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“MALOPOLSKA EDUCATIONAL CLOUD”: AN INNOVATIVE EDUCATIONAL PROJECT EQUALING CHANCES OF STUDENTS WITH VARIOUS NEEDS

Abstract: Introduction: The article describes the design assumptions and the practical implementation of the educational project called “Malopolska Educational Cloud”. It is an example of an innovative solution using modern technology in the field of education. **Research Aim:** The implementation of the project resulted from the observation of unfavorable phenomena occurring in the area of education at the junction of upper secondary and higher schools, which were confirmed in the research described in the paper. Successively, the issues covering the project’s objectives were discussed, the target group: recipients, was characterized and the project’s innovation was assessed. **Evidence-based Facts:** Then the issue of a disabled person as a user of the Educational Cloud was presented. The assessment indicated that the project implementation allows for greater activation of people with disabilities, including thanks to the possibility of participating in virtual classes, lectures and laboratories, and thus remote learning using the created network, without the need to move. It has been shown that the project implements the principle of equal opportunities and non-discrimination, including accessibility for people with disabilities, has a positive impact on it and is made in accordance with the principle of universal design. **Summary:** The described project consists in incorporating technology into improving the course of cognitive processes and the importance of this research for education, including increasing the effectiveness of the learning and teaching process by virtualizing education. The conclusions drawn concern the most difficult group in terms of education: disabled students as users.

Keywords: educational cloud, digitization, disability, innovation, user, virtual teaching and learning

INTRODUCTION

Students with disabilities are very often isolated from the social environment because of the impairment (Zielińska, 2016). This situation is fundamentally changed by access to the Internet. In the case of students with disabilities, the role of the Internet is special and is part of the ongoing international discussion on the implementation of the goals adopted under the United Nations Sustainable Development as signposts leading to peace and prosperity for all people and the planet by applying the principle of inclusion, which leaves no one behind. Internet gives students with disabilities the equal access to information, communication, services and other resources. It has significant impact on the quality of life of this group. The ongoing digitization of education is one of the ways of achieving the goal of equal chances and opportunities (Shiroishi et al., 2019). In the era of “big data” there is an unprecedented increase in the amount of data collected. The knowledge that can be gained from them is currently used in three areas: supporting strategic and key decisions made by governments and enterprises, artificial intelligence (AI) and machine learning (ML).

“Malopolska Educational Cloud” project (Zieliński et al., 2017) is part of this trend. It is an example of an innovative solution using modern technology in the field of education. Its need and practical implementation resulted from the observation of unfavorable phenomena occurring in the field of education at the border of upper secondary and higher schools, which were confirmed in professional research – e.g. the PWC report on career plans, e.g. students of Polish secondary schools, from which the numbers provided in the further part of the report were taken (there are no indications that the situation of Malopolska differs significantly from the national average) (PricewaterhouseCoopers, 2014). In a study of high school students, they said that the prospect of finding a job after graduation was important or definitely important to them, only 25% were actively interested in the labor market. Secondary school was a time for career decisions for 68% of high school students both non-disabled and with disabilities. It can be presumed that the choice of a career path may be taken by some high school students at the last minute and rashly. The consequence of making important and strategic educational decisions in an incompletely thought-out manner may be inappropriate use of one’s own predispositions and difficulty in finding a satisfactory job the resulting failure. Not in the demanding labor market, and even the need for a significant and quick change of education and acquisition of completely new skills.

A commonly observed phenomenon was and is a significant decrease in the number of students between the 1st and 2nd years of studies. This decrease is on

average about 25–30%, and the most important reasons for this state of affairs are again incorrect choices of the field of study – inconsistent with one's own talents and interests, and sometimes a wrong decision to continue education at a higher level, despite the lack of appropriate predispositions – resulting from ignorance the specifics of studying. This phenomenon results not only in wasted time and effort, stress and frustration of young students, but also has specific financial consequences for the payer of the public education system. The Development Strategy for the Malopolska Region shows that Malopolska has grounds to be perceived as a "creative" region, rich in intellectual capital, creating favorable conditions for progress in a creative and innovative environment. An unfavorable phenomenon is the current distribution of preferences of secondary school students applying for higher education: the fields of study considered by this strategy as prospective (e.g., belonging to the so-called smart specializations) often do not achieve the expected popularity, which is mainly due to potential candidates' fears of failure to meet requirements. Certain fields of study, especially technical ones, are commonly considered to be very difficult (although they offer a good profession), one of the reasons for which is insufficient practical presentation of the issues discussed, which in turn results from the limited laboratory base in secondary schools. This problem has existed for many years and is to a very small extent solved by traditional, intermittent visits of secondary school classes to universities to observe certain experiments. Due to the distance, these visits are usually not carried out by students from places further away from Krakow. Students with disabilities constitute an even more difficult group in this area.

