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Learning Technologies for People with Mild Intellectual Disabilities From Digital Exclusion to Inclusive E-education in Network Society

Abstract

The research focuses on the issue of learning technologies for people with mild intellectual disabilities. The analysis carried out is grounded in the theses of the network society. The initial objectives addressed three main issues: analysis of risks of digital exclusion of people with mild intellectual disabilities in highly technological developed societies; a conceptual view of learning technologies as tools to support social inclusion; and the importance of creating accessible e-learning environments to support inclusive e-education for people with mild intellectual disabilities. The authors used the analytical and descriptive method on the basis of the chosen literature sources to draw the conceptual view of functions of learning technologies in network society. The paper is structured as follows: introduction; analysis of theoretical background of network society to understand the need to go beyond technology to understand contemporary digital disparities; the overview of learning technologies for inclusive e-education for individuals at risk of digital exclusion, the research conclusions and directions for future research.

Key words: learning technologies; people with mild intellectual disabilities; network society; inclusive e-education, digital exclusion

The disability reports and many research findings confirm that over one billion individuals worldwide live with some disabilities (Mitra et al., 2021; AAIDD, 2020). In addition, it is estimated that school-age children with disabilities are approximately 150 million and many of them are deprived of primary education. It is claimed that approximately 200 million people worldwide have intellectual disability (ID) (AAIDD, 2020; Bircanin et al, 2021; Gajdzica et al., 2021). This represents 2.6% of the world's population, and of those about 85% have mild intellectual disability (MID). Diagnosis of ID often results in lifelong stigmatisation, social exclusion and limitation of human rights. Accepted diagnostic criteria for intellectual disabilities encompass behavioural, cognitive, as well as developmental issues. The WHO defines it as “a significantly reduced ability to understand new or complex information and to learn and apply new skills (impaired intelligence)” (AAIDD, 2020). We use this term when an individual has certain cognitive limitations and other competence deficits. The examples include social competence, communication skills and the level of self-care independence. These limitations may have a negative impact on the development of the child, who may be slower to acquire knowledge, unlike a typically developing child. Intellectual disabilities may be considered to include problems with an individual's general mental abilities. These affect an individual's functioning in two core areas. The first is her or his intellectual functioning, i.e. learning, problem solving, judgement. The second one is his/her adaptive functioning, i.e. various activities of daily living, such as communication and independent living. These characteristics are consistent with the American Association of Intellectual and Developmental Disabilities, which accepts that an individual has intellectual disabilities if he or she meets three essential criteria (Mitra et al., 2021). His or her IQ is below 70–75. He or she is considered to have important constraints in two or more adaptive fields (life, work, activities in a community). These problems usually start to appear before the age of 18.

The label of ID transforms into the individual's primary identity and in many cases it becomes more socially important than the other identities such as gender, sexuality and ethnicity. It is accepted in the literature that five levels of intellectual disability are most commonly manifested: 1. Profound (IQ < 20); 2. Severe (IQ 20–34); 3. Moderate (IQ 35–49); 4. Mild (IQ 50–69); and 5. Borderline intellectual functioning (IQ 70–84). For example, mild intellectual disability (formerly known as mild mental retardation) refers to deficits in intellectual functions relating to abstract/theoretical thinking (Mitra et al., 2021). This occurs in approximately 1.5 % of the population (AAIDD, 2020). Additional cognitive functions are usually also impaired, leading to deficits/disorders in other areas. The most commonly cited symptoms of an individual's mild intellectual disability include: taking a long time to learn to speak, but communicating well once she or he knows how; being fully independent in caring for herself or himself as she or he gets older; problems with reading and writing; social immaturity; increased difficulties

with the responsibilities of marriage or parenthood; use of specialised education plans; an intelligence quotient between 50 and 69 (AAIDD, 2020; Kennedy et al., 2011). Individuals with ID are extremely diverse in many ways. The aetiology of disability is very complex. The examples include physical (20–30%) and sensory disability (10–33%), which in many cases appear apace with perceptible, operative and educational limitations. The definitions of intellectual disability have most often focused on deficits (Buchnat et al., 2016; Brereton et al., 2015). It should be noted that this approach has changed over the last decade. It is increasingly emphasised that ID is an example of the social construction of humanity's reality. This concept is immersed in a specific historical and cultural context, which implies a peculiar labelling of this category of people in society (Gajdzica, 2020; Gajdzica et al., 2021). Moreover, nowadays we see the shift in thinking about disabilities (Rembierz, 2021 a). It is stressed that the recognition of limitations is an essential element of the support process. The trend is on highlighting people's strengths (Betlej, 2022).

