



Promoting digital transformation and social innovation in VET for better access of deaf students to the labour market

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INTRODUCING 3D TECHNOLOGIES IN TEACHING AND LEARNING FOR A SUSTAINABLE
FUTURE

A1: 3D4DEAF COMPARATIVE INDEX & PRACTICAL GUIDEBOOK

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EDUCATION OF DEAF STUDENTS

Statistics on the total number of deaf people in the community

It is estimated that 900,000 Poles have a serious hearing impairment (Potakowski, 2019). Based on the available data, it can be assumed that there are currently about 50,000 deaf people in Poland (Kotyniewicz, b.d.). Determining the extent of the phenomenon of deafness is a difficult task. The discrepancies are so large that the estimated number of deaf people in Poland ranges from 10,000 to 150,000 (Zajkowska, 2013).

The number of deaf students

In the 2021/2022 school year, over 15,000 students with hearing disabilities were studying in educational institutions across the country. Most of them - about 86% - were hard of hearing people who, despite hearing impairment, study with their hearing peers, about 14% (2,100 people) were deaf students who also use sign language during their education (NIK, 2022).

Organization of the teaching system

People who communicate with deaf students daily use all available communication methods - writing, symbols, sign language signs or illustrations (NIK, 2022). The oral method dominates in the institutions, i.e. based on phonic communication, in which the student reads the message from the teacher's mouth. This method does not work as an effective method of educating the deaf, which is why many schools use sign language as a tool to support the communication process. It is most often the sign language system (SJM), because only SJM is taught at pedagogical universities. The native language of the Deaf is Polish Sign Language (PJM). PJM is not a compulsory subject in any school in Poland (Biuro Rzecznika Praw Obywatelskich, 2014). Some schools offer sign language classes as part of revalidation. There are also no exam requirements. During the external exam, which is not designed specifically for people with hearing impairment, the student is left alone with written Polish (NIK, 2022).

The provisions of the education law make it possible to learn sign language or other alternative methods of communication from the moment the child is included in early development support classes, organized from the moment the disability is detected, during pre-school education and school education. For deaf children and adolescents with certificates of special education, learning sign language or other alternative methods of communication should be included in revalidation classes. Sign language learning can also be organized at school outside of compulsory educational classes, in accordance with the needs of students, in particular deaf children and youth. The scope of support results from the recommendations indicated in the ruling. Adjusting the content and individualizing the teaching process is the task of teachers and specialists working with the student. Indications, recommendations and forms of work are defined in the individual educational and therapeutic program (IPET) (Wysocka, 2023).

The organization of the education system imposes on schools the obligation to prepare many documents. In the case of students with a statement of the need for special education, these include, among others: WOPFU and IPET. These abbreviations mean: Multidisciplinary Assessment of the Student's Functioning Level and Individual Educational and Therapeutic Program. Such a certificate is issued due to: disability, social maladjustment; the risk of social maladjustment. There is no specific, uniform template or WOPFU and IPET questionnaire. Each educational institution can develop its own, most suitable form or use the proposals available in publications (WSiP, 2023).

Unfortunately, the organization of the education system does not meet the expectations of deaf people and their families, as it lacks adaptation to the needs of deaf people. Specialists working with graduates of schools for the deaf point to the lack of curricula tailored to the needs of deaf people. For this reason, they cannot master their mother tongue (Polish) well enough to communicate in written form. The grammar of the written language is completely different from the grammar of the sign language, which causes communication problems, but also difficulties for students at various levels of education, where at least correct use of the language in writing is required. Deaf students also have no alternative, because they do not have materials, textbooks and aids for learning in sign language. The ones that are created are usually materials supporting education and are not widely available. The reason is the lack of specialists who could translate the manual into sign language in a friendly form

Teachers who teach deaf students

Teachers working with deaf students do not need to know sign language. Approx. 60% of teachers and pedagogues in controlled special institutions and about 85% in integrated schools either did not know sign language at all or used it at a level that did not allow for efficient communication. The regulations require teaching staff working with deaf and hard-of-hearing people to know sign language only at a basic level. Most of the teaching staff had appropriate education to be able to work with deaf and hard of hearing students. The main problem was the lack of knowledge of sign language. The lack of a minimum, uniform standard of the level of language and communication skills allowing to work with a deaf student did not help to improve their language competences. In 15 schools covered by the study, out of 674 teachers, knowledge of PJM was declared by less than 40% of them, and knowledge of SJM by about 35% (NIK, 2022).