The Strategic Intellectual Capital and Labor Market Program points to the need to identify and develop individual abilities and talents of both non-disabled and disabled students. It emphasizes that ensuring optimal conditions for developing talents is a necessary condition to raise the general level of education of the society (Strategic Program "Intellectual Capital and Labor Market" – project, Krakow 2013). Secondary schools try to give exceptionally intelligent students opportunities to develop their talents, however, these activities are rarely coordinated and, in a few cases, involve academic staff and the laboratory base of universities. A smaller number of students requires attention to improve the quality of education, didactic offer and contacts with the social and economic environment.

The Ministry also points to the need to improve contacts between student and lecturer, bringing them closer to the traditional master-student model. These activities should also be extended to both non-disabled and disabled students at upper secondary schools to better manage the existing human capital. It should be emphasized that the education process in schools, despite considerable expenditure on its modernization, remains to a large extent traditional and comes down

to contact of a group of students with the teacher of a given subject and the use of a set of imposed textbooks. It is more and more often perceived by students who use Internet resources effectively on a daily basis, not attractive enough and more and more archaic, which reduces their motivation to learn. The document “Intellectual Capital and the Labor Market” draws attention to the need for both non-disabled and disabled students to develop competences desired on the labor market, such as teamwork and independence, as well as using the media.

RESEARCH AIM

The research problems presented in this paper concern finding answers to the following questions: How can a platform for virtual education of non-disabled and disabled students’ function? What theoretical and practical foundations made you build a virtual educational platform? What features does the “Malopolska Educational Cloud” meet in the areas of teaching, methodology and IT? The aim of the considerations is to present an exemplary educational solution based on modern technologies implemented in practice in 2014–2020, and thus to encourage, the implementation of similar solutions in school practice and the use of them by both teachers and students.

Taking into account the importance of the phenomena described above, the Board of the Province Malopolska decided to implement the “Malopolska Educational Cloud” pilot project, which was carried out in 2013–2015. Its leader was the AGH University of Science and Technology in Krakow. A prototype IT infrastructure was created that allows remote communication of selected upper secondary schools of universities, used in non-infrastructure projects (so-called soft) as part of Regional Operational Program projects: “Malopolska Educational Cloud – the use of modern information and communication techniques in the process of teaching and developing key competences of high school students from Malopolska area – pilot” and “Modernization of vocational education in Malopolska”. The results of the evaluation of the pilot project fully confirmed that the adopted solutions in the field of building the IT infrastructure are correct and effectively support the implementation of the educational service at the border of universities and upper secondary schools. Most of the students-respondents in the study expressed the opinion that the project contributed to an increase in competences in the use of modern information and communication techniques, familiarization with the specificity of studying, increased motivation to continue learning, and that the use of modern information and communication techniques was more effective than the methods of knowledge transfer used so far. The experience gained has

confirmed that the concept of the educational cloud as an element of knowledge transfer has proved successful and it is necessary to continue the actions already started, while adhering to the indicated imperfections – both of a technical, organizational and methodological perspective (Application for funding under the Regional Operational Program of the Małopolskie Voivodeship for 2014–2020).

While developing the assumptions of the target “Małopolska Educational Cloud” infrastructure project, all critical comments were taken into account (Zieliński et al., 2017). Based on the results of the “Małopolska Educational Cloud – pilot project”, it was found that the further implementation of the project concept is able to solve the identified problems and meet the relevant challenges presented in the documents indicating the development strategies of the Voivodeship of Małopolska. AGH University of Science and Technology, as a coordinator and technical partner, as well as academic centers coordinating education in individual thematic areas, gained significant experience allowing the implementation of the target project, achieving all the assumed goals.