On the contrary, many studies indicate that people with intellectual disabilities are still facing many obstacles, as education and information access, no employment probability despite their potential for social integration (Cano, 2016; Haug, 2017; Morze et al., 2014). They also would appear to be particularly vulnerable to digital exclusion in today's technologically advanced societies (Vasilyeva et al., 2021; Betlej, 2017; Chadwick et al., 2017). The inclusion movement of individuals with ID was initiated worldwide many years ago (Balasuriya et al., 2022; Bennett et al., 2018). In the European Union social integration of people at risk of digital exclusion is a priority issue (Gajdzica, 2020; Haug, 2017). Many challenges can be discussed in relation to inclusion of children with ID in school classrooms (Hornby, 2014; Hornby, 2015). One of the more popular contemporary approaches is collaborative learning in the classroom, where each child is encouraged to make a contribution to the group. Jointly organised activities have also proved effective in promoting the integration of children with ID out of the class especially during the leisure time. Similar findings were also noted in programmes that used sport as a platform to support the social inclusion of children with ID.

Similar assumptions are made in research on digital exclusion of adults at risk of digital exclusion (Betlej, 2022; Boot et al., 2018). New technologies (ICT, AI) seem to be underestimated tools in supporting the process of sustainable social integration of people with ID and their lifelong e-education (Betlej, 2020). Developments in technology can enable individuals to improve their quality of life. The effective use of such technologies can help to make the classroom space more suitable for students with special educational needs. Digital tools effectively support the process of creating content and improving teaching techniques, as well as the learning process itself. Most importantly, geographical and economic barriers to extending their competences may become less important. The development of these tools offers particular opportunities for e-education of adults already

in the labour market. In fact, the continuous advancement of information and communication technologies has created the need to improve the quality of learning and increase the availability of learning technologies usable in formal education, training and individual home learning systems by providing new viewpoints and probabilities (Morze et al., 2016). E-learning is emerging as a response to this need and guarantees to meet the learning needs of individuals in a personalised and inclusive manner in technological societies (Morze et al., 2014).

In this paper we analyze the issue of learning technologies for people with mild intellectual disabilities. The analysis carried out is grounded in the theses of the network society. This is a special category of individuals in many respects. As shown in the introduction, mild intellectual disability does not usually prevent people from performing everyday activities such as dressing, personal hygiene or taking meals. Individuals with MID usually have little difficulty in communicating with others and maintaining conversation. Very often they are socially resourceful. Many people with MID can do professional work. Providing them with learning technologies to support their e-education can contribute to their full social inclusion. Thus, our analysis captures new aspects of the social inclusion process for people at particular risk of digital exclusion. The focus on the creation of accessible e-learning environments aims to support them in life-long learning by adapting the process to their needs.

We also explore the challenges of e-education for people with MID related to rapid technological development and transformations resulting from digitisation. We use an analytical and descriptive method on the basis of the chosen literature sources. The paper is structured as follows: section 1 outlines the theoretical background of network society to understand the new risks of digital exclusion for people with mild intellectual disabilities. Section 2 provides an overview of the learning technologies for inclusive e-education for individuals at risk of digital exclusion, while in the the end the conclusions of the research and directions for future research are highlighted.

Digital Exclusion: Beyond Technology

Manuel Castells' concept of the network society, despite its numerous weak points and shortcomings, provides interesting tools for analysing a transformation process from digital exclusions to inclusive e-education of people with MID in many respects (Betlej, 2019). It is an exceptionally extensive template showing the relations between various types of social reflections on social divides. The network model has become a kind of battlefield for the sustainable tomorrow of humanistic civilization. Labelling societies and setting development trends based

on the observation of trends in technical progress is not a *novelty* in social thought. Castells, however, happened to capture important perspectives on social changes. He focused on the description of specific properties of new technologies that have their social determinants. Tightening social bonds, interactions, communication, creating structures, redefining cultural assumptions, gathering information and knowledge, social control – all these concepts have been translated into the language of network analysis (Gondek, 2020). In a sense, one has to admit that no other contemporary perspective referring to technical categories is so epistemologically comprehensive. Analysing change by referring to a technicalised perspective (digitisation, virtualisation, networking, hyperconnectivity) opens up fields of analysis of essential issues such as social divides and developmental risks (Lavrinenko et al., 2022). Technologies are social. Society therefore resembles technology in this perspective. Questions are increasingly being asked about humanity's global security in a world of technically mediated paradoxes (Chojnacki, 2021). The category of social bonds, communication or relations has been functioning for years in sociological thought (Rembierz, 2021 a). It does not appear that man will change the way he/she enters society even more radically in the next few years. The idea of social technologies seems to meet the criteria of learning technologies and find application in forecasting various models of e-education of people with intellectual disabilities (Rembierz, 2021 b). The category of learning technologies refers to the changes in the field of science, the design of society, the social construction of technology and technical innovations and their impact on social changes (Andrade et al., 2022; Bayor, 2019).