PJM is neither the language of instruction nor a compulsory subject in any school in Poland. There are no PJM curricula or standards for PJM teachers. There are no specific qualification requirements for a teacher who wants to work with the bilingual method in a school for deaf children. A teacher at deaf education studies receives only information about what a deaf student cannot do and what cannot be done with him. Teachers use books for children with intellectual disabilities. They are not prepared to work with the bilingual method, as Polish deaf education is still dominated by an oral approach, the aim of which is to teach speech. The teacher at the university is familiarized with the Sign Language System and, to a minimum extent, with PJM. The teacher, not knowing PJM, knows nothing about the deaf community in Poland or their culture, because these topics are irrelevant to the oral approach to a deaf child (Biuro Rzecznika Praw Obywatelskich, 2014).

Education in the field of functioning of the deaf and hard of hearing in society can be obtained at first and second degree studies, as well as postgraduate studies in deaf education, speech therapy and, less often, special education. However, the study programs focus mainly on the issues of rehabilitation, correction of speech defects and issues of social integration and education of the deaf. They lack topics related to deaf culture, sign language, the identity of the deaf as a linguistic minority and many other issues important for this environment. There are no sign language courses, only occasionally a Sign Language System course is available as part of the study program (Biuro Rzecznika Praw Obywatelskich, 2014).

The training of special education teachers in the field of education and rehabilitation of people with hearing disabilities (deaf education) can take place: in the uniform master's studies in the field of "special pedagogy", as well as in the framework of three-semester postgraduate studies in the field of deaf education - the latter option is intended for people already working as teachers who want to obtain additional qualifications in this field. Professionally active teachers can take up Polish Sign

Language courses at the B1 intermediate level and obtain certificates confirming knowledge of this language at a certain level only in the professional development system. The Ministry of Education and Science has launched free postgraduate studies. The offer addressed to teachers working with hearing-impaired children and youth includes studies in the field of methodology of supporting students' language communication. The studies will allow you to gain practical skills in providing effective support to children with disabilities and special educational needs. A 4-semester study entitled "Early support for child development and family support" has been launched. Their goal is to prepare specialists for the implementation of tasks in the cross-sectoral model of early child development support and family support. At the request of the Ministry of Education and Science, post-graduate studies were also launched in the following directions: "Family Advisor", "Perfecting post-graduate studies for primary and secondary school teachers conducting classes with students with diverse development and educational needs" (Wysocka, 2023).

The Ministry of National Education organizes trainings and conferences for school head teachers and teachers on the dissemination and implementation of inclusive education. Superintendents of education organized conferences on the dissemination of legal solutions and good practices in the organization of education and support for students with special educational needs. The addressees of the conference were the managers of kindergartens, schools and institutions, as well as teachers responsible for the organization of special education and psychological and pedagogical assistance. The Centre for Education Development, in cooperation with the Ministry of National Education, has also prepared a guide "Students with special educational needs in the education system in the light of the new provisions of the education law". The publication discusses new legal solutions and practical examples of organizing and providing psychological and pedagogical assistance, special education, and individual compulsory one-year pre-school education and individual teaching (MEiN, 2018).

Summing up, activities in the field of education of deaf people in Poland are still insufficient and contribute to the deepening of the process of excluding many young people from the process of formal education. Only the determination of themselves, parents and other specialists allows some of them to go through the educational path at a level comparable to able-bodied people. There are more and more such people, and some of them achieve high academic results, and thus the way to further success in life opens for them. Unfortunately, a large part of young people do not have such opportunities and quickly finish their education looking for their way of development in non-formal education.

THE SITUATION OF DEAF PEOPLE IN THE LABOUR MARKET

In Poland, deaf and hard of hearing people have problems finding a job. It is estimated that up to 80% of deaf and hard of hearing people in Poland do not work (Potakowski, 2019). Deafness hinders employment and even prevents many jobs. There are professions in Poland inaccessible to deaf people, which they successfully perform in other countries. This is due to the stereotypical approach to deaf people, the unpreparedness of employers to employ them and the lack of knowledge of how to ensure them the safe performance of many jobs. Deaf people who have significant problems in communicating with hearing people are often socially excluded, their professional activation requires special activities, which are difficult to reach excluded people. There are many programs to support the employment of deaf people, financed both from national and EU funds.

The effectiveness of public institutions in supporting professional activation of deaf people is low. Too many doctors still issue judgments limiting the ability to perform work or prohibiting work in certain positions, inadequate to the working conditions, which do not pose a threat or may not be any contraindication to employment. It happens that deaf people have to look for employment abroad in order to work and earn money, because in Poland they are considered incapable of performing the same job.