As part of the definition of the objectives of the “Małopolska Educational Cloud” project, it was assumed that:

- it will result in the creation of a modern e-service,
- it will have an extremely wide range of impact (more than 120 upper secondary schools from the entire Małopolskie Voivodeship have been qualified to participate in the project).

The project infrastructure was additionally launched in selected pedagogical libraries, increasing the attractiveness of these educational institutions. Such positions were created especially in localities where there were no schools qualified to participate in the project. This allows (Application for co-financing under the Regional Operational Program of the Lesser Poland Voivodeship for 2014–2020):

1. Non-disabled and disabled students at upper secondary schools to better assess whether their knowledge and specific predispositions are sufficient for the effective study of a given field and study in general.
2. For the scientific care of gifted students by the academic staff and – if necessary – by teachers of a given subject, regardless of their employment in a given school. These students can work together remotely within dedicated research clubs.
3. Conducting some educational activities: a) remotely, in direct, interactive contact with academic staff and peers from other schools, b) remotely, non-interactively, in the group of peers using the Web 2.0 approach. This should be positively received by students and increase their motivation to learn, resulting in better substantive and social competences. This functionality is in line with the project from Action 3, Priority 1 of the

Intellectual Capital and Labor Market program, which aims to increase the skills and competences of Malopolska students and teachers in the field of communication, cooperation, project work, emotional intelligence and media education.

4. Based on the experience of the pilot project, its participants were offered richer functionality and better organization of educational activities. The “Malopolska Educational Cloud” infrastructure has been designed and constructed with the use of contemporary trends in the construction of specialized ICT systems. It is conducted with care to ensure technological interoperability. It has a positive impact on the principle of equal opportunities for girls and boys, including students with disabilities. It is a mechanism for reducing the phenomenon of digital exclusion and contributes to the equalization of educational opportunities for students from centers geographically distant from universities.

EVIDENCE-BASED FACTS

The diagnosed problems and needs in the field of education existing in the Malopolska Voivodeship, described earlier, became the basis for the implementation of the project Malopolska Educational Cloud among 26 040 students from high schools and technical universities, 400 teachers of vocational education and 2600 teachers of general education. The “Malopolska Educational Cloud” project consists of 3 non-competition projects and numerous competition projects. The general nature of the project allows for the extensive use of equipment, tools and the dissemination of modern methods of working with students. The direct recipients of public e-services in the field of online classes and workshops are:

- as part of the project entitled “Modernization of Vocational Education II”
 - 2040 students at technical schools,
- as part of the project entitled “Malopolska Educational Cloud – a new model of teaching” – 3500 students at general secondary schools,
- in competition projects organized by the Malopolska Center of Entrepreneurship – 20 500 students at general secondary schools and technical schools.

Students selected to participate in the project have the opportunity to use the e-service in schools covered by the project during the implementation of online classes and research clubs, at universities, during the summer and weekend workshops, but also at their own home, computer lab or from any computer with access to the Internet. Thus, the e-service is available to every student participating in the project at any time. In addition, at the Malopolska Centre of Teachers

Improvement and pedagogical libraries, there are classes for groups of 15 students from schools that were not given the equipment under the Project, in at least 2 thematic areas in the province/commune, on the equipment located in libraries, Malopolska Centre of Teachers Improvement and its branches (Application for co-financing under the Regional Operational Program of the Lesser Poland Voivodeship for 2014–2020, 2015).

The equipment of the laboratories in provincial pedagogical libraries and Malopolska Centre of Teachers Improvement consists of equipment constituting the equipment of each laboratory that provides access to the cloud, with the same parameters as those installed in schools. Two options can be distinguished within this framework: a videoconference set and a mobile videoconference set. Both perform the same function, but in some locations, due to the housing conditions, equipment solutions are used on mobile stands, similarly to some school laboratories. An additional element that distinguishes library studios from school studios are VDI (Virtual Desktop Infrastructure) workstation computers working in a cloud environment and additionally scanning and copying devices (Application for funding under the Regional Operational Program of the Lesser Poland Voivodeship for 2014–2020).