Network society concept draws the interesting perspective for analysis of different models of social exclusion. Social aspects of technological driven transformations are of great relevance in a virtually immersed world (Rembierz, 2015; Dancák, 2017; Mariański, 2020). The network society can be characterised by two key features (Castells, 2010). The first is the ability to reproduce and institutionalise networks. The second characteristic is its technological mediation and dependence to an unprecedented level on the operation of new network technologies related to the production and processing of information and knowledge (van Dijk, 2012). Network technology is very different from the past solutions, changing the social experience of space and time (temporal-spatial compression), geography (deterritorialisation), decentralisation and control, and interactivity (Castells, 2012). Digital skills and access to new technologies influence the individual and social potentials of participation in consumption, culture, democracy, education and entertainment (Betlej, 2019). The network society is based on information transfer. In this socio-economic whole, the greatest value, or source of value, becomes the network itself and its features. The traditional boundaries of social differentiation seem to be shifting towards much more intangible determinants of people's position and quality of life. Limited access to networks and new technologies is the most frequently cited example of

sources of development disparity (Aleksejeva et al., 2021; Androniceanu et al., 2020; Bedianashvili, 2021). In a social world dependent on new technologies, we witness a diversification of traditional social divisions. The determinants of a social position of individuals are not only material issues. The quality of life of people also depends on their competences in using digital devices and processing data, understanding them and the ability to distinguish information from propaganda (Betlej, 2020). Limited access to networks and new technologies is still one of the most frequently cited examples of the determinants of social exclusion. However, the importance of soft skills related to the ability to use new technologies in education and the development of lifelong learning competences is increasingly highlighted (Dancák, 2017; Kennedy et al., 2017).

Connecting to the Internet is a key stage in the contemporary socialisation process of socio-demographically diverse individuals (Szpunar, 2012). Age is no longer a key factor in the analysis. Access to information, education, as well as the power and possibility to co-create digital content and thus influence the social world, requires the improvement of many hitherto undervalued competences (Smrtnova-Trybulska et al., 2016; Betlej, 2022). Digital exclusion, defined not only by access to new technologies, but above all by deficiencies in the ability to evaluate digital content, to understand the new rules of the game, to educate and to access the co-creation of digital resources, will result in very serious social consequences for those rejected from technologically mediated societies. The traditional variant of the digital exclusion analysis looked primarily at the importance of the Internet and ICT access (see Table 1).

Table 1
Social divisions in the network model of society. Traditional variant

Social divisions in the network model of society Traditional variant	
Connection to the network: access to new technologies, high level of technical competences, high level of social competences, fast adaptation to changes, high income, age of users, place of residence.	Lack of connection to the network: novelty and types of technologies used, low level of technical competences, low level of social competences, slow adaptation to changes, low income, age of users, place of residence.

Source: own study based on: Betlej, A. (2019). *Spoleczeństwo sieciowe – potencjały zmian i ambiwalentne efekty*. Wydawnictwo KUL, p.235.

In this theoretical perspective, digital exclusion, as well as many of its determinants listed above, will affect the employment, education and social participation opportunities of participants in technologised societies. The performative potential of social actors is considered as an important factor for radical social change in the near future. Technological enhancement does not abolish classic social divisions. It gives them new content and, in effect, implies in a sense previously unknown principles of social stratification. The importance of cultural factors is increasing in these processes. A change in the perspective of the individual and the aspect of his or her re-empowerment in the spirit of humanist assumptions is also apparent. Assessing social divisions from this perspective leads to numerous ambivalences. The process of networking, knowledge production and global alignment of meanings will trigger various phenomena. In this view, being networked does not ultimately determine an individual's position in the power structure. The category of the digitally excluded can be broadened to people who are connected and moreover well-functioning in the social, professional and technological spheres (see Table 2).

Table 2
Digital exclusion in the network model of society. Ambivalent variant 1. Excluded people with connection

Digital exclusion in the network model of society Ambivalent variant 1. Excluded people with connection	
Excluded people with connection: alternative exchanges of information resources, low level of social performativeness, informal circuits of culture, cyberhacktivism, alternative network spaces, individuals, social groups, social networks, naive cyber-consumers.	Elites – Not connected to the network: knowledge networks, power networks, classic actors of change (e.g. mafia--oligarchic systems), creators of new technologies, prominent individuals, new social movements, technosocial systems, digital refugees.

