

# REVIEWS

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## E-learning in the Education of People with Disabilities

### Zdalne nauczanie w edukacji osób niepełnosprawnych

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#### Abstract

Increasing survival rates in severe illnesses and traumatic injuries have led to an increase in the number of disabled people of working age or younger. According to the World Health Organization (WHO), there are about 650 million people with disabilities worldwide. Education is one of the factors that can help them overcome their own limitations. According to the Polish Government Plenipotentiary for Disabled People, in 2009 only 5.9% of disabled Poles had a degree, and only 21.4% were employed, which reflects the marginalization of the disabled from the rest of Polish society. Distance learning may offer hope for breakthroughs in the area of education for people with disabilities. This article aims at investigating the extent to which the available opportunities are being exploited, including e-learning as a part of the concept of the disabled person's integrated IT environment (**Adv Clin Exp Med 2011, 20, 1, 103–109**).

**Key words:** rehabilitation, education, disabled people, e-learning.

#### Streszczenie

Zwiększona przeżywalność poważnych schorzeń oraz urazów traumatycznych powoduje wzrost liczby osób niepełnosprawnych w wieku produkcyjnym i młodszych. Zgodnie z danymi Światowej Organizacji Zdrowia na całym świecie żyje już ponad 650 milionów osób niepełnosprawnych. Obecnie edukacja jest jednym z elementów, które mogą pomóc osobom niepełnosprawnym przezwyciężyć własne ograniczenia. Według danych Biura Pełnomocnika Rządu ds. Niepełnosprawnych w 2009 r. tylko 5,9% niepełnosprawnych Polaków miało wykształcenie wyższe, a 21,4% osób niepełnosprawnych miało pracę, co odzwierciedla przepaść w stosunku do reszty społeczeństwa. Zdalne nauczanie daje szansę na przełom. Artykuł jest próbą oceny, w jakim stopniu wykorzystuje się możliwości w tym obszarze, również jako element „zintegrowanego środowiska teleinformatycznego osoby niepełnosprawnej” (**Adv Clin Exp Med 2011, 20, 1, 103–109**).

**Słowa kluczowe:** rehabilitacja, edukacja, osoby niepełnosprawne, zdalne nauczanie.

Increasing survival rates in cases of severe illnesses and traumatic injuries have led to an increase in the number of disabled people of working age or younger. According to the World Health Organization (WHO), there are about 650 million people with disabilities worldwide. Disabled people, especially those living outside of urban areas, have limited access to education – but education is one of the factors that can help them overcome their own limitations. At the same time, as the „information society” develops, there is more and more work for independent specialists, who can even work at home, and distance learning may of-

fer hope for breakthroughs in the area of education for the disabled.

E-learning (also called online learning or distance learning) is an interactive method of education using the Internet, TV or other common means of communication. The most popular and widely used medium is the Internet. This form of interactive education can usually provides:

- home education, which is important for people with limited mobility;
- a flexible program: the time and place can be adapted to suit each student's situation;
- access to a wide range of multimedia sources,

including publications, images, movies, simulations and interactive exercises and exams;

- access to sources inaccessible in other ways, e.g. rare specialists, native speakers of uncommon languages or research on unusual medical conditions;

- lower costs, because there is no need to commute to classes;

- integration with telemedical systems (including telerehabilitation systems) and health-care educational programs (e-health), which can be inexpensively introduced, since they usually use the same communications medium as e-learning systems;

- useful training with e-work technology [1, 2].

All of these advantages make e-learning an excellent opportunity for the disabled. E-learning can be used separately, but a more effective solution is to integrate it with the disabled person's integrated IT environment. This environment allows for full interoperability among the assistive devices used, making it easy to switch from one to another as needed and to add new ones when required. Ac-

cess to mobile internet increases the mobility of e-learning users, regardless of whether they use a wheelchair, scooter, exoskeleton or car.

The issue of expanding the use of e-learning by people with disabilities is the subject of a number of governmental<sup>1</sup> and social initiatives<sup>2</sup>.

## E-Learning in Poland and Abroad

The range of e-learning programs available is wide and seems to grow wider every year. For example, 66% of the universities in the USA offer some e-learning courses, and 35% offer full pro-

<sup>1</sup> E.g. The Council of The European Union Resolution on "eAccessibility" – improving the access of people with disabilities to the knowledge-based society (2003/c 39/03), or the 2004 Individuals with Disabilities Education Act in the USA.