Libraries are a place that provides access to the resources of the "Malopolska Educational Cloud" for both non-disabled and disabled students from schools who do not participate in the project and, due to the specificity of pedagogical libraries, as a place for training and professional preparation of teachers who care about those students. The "Malopolska Educational Cloud" project assumes that high school students will participate in on-line classes (using broadly understood ICT equipment) and will gain access to all kinds of materials collected and made available on the platform created as part of the project, in order to expand their knowledge and prepare for online classes. Analyzing the existing equipment of libraries with computer equipment with access to the Internet, basic shortages and outdated equipment were found in this area, which does not allow for reproduction and access to many multimedia materials (cloud resources). After analyzing the problem, it was decided to supplement the studio with stationary equipment enabling students and teachers participating in classes to access cloud resources posted in the above-mentioned portal. Without additional computer workstations, participants in libraries who do not have their own equipment and access to the network would be given the possibility of using the platform and Internet resources. In the case of workshops created in schools, such access is provided by school IT laboratories. VDI terminals were chosen. Such a solution is characterized by a lower investment in equipment installed in the studio. The equipment on the student's or teacher's side is a terminal that connects through the network

to the central system “separating” computing power and disk resources between various students or teachers. This solution is more flexible than classic PC devices, resources used more rationally, computing power and resources are used only by currently working students or teachers. Possible expansion and modernization of such a system involves the expansion of the central part of the system. There is no need to replace VDI terminals, which in the era of enormous technological progress is an argument for this solution. In simple terms, VDI is a desktop virtual machine (VM) dedicated to each student or teacher, working under the control of a central system. The VDI computer is the equivalent of a desktop computer, classically used so far, but with most of its disadvantages removed: the system is easier and cheaper to modernize, less energy-consuming, smaller in size, compact, lightweight, does not require local administrators, management is concentrated in the computing center.

Despite the continuous increase in the amount of digitally transmitted and created information, there is still a need to transfer digital data to paper and vice versa. Participants of classes organized as part of “Malopolska Educational Cloud” can both use cloud resources and create them themselves. It is difficult to imagine an educational process completely without materials in the classic paper version, on which a student can work, as well as the preparation of materials for classes that will be posted on the portal in a digital version without the possibility of using an easy and available scanning and printing tools.

The partnership agreement guarantees that the libraries conduct classes for at least 15-person groups in at least 2 thematic areas. Thus, with the participation of one school in classes in libraries, at least 60 hours of online classes and at least 60 hours of research clubs are offered. The number of schools multiplied by the number of areas (at least 2) makes it possible to carry out at least several hundred hours of classes in each of the libraries in the school year (minimum 120 hours per year in the library). Schools that were not covered by the Axis 2 project have at their disposal on-line classes depending on their needs. These students were included in the total number of 26 040 students (Application for funding under the Regional Operational Program of the Lesser Poland Voivodeship for 2014–2020).

The Malopolska Educational Cloud project uses various ICT technologies in an innovative way (Intelligent Specialization 3 – Information and Communication Technologies), that allows the project to be placed under sub-specialization number 3.15 – “Intelligent creative technologies”. The specialization covers all methods, algorithms, information systems and organizational innovations based on ICT technologies used in the design, production and operation of teaching and learning support systems. One of the key technologies used in the “Malopolska Educational Cloud” project are multimedia communication technologies indicated

in sub-specialization 3.15.3. When assessing the innovation of the Malopolska Educational Cloud project, it should be emphasized that:

- the project concept is an innovative method supporting the process of producing and disseminating educational content;
- the project infrastructure includes devices and applications for the production of audiovisual content, their real-time distribution via computer networks and the automation of the post-production and publication process;
- the project's infrastructure allows creation of innovative educational and presentation models using multimedia and interaction;
- the project defines an advanced educational platform that is a significant extension of e-learning;
- the project significantly supports the creativity of the learning process.

The project is also part of the sub-specialization number 7.3.2 "Audiovisual activities" (Specialization 7: Creative and leisure industries) through the development of technologies, methods, processes and tools used in the development and production of media, which are a combination of several different forms of information transfer in order to provide recipients with information or entertainment used in education and sub-specialization number 7.3.3 "Multimedia". The "Malopolska Educational Cloud" project supports education in many thematic areas, discussing issues included in the list of smart specializations like Life Sciences (Application for co-financing under the Regional Operational Program of the Malopolska Voivodeship for 2014–2020, 2015).