Source: own study based on: Betlej, A. (2019). *Spółeczeństwo sieciowe – potencjały zmian i ambiwalentne efekty*. Wydawnictwo KUL, p. 237.

Individuals with MID are particularly at risk of digital exclusion. The Internet and new technologies create an extremely effective environment for their social activity and education. On the contrary, many negative aspects of online presence of people with MID might be discussed (Szpunar, 2021). They are particularly

vulnerable to many risks due to their undeveloped learning abilities. Cognitively inaccessibility of education content may be considered as the effect of the most important barriers to Internet and computer access (see Table 3).

Table 3
Barriers to Internet and Computer Access for People with Mild Intellectual Disabilities

Barriers to Internet and Computer Access for People with Mild Intellectual Disabilities	
Individual:	Social:
educational barriers,	financial constraints and economic barriers,
language and communication abilities,	societal attitudes, social exclusion,
auditory reception abilities, reasoning abilities, idea production abilities, cognitive speed abilities, memory and learning skills abilities, visual perception abilities,	contextual factors that impact on training and support from family carers and other direct stuff (views, experience, digital skills, knowledge),
knowledge and achievement abilities	lack of inclusive policies; lack of government support
lack of interest in developing digital skills(attitudes)	cultural barriers (values, superstitions, interpretation schemes, norms, images of people with MID etc.)
Internet content	technology design
lack of family carers' support (attitudes)	rapid technological development, digital disparities
lack of direct support from training staff (attitudes)	environmental barriers

Source: own study based on: Betlej, A. (2019). *Spoleczeństwo sieciowe – potencjały zmian i ambiwalentne efekty*. Wydawnictwo KUL. Kennedy, H., Evans, S., & Thomas, S. (2011). Can the Web Be Made Accessible for People with Intellectual Disabilities? *The Information Society* 27, 1, 29–39.

Access to the Internet and computer may provide many opportunities for people with mild intellectual disabilities. Despite the mentioned barriers, there are many opened up avenues for education, learning, self-expression, networking, working, entertainment and self-advocacy. The socializing aspects seem to be of the most interest of social scientists. So far in literature the main topics of discussions have been the potential opportunities for people with MID to create and sustain social relationships online that transcend the individual's disability, allowing them to develop an identity as an independent person and transcend social distance (Szulc, 2020). Development of Internet content could lead to reducing social stigma of a person with MID. Moreover, the perceived benefits are

possibilities of expressing self-identity among online citizens. Previous research includes descriptions of people with MID as social media users (Kennedy et al. 2011). Their networking activities are interpreted as milestones to reduce social inequalities. Internet and computer access are often analysed in terms of key factors in strengthening their self-determination and self-advocacy on a global scale. Promotion of positive attitudes towards people with MID may lead to social changes in cases of developing support strategies for people with special needs as well as addressing their needs by technology designers.

Network society is open and innovative (Betlej, 2019). Traditional causality and continuity disappear and an accidental infosphere appears here. The advantages of social networking in shortening social distances and counteracting social exclusion of people with special educational needs is a very frequently addressed topic of research. The second extremely important aspect is also addressing the topic of participation in the process of creating online content and understanding the networked logic of functioning in technological societies. The use of sophisticated technologies allows for an extraordinary intensification of information production and processing in key areas of socio-economic activity, such as rationality-based learning, the information economy, the knowledge-based labour market, and culture dominated by media products (van Dijk, 2012). People with MID who have access to the Internet and a computer and who actively participate in social media are also potentially at risk of digital exclusion if their education does not address the issue of understanding online content. The development of digital skills in networked societies cannot be limited to learning only the technical aspects. The focus should be on the social and educational side, leading to the shaping of modern, inclusive e-education. Learning technologies can become effective tools for the education and development of people with MID. Going beyond technology is a starting point in understanding the multidimensional risks of digital exclusion in a network society. Applying the potential of social technologies could help to enhance learning opportunities for people with special needs.