<sup>2</sup> E.g. e-ISOTIS – Information Society Open to ImpairmentS.

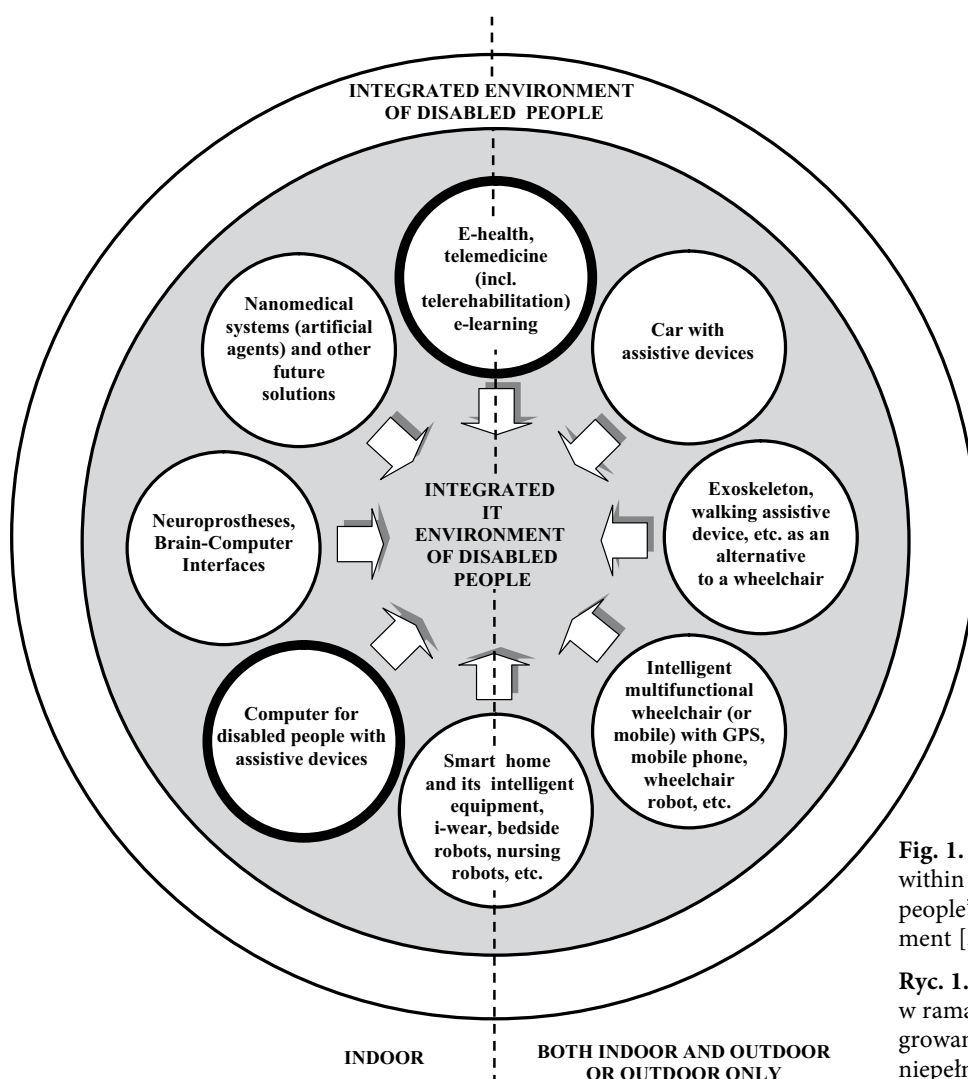


Fig. 1. The place of e-learning within the concept of disabled people's integrated IT environment [3]

Ryc. 1. Miejsce e-learningu w ramach koncepcji zintegrowanego środowiska IT osoby niepełnosprawnej [3]

grams. More than 12% of the students in the USA have taken part in some form of e-learning [1, 2]. Leading international universities offer undergraduate, graduate and doctoral degree studies in e-learning mode in a wide range of fields [4]. However, there is a striking lack of solutions offered for people with disabilities. At present initiatives for the disabled are being carried out by governmental and social foundations rather than by private schools and companies. The main worldwide proj-

ects in the area of e-learning systems designed specially for people with impairments are shown in Table 1.

In Poland the situation is not as good: There are only a few e-learning programs, provided by the centers listed in Table 2.