Educational centres do not prepare for independence, including taking up a job (Biuro Rzecznika Praw Obywatelskich, 2020). The system of vocational education for the deaf does not correspond to the preferences and abilities of the deaf, nor to the labour market. The biggest barrier to vocational training is the language/communication barrier. Vocational teachers do not know PJM to a sufficient extent, and students do not know the Polish language to an appropriate extent. This causes an unknown percentage of students to pass vocational exams, especially written exams. As a result, an unknown percentage of vocational school graduates hold a certificate, most only a certificate of graduation, which reduces employment opportunities and eliminates the possibility of further education (Kosz, 2019).

The experience of job coaches shows that they educate the deaf from scratch. They must explain to them what work is, what are the realities of the labour market and individual professions, what are the requirements for employees, what rights and privileges a deaf person has, and what duties. Career guidance for the deaf is at a very low level. Therefore, it is extremely difficult for deaf people who communicate in PJM to find themselves on the open labour market. Employing many deaf people in one place means that the coordinator of the group plays an additional role - a personal advisor or confidant of deaf employees. This is excessively burdensome for the coordinator (Biuro Rzecznika Praw Obywatelskich, 2020).

The Labour Code does not provide for a specific type of employment contract for a disabled person. However, people with disabilities have been granted additional rights related to employment, and special obligations have been imposed on the employer who employs such people. The state does not impose any additional requirements on setting a higher or lower salary for people with disabilities. They are to be treated by employers in the same way as all other employees.

Qualifications and competences of deaf employees

An important issue is the adaptation of the workplace, which guarantees that a given position will be filled by an employee with competences corresponding to the requirements. It is important that the workplace is adapted to the hearing impaired employee not only in terms of his professional competences, but also in terms of communication and relations with other employees. Deaf men over

30 years of age have mainly vocational education as a carpenter and locksmith, while women as a seamstress or tailor. Persons under 30 who have completed a technical school, high school or post-secondary school have competence in gastronomy or IT. After graduating from university, most often teaching. In Poland, deaf people generally work in support and physical positions. There are several reasons for this: communication barriers, lower education and professional competences, and stereotypes about deaf people (Kotyniewicz, b.d.).

As part of the vocational rehabilitation system, which can also be used by deaf people, there are many instruments that professionally activate people with disabilities. Among them, there is the possibility of undertaking, for example, training courses, internships, professional preparation for adults, intervention works or studies, as well as support instruments addressed to people with disabilities who are interested in starting or running a business. In addition, there are also instruments to support the employment of people with disabilities, addressed to employers who employ or intend to employ such people - e.g. monthly subsidies to the remuneration of a disabled employee. Every employer employing at least 25 full-time employees is obliged to make monthly payments to the State Fund for Rehabilitation of the Disabled (PFRON) (Ministerstwo Rodziny i Polityki Społecznej, 2016). The community of deaf people is supported from its funds.

Many deaf people use the help of PFRON because they have limited opportunities to find a job (Biuro Rzecznika Praw Obywatelskich, 2014). The activities of PFRON, undertaken jointly with the Ministry of Family, Labour and Social Policy, are aimed at providing support on many levels of building a professional career path, starting with the education of people with disabilities and further through support in professional development. The employment of people with disabilities on the open labour market is supported by refunds of salaries, subsidies for employers to create or equip workstations for people with disabilities, and refunds of social security contributions for people with disabilities running a business and disabled farmers.

The employment of people with disabilities on the protected labour market is supported by co-financing the creation and subsequent operation of Vocational Activity Institution and supporting the activity of Sheltered Employment Establishments. The Vocational Activity Institution is an organizationally and financially separate unit created to employ people with disabilities. The task is the professional and social rehabilitation of disabled people. Vocational Activity Institution, employing disabled people with the most difficult situation on the labour market, allows their employees to gain professional experience. This experience may later help them find employment in the open labour market.

The Vocational Therapy Workshop is an organizationally and financially separate facility that provides people with disabilities who are unable to work the possibility of social and professional rehabilitation in terms of acquiring or restoring the skills necessary to take up employment (Piotrowski, 2019).

The Ministry of Family and Social Policy is the leader of the "Inclusion of the Excluded" project. Its aim is to prepare new solutions and tools to professionally activate people with disabilities, enable them to enter the labour market and stay on it (Ministerstwo Rodziny i Polityki Społecznej, 2022). The project "Activation = Work without barriers" finds companies that are ready to open up to employees with disabilities, and effectively reach the Deaf, whom they connect with companies.