Learning Technologies: Crossing the Line

Accelerated advances in information and communication technologies (ICT), assistive technologies with the Internet at the foreground, significantly change the opportunities for learning and social interaction (Morze et al., 2014). The number of people using mobile devices on a daily basis continues to grow (Doughty et al., 2013). Thus, being digitally connected is becoming essential to personal and social development in different environments. Internet access is considered as universal and undeniable (Dobosz et al., 2018). However, learning technologies is

a broader concept than the Internet and encompasses many specialised programmes, applications and solutions for specific audience categories (Betlej, 2019; Buchnat et al., 2020). People with MID can, in many cases, benefit significantly from access to modern technological developments. It should be stressed that the great potential of these is seen in helping individuals in better integration into society and experiencing various benefits of full citizenship. New technologies offer the promise of reducing or removing many of the barriers that limit their educational opportunities, as well as their self-development and well-being.

New technological solutions that can assist people with MID include many others that are not widespread on a mass scale. Assistive, supportive or enabling technology include devices, tools, equipment, alongside with software and hardware that partially enable people with certain disabilities to use a computer. Although computers and computing devices come to mind when we think of assistive technology, it can also be very low-tech, like pencil grips. These types of devices create a different way of accessing content on the screen, giving commands to the computer or processing data. Assistive technology supports individual and inclusive learning and makes it easier to bypass difficult tasks such as handwriting. (Kennedy et al., 2011). It should be considered as an effective tool of enhancing writing skills of individuals with special educational needs (Dobosz et al., 2018). People with MID in many cases have difficulty in writing and reading effectively, as well as remembering content. Assistive technology could support the avoidance of these technical conditions of writing and other specific cognitive competences. Using spell-checking and grammar-checking qualities can help individuals focus on communicating their thoughts. Specific adaptive software or computer manipulation devices include inter alia:

- Screen reading software (speaks the displayed text, simulates mouse actions with the keyboard);
- Text-to-speech software, such as Kurzweil 3000, can read digital or printed text aloud. This digital tool provides many opportunities for effective learning. People with MID are more likely to understand a text when unfamiliar words are read to them. Text to speech has a positive effect on interpretation and word perception. It also impacts reading fluency and comprehension. -screen magnification software (to enlarge the content of the screen). The use of the Kurzweil 3000 software also improves people's perception of learning itself and their individual assessment of their expressive writing skills. Important in this context is the aspect of emotions and the individually perceived well-being of people for whom reading and writing is no longer linked to the experience of frustration;
- Speech-to-text – People with MID have some transcriptional limitations and therefore show difficulties with handwriting, spelling, punctuation, difficulties in learning grammatical rules. In opposition to this, they often develop good composition skills that enable them to plan, create content and revise it. Speech

recognition software transcribes the spoken word into computer text. The user therefore does not have to type or handwrite independently. People with MID can create longer and more complex stories with fewer errors thanks to this solution (e.g. XpressLab). In addition, voice recognition software can improve word identification, spelling and comprehension skills for people with learning disabilities;

- Braille display (to display Braille characters);
- Alternative input devices (e.g. on-screen keyboard) and special keyboard (to facilitate data entry);
- Keyboard enhancements and accelerators (such as StickKeys, Mousekeys, repeatKeys, SlowKeys, BounceKeys or ToggleKeys), mnemonics and keyboard shortcuts;
- Assistive robots and robotics equipment validated to improve the learning opportunity;
- Alternative pointing devices (e.g. foot-operated mice, head-mounted pointing devices or eye tracking systems);
- Mid-tech devices- audio recorders, portable note takers, mp3 players, calculators, and pentop computers.

Assistive technology is often discussed by domain (Smyrnova-Trybulska et al., 2020). The types of devices listed are cited in the literature as examples of learning technologies for people with learning disabilities. These are helpful for people with ID for a number of reasons, not least because they support the process of writing, reading and logical thinking. It should be noted that rapid technological progress is constantly being made in this area. There are still many relatively simple technological solutions available on the market to support learning processes by benefiting receptive, speaking, reading, writing, reasoning and math skills (see Table 4).

Table 4
Examples of Assistive Technology by Domain. Low- to mid-tech

Examples of Assistive Technology by Domain Low- to mid-tech				
Speaking	Reading	Writing	Reasoning	Math
Cue cards	Highlighter strips	Pencil grips Computerized pens	Graphic organizers	4-function calculator

Source: own work based on: Tsikinas, S., & Xinogalos, S. (2018). Designing effective serious games for people with intellectual disabilities. *IEEE Global Engineering Education Conference (EDUCON)*, pp. 1896-1903; Hornby, G. (2014). *Inclusive Special Education: evidence-based practice for children with special educational needs and disabilities*. New York: Springer; Brereton, M., Sitbon, L., Haziq Lim Abdullah, M., Vanderberg, M., & Koplick, S. (2015). Design after design to bridge between people living with cognitive or sensory impairments, their friends and proxies. *CoDesign* 11 (1) , 4–20.