The range of e-learning offers in Poland is not wide: It consists of courses, undergraduate or graduate degree studies, mainly in IT and management. Moreover, degrees from online universities

**Table 1.** Examples of e-learning systems designed specially for disabled people [5–9].

**Tabela 1.** Przykłady rozwiązań w obszarze zdalnego nauczania projektowanych specjalnie dla osób niepełnosprawnych [5–9].

Solution (Rozwiązanie)	Properties (Właściwości)
Flexi E-Learning System (Universiti Putra Malaysia)	system both for normal students, visually- and hearing-impaired students and/or spastic students. Includes speech-to-text and text-to-speech converters, audio and/or video network transmission (including transmission among students as well). Teacher/lecturer does not need any special skills related to the students' disabilities. Conversion of material to the format needed by each individual disabled student is done automatically, without interruption or delays. Each student can have lectures and communication with the teacher/lecturer and other students recorded for later use. Spastic students, because of limited or slowed movement, can have a simplified user interface
Xerte Online Toolkits (The University of Nottingham and JISC TechDis)	open Source content creation tool with high levels of accessibility built in. Very easy to use, has a series of tutorial guides and is relatively low cost. Winner of first prize at the 2010 IMS Global Learning Impact Awards
Project ALPE – Accessible eLearning Platform for Europe (eTEN project)	project aimed at visually- and hearing-impaired people. An accessible, open-source, standards-based collaborative platform and learning management system. ALPE permits the creation of accessible virtual communities (including platform interfaces) for users with and without special needs

**Table 2.** Main Polish e-learning centers (based on [2]). The offer may vary by year

**Tabela 2.** Główne polskie ośrodki zdalnego nauczania (na podstawie [2]). Oferta może się zmieniać zależnie od roku

Center name (Nazwa ośrodka)	Examples of courses offered (Oferta)
Warsaw University of Technology www.okno.pw.edu.pl	bachelors degree studies in IT, Telecommunications or Automatics and Robotics; masters degree studies in IT; postgraduate studies: IT and Internet Technologies, E-business, E-learning in the Company
University of Warsaw www.come.uw.edu.pl	various courses, including languages The e-learning system can be adapted upon request for disabled people with visual or motor impairments
Warsaw School of Economics www.e-sgh.pl	some courses available on line
Jagiellonian University www.czn.uj.edu.pl	various courses, including IT
Polish Virtual University www.puw.edu.pl	bachelors degree studies in IT, administration, pedagogy or political sciences; masters degree studies in pedagogy; postgraduate studies in pedagogy; various courses in 14 disciplines
Polish Open University www.pou.pl	wide range of bachelors degree studies, masters degree studies and postgraduate studies in management, finances, HR or e-business; Executive MBA program; language courses
PAM Center http://www.pamctr.uni.lodz.pl	postgraduate “Distance Learning” studies, Global Mini MBA
West Pomeranian Business School http://www.zpsb.szczecin.pl	bachelors degree studies, masters degree studies in management, economy or human resources (HR)

can be perceived by employers as less valuable than traditional degrees [1, 2].

According to the Polish *Government Plenipotentiary for Disabled People*, in 2009 only 5.9% of disabled Poles had degrees, and only 21.4% were employed, which reflects the marginalization of the disabled from the rest of Polish society [10]. At present it is difficult to find examples of Polish e-learning projects designed especially for disabled people. One promising project called “EdukON on-line” was terminated in 2008. Only the University of Warsaw, mentioned in Table 2, offers (upon request) individualization of e-learning courses to the particular needs associated with different disabilities, e.g. visual or motor impairment. Disabled users of other e-learning platforms in Poland have to try on their own to adapt their PCs to e-learning requirements, and to use adaptive technologies to expand their own possibilities.

All of this indicates a need for further research to create new opportunities for disabled people. One of the main scientific centers in this area is the Laboratory of Distance Learning at the Academy of Special Education in Warsaw, headed by Prof. Józef Bednarek.