In Poland, there is still a belief that the employment of people with disabilities is associated with difficulties. The Accessibility Plus program aims to change this situation, its task is to eliminate barriers for such people and respond to their needs. As a result, architecture, public administration, digitization, education and health care are obliged to take into account its recommendations (Potakowski, 2019).

To sum up, the employment of deaf people is more difficult than in other disability groups, because it is easier to adapt a workplace for a person with physical disabilities, providing them with appropriate tools and workplace than to prepare the environment for communication in sign language. Employers, being afraid of difficulties in communicating with a deaf employee, when they have a choice of an employee with a different disability, prefer to choose the latter, because the time of transferring information, instructions and tasks is much easier and faster. On the other hand, employers who dare to employ a deaf employee often indicate that he is a hard-working, dedicated and well-performing person.

In recent years, the best method of preparing deaf employees and employers for mutual cooperation are professional internships carried out as part of projects co-financed from EU funds. A period of at least 6 months allows you to master your duties, get to know the work environment and assess your skills at a specific job position. For the employer, it is a period when he can prepare a potential employee free of charge and work out his methods of communication with the participation of a sign language interpreter. Our experience shows that such internships are of great importance when deciding on the potential employment of an employee and make it easier for deaf people to find themselves on the labour market.

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STATE OF ART IN THE FIELD OF DIGITALIZATION IN EDUCATION

Please describe the state of the art in the field of digitalization, industry 4.0, 3D technologies, and STEAM Education in Your country. What are (if any) national policies which support and promote the overall digital transformation in education, especially for deaf students?

The key aspect of the fourth industrial revolution is Smart Industry, which includes activities and phenomena related to the digitization of the economy (especially industry). The foundations of Smart Industry are:

- digitization of information (thanks to which it is possible to create a more effective and efficient value chain management of production processes at all levels),
- flexible and intelligent technologies used mainly in production,
- modern communication with the use of technology and the possibilities of modern networks between stakeholders' market, as well as systems and end users.

The COVID-19 pandemic has accelerated activities in Poland related to digital transformation among industry 4.0 organizations. The PSI Poland survey conducted in 2019 shows that 52% of the companies participating in the survey declared knowledge of the concept of Industry 4.0, and 70% are planning to implement Industry 4.0 solutions or have already started their implementation (PSI Poland Report 2019).

The results of the survey in the field of digital technologies, carried out as part of the Digital Economy and Society Index (DESI), indicate that Poland is ranked 24th (2022) in the European Union. As many as 60% of enterprises are characterized by a very low level of digitization. It is indicated that currently in Poland nearly 50% of activities could be automated by 2030 thanks to the use of today's technologies. The greatest challenges for Poland are in human capital. The results of the ranking show that Poland is below the EU average (24 out of 27). Less than half of people aged 16-74 have basic or higher digital skills (Poland 43%, EU 54%). In contrast, 57% of the population have basic digital content creation skills (EU 66%). Analysing the area of Information and Communications Technology (ICT), Poland lacks specialists, and the percentage of the workforce is lower than the EU average. In Poland, the number of households covered by fixed networks with very high capacity is systematically growing - 70% in 2021 (compared to 65% in 2020). The key challenges in this matter include, above all, the development of the 5G network.

According to the World Economic Forum Report, The Future of Jobs Report (2018), the declaration of implementation of 3D technology in Polish organizations was submitted by financial resources are also allocated in the education sector to projects such as: "Lekcja: Enter" ("Enter: Lesson"), "Zdalna Szkoła" (Remote School, Remote School+). The funds finance the purchase of equipment for students and teachers for distance learning (computers, laptops, or tablets). Financial support was provided to nearly 2,800 Polish communes and districts that applied for co-financing in the form of a grant for the purchase of equipment for students and teachers. Thanks to the expansion of the Remote School+ program, another 2,467 municipalities received grants. Key activities in the field of digitization of the education area were financed by the Digital Poland Operational Program for 2014-2020 (co-financed by the European Regional Development Fund) (World Economic Forum Report, 2018). The aim of the "Lekcja:Enter" Program is to provide support to teachers in conducting remote lessons by offering various courses. Thanks to this Program, teachers could learn about new digital technologies and learn how to solve problems related to remote learning (distance learning methodology, monitoring psychological challenges, assessing students' progress in the remote learning process and cooperation between school and parents). Over 75,000 teachers participated in the "Lekcja:Enter" program (open, specialist and professional training). Another initiative supporting the development of new technologies is the IT Talent Development Program. The key objective is to improve advanced digital skills among young people (pupils and students) - to support development in algorithmics,

programming and designing computer games. Program participants - young people with above-average skills - develop advanced digital skills that are in high demand on the labour market (Program Rozwoju Talentów Informatycznych, 2019). In terms of the development of digital competences, attention should be paid to the UNESCO global initiative in the field of education - The Futures of Education. Its aim is to rethink and formulate the role of knowledge and education in shaping the future of people and the Planet. One of the key challenges is the growing gap between an educating society and qualified people ready to work in a dynamically changing world. Therefore, it is necessary to reorganize activities for education and reformulate its key areas, so that people graduating from education are prepared not only in terms of hard knowledge and competences, but also soft ones, including those related to digital. (UNESCO, 2020).