The market of new technologies is very diverse in terms of the technical parameters of learning technologies. A very extensive branch of it is intermediate devices supporting the development of key competences. These digital devices are also relatively easily accessible to potential end users (see Table 5). People with MID are regarded as disadvantaged groups with limited economic resources. Empirical evidence from a number of studies confirms that economic factors are important variables in access to technology.

Table 5
Examples of Assistive Technology by Domain. Mid- to high-tech

Examples of Assistive Technology by Domain Mid- to high-tech			
Reading	Writing	Reasoning	Math
Kurzweil 3000	Word processing	Inspiration Spark-Space	Graphing calculator IXL Math

Source: own work based on: Tsikinas, S., & Xinogalos, S. (2018). Designing effective serious games for people with intellectual disabilities. *IEEE Global Engineering Education Conference (EDUCON)*, pp. 1896-1903; Hornby, G. (2014). *Inclusive Special Education: evidence-based practice for children with special educational needs and disabilities*. New York: Springer; Brereton, M., Sitbon, L., Haziq Lim Abdullah, M., Vanderberg, & M., Koplick, S. (2015). Design after design to bridge between people living with cognitive or sensory impairments, their friends and proxies. *CoDesign* 11, 1 (2015), 4–20.

A contemporary trend is the development of applications for mobile devices. These solutions are becoming more common due to the high popularity of smartphones and touch screens (see Table 6). These tools are also readily available, although economic issues, such as in some cases the purchase of licences and other usage costs, can become a barrier. The use of mobile applications comes with the potential for a number of cyber threats. These devices' complexity is often perceived as a barrier to Internet use. There is a need for universal design principles development. Barriers to accessing and using learning technologies should be considered from the perspective of the individual user. Differential cognitive, physical and sensory impairments associated with intellectual disabilities may be important factors. The barriers leading to challenging educational problems are related with specific language and communication ability, as well as auditory reception, reasoning, memory visual perception, etc. Impairments affecting literacy and reading comprehension become very problematic when assimilating electronic content, e.g. words with multiple meanings (window, menu, files). Using applications for mobile devices requires a level of sequential reasoning, but these tools seem to meet the needs of people with MID despite the mentioned barriers.

Table 6
Examples of Assistive Technology by Domain. Apps for Mobile Devices

Examples of Assistive Technology by Domain Apps for mobile devices				
Speaking	Reading	Writing	Reasoning	Math
ShowMe Interactive Whiteboard	Speak Selection GoodReader	Pages iWordQ Dragon Dictation	SimpleMind+	ShowMe ScreenChomp

Source: own work based on: Kennedy, H., Evans, S., & Thomas, S. (2011). Can the Web Be Made Accessible for People with Intellectual Disabilities? *The Information Society* 27 (1), 29–39; Doughty, T., Bouck, E., Bassette, L., Szwed, K. & Flanagan, S. (2013). Spelling on the fly: Investigating a pentop computer to improve the spelling skills of three elementary students with disabilities. *Assistive Technology*, 25, 166–175.

The examples described support the thesis that assistive technologies can be either devices or equipment (hardware), e.g. Braille, and software applications, e.g. screen reading software (Young et al., 2014). This raises the question of whether these technologies are sufficient to provide full support for people with MID. In this respect, it must nevertheless be noted that these devices do not meet their needs of living in highly technological societies. The inclusion of people at risk of digital exclusion requires a new approach. The barriers to the access to new learning solutions despite the evaluation of its technological advancement, are not always effects of financial constraints. Accessibility demands for people with MID have often been ignored or misunderstood. The invisibility of this group to the general public seems to be unquestioned. Many learning technologies are cognitively inaccessible for those potential end-users. Despite the knowledge on benefits from new technologies people with MID seem to be not included in the designing process (Tsikinas et al., 2018). In addition, they are rarely found in leadership or decision making on Internet policy positions in organisations. Internet content providers should also be involved in the process of including them by introducing solutions that take into account the specificities of people with intellectual disabilities when creating online content (Tsikinas et al., 2020). We can refer to the examples of efforts taken around the world to address this issue, like the benefits of artificial intelligence for learning. What needs to be underlined, the design should be considered as a core of inclusive learning technologies.