## Opportunities for Disabled People

The most important thing for disabled people is perceived independence. E-learning is an important opportunity for them to achieve it. Better education often means improved employment opportunities [11, 12], and as a consequence financial independence, increased contact with other people and enhanced self-esteem. In 2008 in Western Europe 50% of the disabled population was employed – which is the highest percentage achieved, but is

not good enough considering the years of governmental and community activity aimed at increasing employment rates among people with disabilities. It is estimated that usability of the Internet is about from three to four times worse for disabled people than for users without disabilities [11]. A shortage of web sites that are constructed to be user-friendly for people with motor, visual and other disabilities is part of the problem. Web sites that are friendly to disabled people are not common (50–77% in 2004 [11, 12]), but educational and governmental web sites perform better than others in this regard [11]. The Web Accessibility Initiative (WAI) has formalized accessibility guidelines for web content developers and designers. They help provide greater accessibility for disabled people. However, some web sites cannot be adapted this way (e.g. because their use entails of precise manipulation, or due to the way data is presented); such sites need to have alternative versions designed specially for people with disabilities. To avoid problems, a useful tool (and friendly habit) in these cases is to have each web site assessed by a group of disabled people. But very little research is being conducted in this area. A critical appraisal of publications has been carried out, based on the *PubMed* database (Fig. 2). The keywords “online learning”, “distance learning” and “e-learning” do not occur in the Medical Subject Headings (MeSH) database. The only keyword is “distance education”, introduced in 1999 and defined by MeSH as “Education via communication media (correspondence, radio, television, computer networks) with little or no in-person face-to-face contact between students and teachers” [13].

Limited access to the Internet (or other communications medium) in poor countries and, sometimes, legal limitations on distance learning can be barriers to e-learning. The problem of lim-

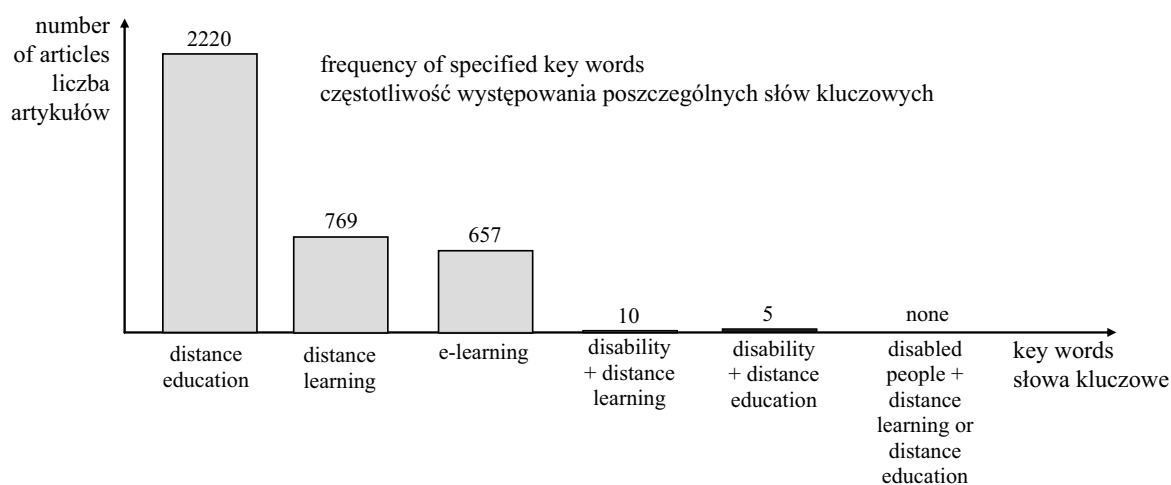


Fig. 2. Results of investigation of the PubMed database (U.S. National Library of Medicine) [13]

Ryc. 2. Wyniki przeszukiwania bazy PubMed (U.S. National Library of Medicine) [13]

ited access seems easy to overcome if e-learning for disabled people becomes part of regular government policy in a given area.

Disabled people's needs in e-learning can be specified as follows:

- The education programs should be addressed and easily adapted to the needs of a wide spectrum of people in terms of age, education level (course, high school, university, postgraduate), type and degree of impairment, their capabilities for community participation, etc.

- Two stages of e-learning are needed: a first stage to prepare disabled people for the learning process (including adaptation to their type and degree of impairment), followed by the second stage, which is e-learning proper.

- Rather small groups of participants are desirable, since distance education for people with disabilities often requires more of the teachers' time than courses for other types of groups.

- A wide range of courses is needed, often directly preparing disabled students for specific jobs, e.g. in customer service, many IT posts, remote control of logistic, maintenance and transportation systems, human-resource (HR) management and accountancy.

- Because some disabled people are shy and have low self-esteem, successful e-learning for disabled people should contribute to their psychological and social development.

- Online helpdesks and stationary support systems are needed for e-learning customers, for both disabled people and their carers (or parents in the case of disabled children).