The results of a study conducted by Ministry of Entrepreneurship and Technology and the Siemens company) indicate that in the first quarter of 2018 as many as 60% of entrepreneurs in the sector of medium and large companies have not heard of the concept of Industry 4.0. In the group of small companies, it was 70%. Only 15% of companies already have done it or plans to implement the Industry 4.0 concept (Ministry of Entrepreneurship and Technology /Siemens, 2018). Innovative technological solutions have been implemented in those companies, primarily to reduce production costs and gain an advantage competitive. In addition, the Report shows that the main benefits of implementing modern technologies in production management include:

- improving the quality of the products offered (91.5%),
- improved efficiency (89%),
- cost reduction (88%).

It is worth noting that 85% of the surveyed entrepreneurs expect higher production profitability, 82.5% of revenue growth, and 80% of acquiring new customers.

At the same time, entrepreneurs pointed out the main barriers that make it impossible to adapt the technology. Among the barriers within the organization are:

- lack of funds for modernization (almost 65% of responses),
- lack of time (62%),
- lack of qualified staff (53%).

When analysing external factors, entrepreneurs most often pointed to:

- slowing down the innovation process with the use of technological solutions,
- administrative activities and bureaucracy (over 78% of responses),
- difficulties in finding competent employees on the labour market (71.5%),
- lack of support from public authorities (71%).

The report also analysed the readiness to take actions (or those planned to be taken) to implement the technology. Respondents pointed to (Ministry of Entrepreneurship and Technology /Siemens, 2018, pp. 5-8):

- investing own funds (90% of respondents take such actions and 85% have such plans),
- raising employees' competences through training (80% and 86%),
- hiring new qualified people (52% and 66%). This means that entrepreneurs aspiring to implement technologies typical of industry 4.0 value and understand the role of competence as an important resource in shaping the level of innovation of the company).

There is still much to be done in terms of robotization and digitization of Polish education. These processes were accelerated by the COVID-19 pandemic, which forced the Polish education system to switch to remote forms of teaching. This attributed to the digital revolution. Today, most facilities are equipped with basic devices necessary to conduct classes with the use of information and computer technologies, i.e. computers, laptops, tablets and interactive monitors. In Poland, there are over two million students with special needs, including the deaf. Especially this group requires investment in digital infrastructure, equipment, teacher competences and appropriate software. There are programs in Poland (including the ones mentioned above), unfortunately they operate for a short period of time or are one-off and do not ensure any continuity of activities.

In a study carried out on a group of 100,129 respondents (students, parents, teachers, and management) 40% of respondents declared using digital technologies several times a week, and 30% every day. On the other hand, every second teacher uses modern information and communication technologies (ICT) once a week. In addition, 80% of respondents believe that the use of digital technologies in the classroom increases the involvement of students. When asked if teachers use ICT in their daily work, as many as 90% answered positively. It should be noted that although the respondents represented different educational stages, the answers were rather consistent. Differences in the percentage distribution concerned rather the territorial location of the facilities. The lowest result in this respect was obtained by teachers representing the province of Lubelskie (72%) and the province Subcarpathian Voivodeship (84%). (Plebańska, 2017).

It should be emphasized that, especially for students with special educational needs, access to information and communication technologies and learning technologies can determine educational success. Pupils with special needs, including the deaf, need increased support and the use of various forms and methods of work. They also open new possibilities in the teacher's didactic work.