Based on this premise, accessible and advanced e-learning should be linked directly to the project features. The technical specificity of these solutions facilitates online learning that is accessible to everyone, regardless of their disability. (Smyrnova-Trybulska et al., 2016). In addition, the process should also take into account more mediators of learning. The mode of implementation also interacts with the learning process. The analysis of unnecessary barriers to his/her interaction with a computer or connecting device is crucial in the development of people-

-friendly technologies (Szulc, 2020). Accessibility should be recognised as a key element in the design of technology-assisted training systems (Bayor et al., 2021). The trend in learning technologies is mobile applications development with AI enhancement. Individuals with intellectual disabilities witness many constraints in this respect. Thus, the future and humanistic oriented solutions are focused on promoting people with MID in accessing, using and interacting with the Internet through e.g. the Web Accessibility Initiative by developing strategies, guidelines and specific resources (Balasuriya et al., 2019). All solutions are based on Web Content Accessibility Guidelines, authoring tools and user agent. The Internet accessibility model is based on the four criteria (Bennett et al., 2018):

1. Perceivable – information and user interface elements must be presented to users in a way that they can perceive.
2. Operable – user interface elements and navigation must be operational.
3. Understandable – information and operation of the user interface must be comprehensible.
4. Robust – the content must be sufficiently robust to be reliably interpreted by a wide variety of user agents, including assistive technologies.

Since e-education is one of the major concerns of new technologies as a tool of social inclusion of people at risk of digital exclusion, applying their standards in this domain is very promising. Social inclusion of people with mild intellectual disabilities should be broadly viewed with support for the innovation development and adoption of learning technologies. Despite many controversies and challenges these solutions are of great importance for inclusion of disempowered people and based on humanistic thinking and solidarity values. In our increasingly digital world the power of universal values is still underestimated, as well as the potential of social technologies (Rembierz, 2021; Mariański, 2020).

Conclusions

Technological invasion causes social, economic and axiological transformations in networked societies. It changes the understanding of the right to education, self-development and citizen participation in social activities. The dominant mechanism of changing the direction of interpreting the axiology of the economy of relations is not only the market monetization of digitized information, data and knowledge. The new models of digital exclusion go beyond the technology to underline the importance of creative humans' presence in development of digital content. Questions about the performative potential of individuals with mild intellectual disabilities in network society will intensify as technology continues to expand.

Democratic hopes for sustainable social development, placed in the increasing speed and efficiency of the Internet, are becoming obsolete. Users, aware of new technologies, with an appropriate potential of access authority, will give up certain technological amenities in favour of the controversially understood freedom. It ought to be admitted that in the future, cultural conditions will further intensify the tendencies of social differentiation in technologically connected societies. As described by Manuel Castells, there is an observable trend towards technological dependence in developed countries. Subsequent networking prospects will be diversified. The dispersion of information in the network has a superficial character.

Descriptions of new technologies increasingly focus on the integration properties of the medium as a tool for inclusive e-education of people with mild intellectual disabilities. The examples of such phenomena are learning technologies and efforts in developing accessible e-learning environments which consist of design, implementation and validation phases (Kennedy et al., 2011). The inclusion of accessibility in e-education is not only to guarantee the opportunities offered by the e-learning paradigm for all, including people with intellectual disabilities. It is also important to realise the full potential of learning technologies beyond social media participation (Betlej, 2019)A. Inclusive e-education cannot only support the removal of barriers experienced by people with MID in accessing digital resources online. Effective use of learning technologies would mean that technological resources would be used by learners of all ages, despite physical and technical barriers, by adapting devices to individual user styles and preferences (Brereton et al., 2015).

The study showed that many daily learning problems can be considered as similar for younger as well as older users, such as difficulties with reading, writing, abstract thinking, etc. What is important, the focus should be on the different strategies to overcome the mentioned problems. In this context, the age category will be crucial in analysing the adaptation of technical innovations to the needs and adaptability of people at different stages of life. Assessing learning technologies in relation to age and learning strategies has the potential to increase usability and design of digital solutions to people with special educational needs. The design of such solutions should therefore not only take into account the latest trends in new technologies. User interfaces and assistive features should be adapted to the learning strategies of people of different ages. Learning tasks involving assistive technologies will then be more effective.

Future research should focus on a micro-level approach and explore the specific needs associated with the use of such devices. In addition, an important question is whether people with MID are interested in participating in the learning technology design process. The authors plan to conduct in-depth interviews with people in MID. Essential questions would be about perceptions of self-development opportunities through the use of learning technologies and familiarity with commercially available solutions. As part of the next phase of the research, the authors plan to conduct focus

groups to get knowledge about their experiences with using learning technologies as well as their expectations towards the design of these tools.