## Computers for People with Disabilities

Some disabilities limit the possibility of using a classic PC. In such cases, assistive devices can adapt computers to the needs of the disabled person [12, 14–17]. The appropriate solution depends mainly on the type and degree of impairment. Assistive devices help compensate for functional limitations, enhance computer utilization and improve the person's ability to compete for employment [15–17]. The main solutions, consisting of both hardware and software, are as follows:

1) for people with motor impairments (depending on the type and severity):

- alternative keyboards (e.g. with larger buttons or alternative key configurations) and typing aids;
- on-screen keyboards;

- alternative mice, trackballs, joysticks and/or electronic pointing devices, often with built-in or separate large buttons;

- touch screens with wands/sticks;
- sip and puff switches;
- voice control and speech recognition.

2) for people with vision impairments:

- screen enlargers;
- screen readers, reading tools, word processors and other text-to-speech devices;
- voice control and speech recognition;
- adapted keyboards instead of mice or trackballs;
- advanced options for Flash web sites (e.g. synchronized narration).

3) for people with hearing impairments:

- adaptive devices to support hearing;
- software for point-to-point video connections or videoconferences, for people using sign language or lip-reading;
- voice-to-text converters;
- advanced features for subtitle reading;
- advanced multimodal<sup>3</sup> Flash web sites with on-screen graphics, animation and text equivalents of the audio.

4) for people with very severe impairments of the spinal cord:

- neuroprostheses and Brain-Computer Interfaces (BCI), usually with simplified navigation tools.

5) for people with cognitive impairments (depending on the type and severity):

- simplified controls;
- simplified and/or enhanced on-screen information, e.g. with animation, help menus and content description.

Wireless communication among these systems is desirable to avoid an excess of cables.<sup>4</sup>

Future adaptive devices for disabled computer users include voice-controlled computers, advanced multimodal interfaces and Ambient Intelligence environments. It is very important to develop such technology, which can be very useful on the job and in everyday life.

Proper assessment and selection of assistive devices can be essential. Because of the various types of available assistive technology products, it is crucial to find ones that are compatible with the computer operating system and programs on the particular computer being used. The help of an experienced physical therapist, occupational thera-

<sup>3</sup> Multimodal communication is communication that simultaneously uses sounds (voice or other audio), pictures and/or movements (hand gesture, body posture, facial expressions) and is similar to direct interhuman communication.

<sup>4</sup> The possibilities for adaptation vary among desktop computers, laptops, netbooks, palmtops and other such devices.

pist or biomedical engineer is needed when choosing the appropriate technology.

## Conclusions

E-learning has a great deal of potential as a new mode of education [18, 19]. Additionally, integrating e-learning with telemedical systems (including telerehabilitation systems) and health-care educational programs (e-health) is very important for disabled people as well as for medical personnel. But it seems that the whole current model of education would need to be redefined in order to exploit the full potential of e-learning. It is necessary to think about the needs of disabled people in the area and offer the same product – i.e. the same level of education – through various methods, so that choices can be made according to the given student's needs. Research is being conducted into the possibilities of adapting multi-user virtual environments (like the "Second Life" game) for e-learning. The further development of IT, communications technology, assistive technology and related fields will enhance the advantages of e-learning. Particular attention should be given to reforms in social and governmental policies that attempt to address issues of equality of opportunity for all citizens. It seems that adapting these policies to rapidly developing technologies is a slow and difficult process [20]. There is need for particular attention to making e-learning

more accessible in poor countries, where it may be the only chance for disabled people to pursue an education. In short, although e-learning can no doubt be an excellent opportunity for people with disabilities, there are still many problems to solve:

- 1) economic problems:
  - high costs at the beginning;
  - a lack of infrastructure;
  - projects (especially in Poland) based mainly on EU funds are often curtailed after EU assistance is terminated;
- 2) social problems:
  - e-learning certificates/degrees are perceived by employers as less valuable than traditional ones;
- 3) organizational problems:
  - the usual target group for e-learning education are adults who need additional courses to enhance their employability or to expand their career opportunities, and such courses often need modification to meet the needs of people with disabilities;
    - instead of being one of the basic modes of education, e-learning is currently a marginal area in most education systems;
    - at Polish high schools and universities there is a shortage of technical personnel and teachers qualified to provide e-learning for people with disabilities;
    - at present, initiatives in the area of e-learning for disabled people seem to be isolated projects rather than a coherent systematic approach [21, 22].

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