In subject lessons, ICT can be used to search, process information, carry out exercises and consolidate the acquired knowledge. The choice of working method used during a given class should depend on the purpose of the lesson. The most used tools include:

- **Quizizz:** Play to Learn: an application that allows you to create quizzes in various forms for students. The advantage is the possibility of individual learning, but also in a group.
- **LabMat:** an application for smartphones and tablets to learn mathematics through fun. It considers the current curriculum framework for classes I–V. The tool is available in two language versions - Polish and English. Class I: learning numbers, addition, subtraction, multiplication, division. Class II: numbers, addition and subtraction, multiplication table, division. Class III: numbers, addition and subtraction, multiplication and division, and fractions. Class IV: tasks in the field of addition and subtraction, multiplication, and division, also the properties of numbers, fractions and decimal fractions, geometry. Simple commands and instructions are conducive to using the application also by deaf students
- **Math Kid:** an application for learning mathematics at the 1st-5th grade level. Allows creative fun with adding and subtracting numbers. The tasks are ranked from the simplest to the more difficult. The application makes it possible to verify whether the task has been correctly solved. An interesting addition is the possibility of additional animation, thanks to which children know which answer is correct.
- **Learning Apps:** a platform with interactive tasks that can be used during lessons. The application supports the learning process with interactive modules. The application supports learning mathematics.



source: <https://matematykawpodstawowce.pl/labmat-matematyka-dla-klas-i-v/>

- **Logomocja-Imagine Demo 2.0.0.408:** educational program for children, thanks to which children will learn the basics of programming.

The state of the art in the field of STEAM Education in Poland is worse than in most countries of UE. The STEAM approach focuses on meeting the needs of the 21st century economy by developing the competencies of the future. It is based on learning, in line with the project approach and considering five key thematic blocks: science, technology, engineering, art and mathematics. The learning process is therefore focused on acquiring knowledge, but above all by acting and thinking in an innovative, non-standard way. Students evaluate and take risks, engage in experiential learning, creative problem solving, collaboration, and active participation in the creative process.

According to the main directions of the state's educational policy in Poland, there are two related to digital upskilling of teachers and STEAM education. First refers to developing methodological skills of teachers regarding proper and effective use of information and communication technologies in educational processes. Second should help teachers in developing pupils' basic and transversal skills, with the use of teaching aids purchased under the "Laboratories of the Future" program.

It is true that classes related to programming have been present in the core curriculum (primary schools) since 2017, and the Ministry of Education and Science (in cooperation with GovTech Centre in the Chancellery of the Prime Minister) gives over a billion zlotys (2.15 million euros) for buying equipment and introducing STEAM education. But the programs such as this are no long-term. Such policies and programs are still lacking. No robotics nor STEAM elements are explicitly included in the national curriculum especially for pre-schools. Many aspects important in ECEC – as indicated in the core curriculum – can be taught within STEAM model but, in practice, this approach is still rarely adopted by Polish nurseries and pre-schools (Plebańska, 2018).

National policies to support the general education of deaf students

Solutions currently used by many universities can be considered an example of good practice in making academic teaching available to deaf and hard-of-hearing people. The organizational unit of the university responsible for carrying out and coordinating such activities is the Disabled People's Office (BON). The activity of BON aims at eliminating all barriers and improving participation in the life of the academic community. In the case of deaf and hard-of-hearing people, this means the possibility of involving third parties in the didactic process, i.e. sign language interpreters and possibly shorthand typists or assistants, but also the use of non-standard forms of notation for the teaching materials used. These forms of education are subsidized by the state budget. This is dealt with by county local governments, which took over from PFRON the task of organizing and co-financing higher education opportunities. "Active Self-government" enables co-financing of the costs of higher education for people with disabilities.

Vocational courses and training is another area of lifelong education, willingly supported by Poland and the EU Funds. The project "4 steps - support for the deaf in the labour market", prepared and implemented by the Polish Association of the Deaf, consisting in professional activation of deaf people, was very popular. Within its framework, the following are organized: meetings with a career advisor, professional activation workshops, vocational training, as well as internships with employers. All projects were co-financed by the European Social Fund under the Human Capital Operational Program and the State Fund for Rehabilitation of the Disabled. Most projects educating the deaf operate locally and are limited to one voivodeship.

Many other projects supporting vocational education of people with disabilities were implemented in Poland (some of them are currently operating). One cannot forget about trainings conducted by county

labour offices. An example of a project that considers the needs of the deaf is "Integration for self-reliance", it helps the deaf in a special way by establishing cooperation with the Educational Center for the Deaf and involving specialists working with the deaf on a daily basis. In the projects, a lot of meetings took place in schools all over Poland. In addition, schools already have qualified staff, they can lend rooms to accommodate the deaf, and help in the proper organization of meetings, taking into account the special needs of the deaf. Deaf people do not have much choice of courses, their form, etc. Unlike hearing people, they cannot learn professionally without a sign language interpreter.