The project "Malopolska Educational Cloud" is an innovative educational solution. The use of modern technology in the process of teaching and learning creates a new educational quality, giving both non-disabled and disabled students' new opportunities. This project supports the development of students with special educational needs, including those with disabilities. It enables their greater activation, by giving them the possibility to participate in virtual classes, lectures and laboratories, and thus remote learning, without the need to move. The project implements the principle of equal opportunities and non-discrimination, including accessibility for students with disabilities, and has a positive impact on them. The problems most frequently encountered by students with disabilities, which limit their possibilities of modern technologies usage and reduce or eliminate the problem of practical solutions, are represented in the literature of special education. It was described by Agnieszka Dejnaka (2012) in the context of the type of disability, limiting the possibility of using, for example, Internet resources and methods of counteracting these limitations. The "Malopolska Educational Cloud" project fits into this area, as it is implemented in accordance with the principle of universal design. Universal Design is a strategic approach to planning and designing both

products and the appropriate environment to promote an inclusive society with full equality and participation.

The system created as part of the project meets the principles of:

- equality in use,
- flexibility,
- simple and intuitive use,
- easy perception of information.

In principle and in practice, the training available on the platform is available to all participants regardless of gender, religion or disability level. The project takes into account the principle of equal opportunities for women and men, equal opportunities and non-discrimination, and also addresses the project's impact on sustainable development and the protection and improvement of the quality of the environment. Due to the nature of the cloud, it is extremely important to ensure its availability and the information published in it for students with disability. Both integrative and inclusive education requires all students to have the same opportunities to acquire knowledge and education. The first important area concerns the availability of the educational cloud itself for students with special needs. It's all about the availability of the educational cloud interfaces for students with manual and sensory disabilities.

For students with disabilities the project should answer the following questions: Are the interfaces equipped with elements enabling the publishing of accessible electronic content? Are they equipped with elements enabling the familiarization (in the case of multimedia) with electronic information in an accessible way, reaching individual functions only via the keyboard etc.? Actions taken in this area should consist in conducting an audit of compliance of the educational cloud with the rules universal design and international accessibility standard WCAG 2.0 (Web Content Accessibility Guidelines 2.0). During the audit, comments are made, and recommendations are prepared on how to correct possible irregularities and groups of students with what kind disabilities can be excluded from the cloud usage.

The second area of activity is the analysis of materials made available in the educational cloud. Without evaluation of the methodological side, only the analysis of the level of accessibility itself electronic information, mainly for students with sensory disabilities. Has graphic information been provided with content alternative for the blind students? Do audio and video materials have an alternative for the blind and deaf students? Is the content of the presentation available for screen readers and whether their presentation form is not excluding dyslexics or visually impaired students? Individual courses should be audited for compliance with an international accessibility standard WCAG 2.0 in the comprehensive audit mode. Similar to in case of interface testing, recommendations will be made for

each course repair of any irregularities. Both the audit of the cloud interface and the audits of individual courses should be repeated on a smaller scale, through the so-called verification audits. After implementing the changes proposed in the reports, further verifying audits are carried out only and exclusively on the corrections implemented.

The third area of activity concerns the creation of dedicated courses available as part of the educational cloud for teachers and lecturers, who are overseeing the education of disabled child or student. From course they can learn about optimal ways of communicating with students with different types of disabilities, what information, both classic and electronic will be available for a given disability and how to prepare electronic information on their own so that disabled students can use it. The course should also include basic information on the characteristics of the individual disability types and tips on where to find a specialist knowledge. Additionally, the course should be provided with information about assistive technologies that are being used by students with all kinds of disabilities, and a guide on how to adapt popular systems operating within native functions to meet the needs of students with disabilities.