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Alina Betlej, Alina Danileviča

Technologie uczenia się dla osób z lekką niepełnosprawnością intelektualną Od wykluczenia cyfrowego do e-edukacji włączającej w społeczeństwie sieciowym

A b s t r a k t

W niniejszym artykule podjęto problem rozwoju technologii uczenia się dla osób z lekką niepełnosprawnością intelektualną, opisany w teoretycznych ramach społeczeństwa sieciowego. Badania koncentrują się na zagadnieniu technologii uczenia się dla osób z lekką niepełnosprawnością intelektualną. Przeprowadzona analiza jest ugruntowana w tezach społeczeństwa sieciowego. Cele wstępne dotyczyły trzech głównych zagadnień: analizy zagrożeń wykluczeniem cyfrowym osób z lekką niepełnosprawnością intelektualną w wysoko rozwiniętych technologicznie społeczeństwach; konceptualnego spojrzenia na technologie uczenia się jako narzędzia wspierające integrację społeczną; oraz znaczenia dostępnych środowisk e-learningowych dla wspierania e-edukacji włączającej w wypadku osób z lekką niepełnosprawnością intelektualną. Autorki zastosowały metodę analityczno-opisową na podstawie wybranych źródeł literaturowych, aby nakreślić konceptualny pogląd na funkcje technologii uczenia się w społeczeństwie sieciowym. Artykuł ma następującą strukturę: wprowadzenie; analiza teoretycznych podstaw społeczeństwa sieciowego; przegląd technologii uczenia się dla włączającej e-edukacji dla osób zagrożonych wykluczeniem cyfrowym, wnioski badawcze i kierunki przyszłych badań.

S ł o w a k l u c z o w e: technologie uczenia się; osoby z lekką niepełnosprawnością intelektualną; społeczeństwo sieciowe; e-edukacja włączająca, wykluczenie cyfrowe

Алина Бетлей, Алина Данилевича

Технологии обучения для людей с легкой умственной отсталостью От цифровой изоляции к инклюзивному электронному образованию в сетевом обществе

А н н о т а ц и я

Исследование посвящено проблеме технологий обучения для людей с легкой умственной отсталостью. Проведенный анализ основан на тезисах сетевого общества. Первоначальные задачи касались трех основных вопросов: анализ рисков цифровой изоляции людей с легкой умственной отсталостью в высокотехнологичных развитых обществах; концептуальный взгляд на технологии обучения как инструменты поддержки социальной интеграции; важность создания доступной среды электронного обучения для поддержки инклюзивного электронного образования для людей с легкой умственной отсталостью. Авторы использовали аналитический и описательный метод на основе выбранных литературных источников, чтобы составить концептуальное представление о функциях технологий обучения в сетевом обществе. Работа построена следующим образом: введение; анализ теоретических предпосылок сетевого общества для понимания необходимости выйти за рамки технологий для понимания современных цифровых различий; обзор технологий обучения для инклюзивного электронного образования для лиц, подверженных риску цифрового исключения, выводы исследования и направления будущих исследований.

К л ю ч е в ы е с л о в а: люди с легкой умственной отсталостью; сетевое общество; технологии обучения; инклюзивное электронное образование, цифровое исключение; люди с легкой умственной отсталостью.

Alina Betlej, Alina Danileviča

Tecnologías de aprendizaje para personas con discapacidad intelectual leve De la exclusión digital a la educación electrónica inclusiva en una sociedad en red

R e s u m e n

La investigación pretende investigar el problema de las tecnologías de aprendizaje para las personas con discapacidad intelectual leve en el marco teórico de la sociedad en red. Los objetivos iniciales abordan tres cuestiones principales: el análisis de los riesgos de exclusión digital de las personas con discapacidad intelectual leve en las sociedades altamente desarrolladas tecnológicamente; una visión conceptual de las tecnologías de aprendizaje como herramientas de apoyo a la inclusión social; y la importancia de crear entornos de aprendizaje electrónico accesibles para apoyar la educación electrónica inclusiva para las personas con discapacidad intelectual leve. Los autores utilizaron el método analítico y descriptivo sobre la base de las fuentes bibliográficas elegidas para trazar la visión conceptual de las funciones de las tecnologías del aprendizaje en la sociedad en red. El artículo está estructurado de la siguiente manera: introducción; análisis de los antecedentes teóricos de la sociedad en red para comprender los nuevos riesgos de exclusión digital para las personas con discapacidad intelectual leve; la visión general de las tecnologías de aprendizaje para la e-educación inclusiva para las personas en riesgo de exclusión digital, las conclusiones de la investigación y las direcciones para futuras investigaciones.

P a l a b r a s c l a v e: tecnologías de aprendizaje; personas con discapacidad intelectual leve; sociedad en red; e-educación inclusiva, exclusión digital