructors teaching style, etc. For simple evaluation it would be sufficient to analyze pre- and post-knowledge exams – if exams show achieved knowledge, the course was effective. But as we already mentioned, pedagogical process is too complex and need for more thorough measurement of pedagogical effectiveness occurs.

3.2.1 Research and methodology

Our method for evaluating pedagogical effectiveness is based on Pedagogy Effectiveness Index (PEI) proposed by Sonwalkar [11]. However, some changes have been applied mainly because of the differences in populations that have been included in project. Our attempt was to develop similar index that would measure the pedagogical effectiveness of e-learning courses adapted for disabled people – adapted pedagogical index (AdaPI). AdaPI is similarly as PEI composed out of three dimensions and several factors. The dimensions are the same as were introduced by Sonwalkar. Main differences between PEI and AdaPI emerge from components that are basic parts of dimensions. Structure of AdaPI is presented in Table 2.

Table 2: Structure of AdaPI – adapted pedagogical index

LEARNING STYLES	MEDIA	INTERACTION
Apprenticeship	Text	Feedback
Incidental learning	Graphics	Revision
Discovery	Audio	E-mail
VAK styles	Animation	Discussion
	Material arrangement	Mentor's role

Dimension *learning styles* retains first three components and changes last two (deduction and induction) with component VAK styles [30]. Reason why we made the changes lies in disabilities that were common in our population. All materials were adapted for this specific population trying to follow the rule - if some sense organ is damaged - others will develop above average and relieve individual's communication and orientation. For instance, if one has vision difficulties, usually his hearing ability is above average. Questionnaire was therefore measuring, among other things, if courses took in consideration different learning styles by VAK theory – visual, auditory and kinaesthetic [31]. This dimension was emphasizing meaning of active learning, which is supported by large amount of practical exercises and giving the possibility of incidental learning and independent discovery. Remaining components were measuring those factors.

Dimension *media* contains five factors, which are referring to e-learning materials – text, graphics, audio materials, animation and organization of materials. Again, we are originating from the fact, that all people have different favourite channel trough which they perceive the world and environment. Some changes were in this dimension also. Components *video* and *simulation*, which are used in original index, are being joined with component *animation*. One new component was added, which it is very important, when it comes to adapting content for disabled people. It was mentioned earlier, that people with special needs often have also learning problems. That is why, *material arrangement* is important to ease their studying – it is important, if are materials arranged in logical sequence (from basic to advanced, etc.).

The third dimension is being called *interaction*, because it emphasizes the meaning of interaction between three factors of learning process – mentor, participant and material. Main difference between Sonwalkar's dimension and the one presented in this paper is inclusion of component *mentors role*, which is very important in every learning process.

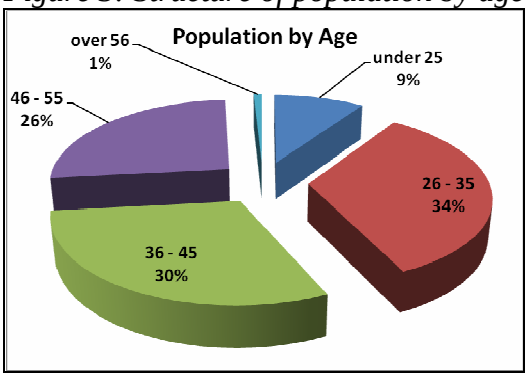
Representation of each component was measured trough participants' opinions with help of a questionnaire. Afterwards AdaPI was calculated trough the procedure that will be described in detail later.

3.2.2 Developing measuring instrument and gaining data

Questionnaire was developed with the help of Sonwalkar's theory. Every component was measured trough several questions or statements. Questionnaire was composed out of closed type questions. Participants could choose from five answers (Likert scale [32]). Instrument was also verified with help of three random chosen individuals, who helped us develop more comprehensible and understandable questions.

Participants were then invited to fill the questionnaire in online classroom. After gathering of the data of 116 participants, the AdaPI was being calculated. Figure 3 is showing us age structure of population.

Figure 3: Structure of population by age



3.2.3 Developing AdaPI – adapted pedagogical index

AdaPI calculation process:

- Questionnaire was composed out of closed type questions. Participants could choose from five answers (Likert scale [32]). Answer one was always the negative dimension and five always positive. For the purpose of processing data all answers were transformed to interval from 0 to 4.
- Each component was measured trough several questions. At this point, results were grouped by components.
- Average values were calculated for each component.
- Final step included calculation of contribution (weight) for each component in particular dimension. The following formula was developed:

  $v_i = v_{pi} \frac{1}{4mn}$, where v_{pi} stands for average value of dimension *i*, *m* is the number of components and *n* is the number of dimensions.
- AdaPI is calculated as $AdaPI = \sum_1^n v_i$

3.2.4 Results and discussion

Value of AdaPI can lie in the interval from 0 to 1. The calculated AdaPI of our courses was 0.68. Since the value of AdaPI exceeded the value of 0.5, we can conclude that the project was successful from the pedagogical point of view. However, the improvement is always possible. Value of AdaPI and particular components is shown in Table 4. It can be seen that all components are balanced – they are achieving similar values. Interaction is the only dimension that is higher, so it can be concluded, that users were more satisfied with components included in this dimension - *feedback*, *revision*, *e-mail*, *discussion* and *mentor's role*.

Better results could be expected, if participants in courses would not have been novice users concerning computer knowledge, or perhaps if courses would have been performed completely as e-learning method and not as blended learning, as in our case.

Table 4: Value of AdaPI

Learning styles	Media	Interaction	**AdaPI**
0.22	**0.22**	**0.24**	**0.68**

In next three tables (Tables 5-7) average values of each component are presented. In Table 5 it is shown, that component value of all four components lies above average, however, they are not very high. In dimension *media*, which can be seen in Table 6 the most component values lay above average, except *material arrangement* component, that is showing almost maximum result. It can be concluded, that participants were very satisfied with arrangement of materials. Last table – Table 7 shows us the highest values of components included in dimension *interaction*. Once more it is proved, that participant needed mentor and that mentor's role is very important.

Table 5: Average values of component learning styles

Learning styles			
Apprenticeship	Incidental learning	Discovery	VAK styles
3.49	3.68	3.93	3.65

Table 6: Average values of component media

Media				
Text	Graphics	Audio	Animation	Material arrangement
3.78	3.98	3.41	3.35	4.24

Table 7: Average values of component interaction

Interaction				
Feedback	Revision	E-mail	Discussion	Mentor's role
4.48	4.50	3.58	3.35	4.47

4 Conclusions and future plans

We hope that with project DISNET an important step was made towards inclusiveness of people with special needs in education process in Slovenia. A new approach to learning for disabled has been introduced. According to the AdaPI results we obtained we can conclude that the project was successful from pedagogical perspective. It was interesting to see, that mentors/tutors played a crucial role in the learning process. If we consider all the special characteristics of primary target group – unemployed persons with different disabilities, this finding is not surprising. Disabled people need special attention because of their special needs, much higher levels of motivation than people without disabilities and especially a lot of help by getting familiar with all the technologies available.

In future it would be interesting to divide participants in different groups according to their knowledge, prior participation in DISNET project and then assess the pedagogical effectiveness with AdaPI. Furthermore, we would like continue our work by involving more disabled people in similar projects to improve the level of their computer skills and to increase their chances of employment.

Of course, it is necessary to conduct more studies regarding effectiveness and usefulness of e-learning for people with special needs before we can claim that e-learning is the solution for most of the problems disabled people have to deal with.

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