SUMMARY

It should be emphasized once again that the "Malopolska Educational Cloud" project is implemented in accordance with the principle of universal design. The conclusion from this is that its implementation allows for a significantly greater activation of students with disabilities, including the possibility of participating in virtual classes, lectures and laboratories, and thus remote learning using the created network, without the need to move. This is very important for this educational group in the context of improving not only the quality of their education, but also the quality of their life. As Marcin Klimek rightly notices: "[...] A man wrapped in the ruthless embrace of a disease has little opportunity to leave his home and find the news he is looking for. He depends on many factors, such as his own disposition and the time of his care or people who help him on a daily basis. If, in addition, he lives alone or the care is limited, the situation becomes even more difficult. The Internet helps a lot here, offering many ways of abandoning a closed room in favor of the boundless space of the world, making new friends, living with the problems of «normal» people [...]" (Klimek, 2020).

Searching for an answer to the question about the place and role of new technologies in the context of student's disability, Marcin Klimek lists two basic functions: communication and information. Another conclusion of a scientific

nature is the statement that the written project meets both of them, being part of a relatively new, intensively developing cognitive area, located at the interface of special education, psychology and biological sciences. It concerns the inclusion of technology in improving the course of cognitive processes and the importance of this research for education, including increasing the effectiveness of the learning and teaching process, among others. through the virtualization of education, i.e., the process of transferring it from the physical to the virtual world (Gregorczyk, 2014). The project “Malopolska Educational Cloud” is a practical example of this.

CONCLUSIONS

Deriving conclusions from the presented considerations, it should be emphasized that the described educational project contributes effectively and efficiently to raising qualifications, increasing the opportunities and equaling chances of both non-disabled and disabled students in Malopolska by enabling them to experience science, and thus developing creativity, teamwork and logical thinking skills. Moreover, the implementation of the described project influences the equalization of the level of access to knowledge and science in the voivodeship. A very important aspect of the presented issue is the possibility of its implementation to other areas of the country and ultimately to various educational groups with various needs. The solution turned out to be very effective in the situation of the pandemic in 2020. It was very highly rated by both teachers and students, giving a new quality of education and pointing to its new possibilities.

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„MAŁOPOLSKA CHMURA EDUKACYJNA”: INNOWACYJNE PRZEDSIĘWZIĘCIE
EDUKACYJNE WYRÓWNUJĄCE SZANSE UCZNIÓW O ZRÓŻNICOWANYCH
POTRZEBACH

Streszczenie: Wprowadzenie: W artykule opisano założenia projektowe oraz praktyczną realizację przedsięwzięcia edukacyjnego o nazwie „Małopolska Chmura Edukacyjna”. Stanowi ono przykład innowacyjnego rozwiązania wykorzystującego nowoczesną technologię w obszarze edukacji. **Cel badań:** Realizacja projektu wynika z obserwacji niekorzystnych zjawisk występujących w obszarze edukacji na styku szkół ponadgimnazjalnych i wyższych, które znalazły potwierdzenie w opisanych w pracy badaniach. Kolejno omówiono zagadnienia obejmujące cele projektu, scharakteryzowano grupę docelową, czyli odbiorców oraz dokonano oceny innowacyjności projektu. **Stan wiedzy:** Następnie przedstawiono zagadnienie dotyczące osoby niepełnosprawnej jako użytkownika Chmury Edukacyjnej. W dokonanej ocenie wskazano na fakt, że realizacja projektu pozwala na większą aktywizację osób niepełnosprawnych dzięki stworzeniu możliwości uczestnictwa w wirtualnych zajęciach, wykładach i laboratoriach, a tym samym nauki zdalnej z wykorzystaniem stworzonej sieci, bez konieczności przemiesz-

czania się. Wykazano, że projekt realizuje zasadę równości szans i niedyskryminacji, w tym dostępności dla osób z niepełnosprawnością, ma na nią pozytywny wpływ i jest wykonany zgodnie z zasadą uniwersalnego projektowania. **Podsumowanie:** Opisane przedsięwzięcie polega na włączaniu technologii w usprawnianie przebiegu procesów poznawczych oraz wagi tych badań dla edukacji, w tym podnoszenia efektywności procesu uczenia się i nauczania poprzez wirtualizację edukacji. Wyprowadzone wnioski dotyczą najtrudniejszej edukacyjnie grupy: uczniów niepełnosprawnych jako użytkowników.

Słowa kluczowe: chmura edukacyjna, cyfryzacja, innowacyjność, niepełnosprawność, użytkownik, wirtualne nauczanie i uczenie się