The head of the Ministry of Education and Science pointed to the increase in financial outlays for the education of people with special educational needs: the symbol of this progress will be almost PLN 1.9 billion in educational subsidy next year, which guarantees 18,000 jobs, new positions for specialists: psychologists, special educators, speech therapists. This is over 90% more jobs than before, fully financed from the state budget. Also investments in special schools, e.g. in the Mazowieckie Voivodship, where a special school is being built for PLN 18 million from the Prime Minister's reserve, or efforts to obtain a Special School Complex at Herbert Street in Lublin. There are a lot of such investments in special education, for which local governments raise money also from the "Polish Order" programme.

Last year, local government officials obtained PLN 5.2 billion from government funds for educational infrastructure, including infrastructure in special schools. Assistance in the form of co-financing the purchase of textbooks, educational materials and exercise materials is one of the forms of implementing the task of equalizing educational opportunities, improving the quality of education for disabled students, and consequently increasing their educational opportunities. A total of PLN 54 million has been planned for the implementation of the program in 2020–2022 - PLN 18 million each year, from the state budget's special-purpose reserve. If the number of students eligible for the program increases, this amount may be increased.

The body coordinating the government program to help students with disabilities in the form of subsidizing the purchase of textbooks, educational materials and exercise materials in the years 2020-2022 is the Minister of National Education. The Ministry of Education and Science has been working for years on solutions to help deaf students learn. In order to facilitate the learning of Polish sign language, a multimedia sign language course for primary school students was developed, entitled "Sign with us." It is a series of ten multimedia help books for learning this language. The Ministry of Education and Science made it possible for students with hearing disabilities to learn Polish Sign Language. These are textbook texts, the most important graphics from books designed to increase readability, boards with pictograms. All adapted texts have been translated into Polish Sign Language. An additional aid in the education of hearing-impaired students is the series entitled "Accessible Readings". These are multimedia auxiliary books for language and Polish language education with corresponding exercise materials. These materials are used to consolidate the knowledge and skills specified in the core curriculum for general education for primary schools.

All the above-mentioned projects and activities are a drop in the ocean of needs of deaf people and are of a short-term, local nature, which does not make it easier for deaf people to gain education. An example of the lack of adequate support is the organization of the final exam, where deaf youth have the same set of questions and tasks as non-disabled youth. The main difference is only the time to complete the tasks is extended by 30 minutes. This is insufficient and inadequate to the language needs of deaf people. It can be said that young people acquire secondary and higher education in another, "foreign" language, Polish, but presented in a grammatical form that is "foreign" for the perception of deaf people. Therefore, young people have to do much more work and devote more time to mastering their native language first, and only then can they absorb content in this language. Unfortunately, the

lack of systemic solutions from the very beginning of the education of such children causes a lot of deficiencies in mastering the national language, which is why they are transferred to the next classes and levels of education, which is not possible to make up for later.

CONCLUSION

An overall conclusion of the national report, which the results will be used later in the comparative index and where support the development of the competence framework.

The dynamically changing environment forces all sectors of the economy to change their approach to achieving goals. Modernization of the approach to management and the use of new technologies can provide not only a competitive advantage, but above all, streamline processes, which increases the effectiveness of the organization's operations. Therefore, it is necessary to implement digital technologies, that includes:

- Internet of Things,
- Industrial Internet of Things,
- Data analytics, Big Data, and Cloud Computing,
- artificial intelligence,
- 3D printing,
- digital twin,
- Collaborative Robots,
- Cost-saving software.

Thus, industry 4.0 directly affects the level of innovation of a given country, including the Polish economy. The diagnosis of the innovativeness of the Polish economy places is still in the third stage of Industry 3.0 (99% of companies). This stage is characterized by the automation of processes, the use of computers and electronics. However, industry 4.0 still lacks systemic solutions that include: cyber-physical systems, the Internet of Things, and networking (Ministry of Entrepreneurship and Technology /Siemens, 2018, pp. 4-6).

More and more digital technologies are being implemented in Polish enterprises. The DESI research shows that 19% of Polish companies use cloud solutions, and 32% are involved in electronic information exchange. These figures are still below the average values for the EU, but they are steadily increasing. The use of cloud computing, big data, or artificial intelligence (AI) by companies varies between 3% and 19%, and only 40% of companies achieve at least a basic level of using digital technologies (EU average: 55%) (DESI Index, 2022). Analysing the financial outlays allocated to digital transformation, for Poland they account for 21.3% (over EUR 7.5 billion) of the total allocation of funds under the RRP plan (Polish name: National Reconstruction Plan, KPO) and exceed the required minimum level of 20%. In terms of robotization and digitization, Poland lags the European average. Both in the economy and in education, robotization and automation are still a big challenge. According to the data of the International Federation of Robotics, the density of robots in our country is 63 robots per 10,000. employed, while e.g. in the Czech Republic and Slovakia - over 160. The same is also true in the case of digital technologies. On the other hand, when analysing the Polish education system, Polish schools differ significantly from Western European schools in terms of technology. It is worth emphasizing that over two million students with special needs, including the deaf, are educated in Poland. Especially this group requires investment in digital infrastructure, equipment, teacher competences and appropriate software. There are programs in Poland (including the ones mentioned

above), unfortunately they operate for a short period of time or are one-off and do not ensure any continuity of activities. As a result, it is difficult to plan education programs in the long term.

Digital education increases the effectiveness of educational processes, develops key social and future competences (including supports creativity, teaches teamwork, responsibility, and a creative approach to one's own development). Technological tools help the teacher actively support the student in the exploration and creation processes. In addition, digital education evens out educational social disproportions and development opportunities for students with special educational needs.

According to the Supreme Audit Office, at the end of September 2021, 949 students with hearing disabilities were educated in Poland, 541 are deaf. In 15 schools covered by the study, out of 674 teachers, 40% of them declared knowledge of Polish Sign Language (250 in special schools and 11 in schools or integration classes). In Polish institutions covered by the survey, only about 20% of the teachers interviewed knew sign language. The above-mentioned statistics show how much change is needed in the Polish education system (NIK, 2021).

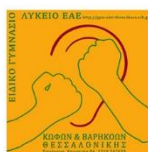
When analyzing a group of people with special needs, including deaf people, it is necessary to act at the level of the Ministry of National Education aimed at developing and implementing a Polish language teaching system based on teaching a foreign language and Polish sign language in all schools for the deaf. There is an opinion of the Ombudsman of 2014 (Biuro Rzecznika Praw Obywatelskich, 2014). Polish sign language is the basic and most important means of communication for deaf people – therefore, it is not sufficient to include it as part of additional activities or developing students' interests. Therefore, it is necessary to increase financial resources, provide infrastructure and qualified staff, thanks to which deaf people will be able to acquire knowledge and experience at all stages of education. To this day, the use of mainstream schools by deaf children is gradually becoming popular. However, this requires a very good preparation of the entire school environment - school staff, children, and their parents. Meanwhile, schools lack speech therapists, very important specialists, especially needed by children with hearing problems. In addition, gaps in the Polish education system bring even greater challenges to special education for the deaf. A serious problem is the core curricula - rigid and too extensive. In the process of educating deaf students, it takes much longer due to communication difficulties. Unfortunately, the applicable regulations do not provide any possibility of a flexible approach to their implementation (Biuro Rzecznika, 2020). In addition, the key challenges include:

- **The qualifications of teaching staff:** in schools for the deaf, they do not always correspond to the real needs of students. The teachers are usually special educators with post-graduate subject studies, some of whom know little sign language. The profession is taught either by special educators who have completed courses and post-graduate studies, or by specialists in each field, but who do not know sign language. Vocational training is sometimes organized outside a special school and with external staff supported by special educators as student tutors and interpreters.
- **Excessive bureaucracy** (the applicable legal regulations require the preparation of the so-called individual educational and therapeutic program (IPET) for each student every six months, together with the so-called diagnoses in each subject.
- **Integration of hearing-impaired and deaf students:** most often, a deaf student must deal with a physical and mental barrier that makes communication difficult. The integration of such a student is therefore not only an educational problem. It is a matter of acceptance and tolerance, as well as the physical possibility of establishing relationships with peers.
- **The status of Polish Sign Language (PJM) in a special school:** This is the language of deaf people and is used in communication with most children in schools for the deaf. Children and young people who do not know sign language (children of hearing parents) often go to these schools, which they learn only at school from their peers.

- **The network of secondary schools for the deaf:** is not adapted to their real needs. The choice of a special school is limited. Parents can send their child to any public school of their choice. However, if you want to send your child to a special school outside the place of residence, you must have a referral from representatives of local government units.
- **Poor knowledge of the Polish language by deaf children:** in the Polish education system, the number of hours of Polish in a school for the deaf is the same as in a mainstream school, which, given the necessity to implement the core curriculum, makes it impossible to compensate for language deficits in the Polish language.
- **Distance learning:** a significant proportion of deaf students do not have computers adapted to their needs to enable them to learn remotely. They also have trouble accessing the Internet. The epidemic has revealed the inequality in access to education in Poland, although the right to education is guaranteed by the Constitution.

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