

Information technologies in higher education teaching in the opinions of academic teachers

Miłosz Wawrzyniec Romaniuk, and Joanna Łukasiewicz-Wieleba

Abstract—The article analyzes the opinions of academic teachers on the use of information technologies (ICT) in higher education teaching. Key conclusions from the study indicate the need to ensure a stable Internet connection and access to functional computer equipment and projectors in each classroom. Teachers emphasize the importance of financing the software and its systematic updating. The university's technical support is also important, including quick response to problems and the availability of the technical department. The respondents point out the need to increase the number of training courses on new tools and AI, which will allow for better adaptation to the needs of students. They also point to the need to equip classrooms with equipment for hybrid classes and support students by providing them with laptops and specialized software.

Keywords—IT in teaching and learning; higher education; academic teachers

I. INTRODUCTION

INFORMATION technologies include human dealings with information, i.e. acquiring, segregating and sorting, collecting, saving, processing, using, transmitting and sharing, deleting and ensuring security [1]. Information technologies in education include many, often overlapping and interpenetrating solutions, and tools, sometimes standing alone and sometimes integrated with other elements. The role of technology is to provide content, but also to create learning communities that include both teachers and students [2]. As Burns notes, technology in education “it is composed of infrastructure and materials and involves people in an array of roles and uses. And it is dynamic—constantly evolving at a rapid pace.” [2, p. 16].

Technology supports the educational process, which enables access to information all the time, without interruption - supporting both teachers and learners, providing access to resources from around the world and enabling continuous improvement of competences [3]. It supports education in crisis situations, enables access to information and open resources, strengthens organizational solutions, allows for effective tracking of learners' progress, simplifies the process of communication and the creation of groups focused on learning [4]. Teachers rely on technologies to search for information, organize content, collect, and analyze, create teaching aids, it inspires and allows for better communication, allows creating groups focused on joint learning and projects, as well as managing these groups [2]. At the same time, however, it is

teachers who decide "how much technology and how they use it in their work" [5].

The UNESCO report contains provisions drawing attention to the impact of education on technology - its promotion, scope of use, development, interest of pupils and students in the use, but also in co-creation of new solutions, including studying sciences and employment in technological innovation institutions. Hence, teachers' attitudes towards STEAM and technology in education translate into the attitudes of pupils and students who are ready (or not so ready) to expand their competences in the use of IT tools and in making decisions about educational and professional choices related to these areas [4]. It is emphasized that technologies influence the teacher's profession and work, giving him many opportunities for greater personalization of the education process, providing prepared materials, automating repetitive activities, cooperating in task and subject teams, increasing the scope of self-education and pedagogical reflection. Creating digital resources requires teachers to be competent in using applications to create visual and audio materials, integrating various forms and content, and respecting copyright and security rights. For teachers and students, the use of technology also involves costs (purchase of equipment, Internet access, software updates) [4], which is not always taken into account by institutions employing teachers.

Currently, the technologies available in education are becoming more and more integrated. The difference between distance and stationary learning is blurring, as both modes of work use the Internet; mobile devices allow education to be carried out anywhere - also in places traditionally considered stationary (school or university) - they become an element of enriching or accelerating access to information [2]. Higher education is undergoing dynamic changes due to the implementation of technological solutions in universities, such as digital platforms and repositories, which brings many ethical, economic, and organizational difficulties [4].

II. LITERATURE REVIEW

Although interest in information technology in the context of teachers' teaching at universities has a long tradition, it is noted that it intensified during the COVID-19 pandemic as a response to the revealed need to document the new socio-technological situation. Analyzes were undertaken related to the first experiences of crisis remote education [6, 7], changes taking place in the process of remote teaching and learning in various

Miłosz W. Romaniuk and Joanna Łukasiewicz-Wieleba are with The Maria Grzegorzewska University, Poland (e-mail: mromaniuk@aps.edu.pl, jlukasiewicz@aps.edu.pl).



types of universities were documented [8-10], including strategies for coping with chaos and uncertainty, including the transition from a state of suspension, through seeking support, normalization, overload and acceptance [11] and recommendations for education for the future were developed [4].

Important issues relating to the scope of the impact of information technologies in the work of academic teachers include, among others, the forms of examination and the consequences of conducting online examinations: organization, fraud prevention, methods of assessment and the costs of such activities [4, 12].

Attention was paid to hybrid solutions [13-15].

The process of communicating and building relationships in a situation of social isolation was analyzed [5, 16-21].

III. PURPOSE OF THE STUDY AND METHODOLOGICAL ASSUMPTIONS

The study concerned the experiences and opinions of academic teachers employed at The Maria Grzegorzewska University related to the use of information technologies in higher education teaching.

The aim of the study was to learn the perspective of lecturers on information technologies and their use in the educational process at The Maria Grzegorzewska University. The subject of the research was: IT competences of academic teachers and ways of improving them, solutions emerging during teaching classes, university support for the computerization of education, the use of experiences acquired during the pandemic and the assessment of their usefulness in education. The following research problems were addressed: what are the IT competences of the surveyed teachers? What IT tools are used by academic teachers in their teaching work? What support does the university provide in terms of computerization of education? How do teachers assess the importance of new technologies for the teaching process?

The diagnostic survey method was used for the research. An original survey questionnaire was prepared. Responses from respondents were collected using Google Forms. The statistical analysis of the research results was performed in IBM SPSS Statistics 29 and jamovi 2.3.28. The analysis of respondents' statements and their categorization was carried out by two competent judges.

Data was collected in the period from November 27, 2023, to January 15, 2024. The survey questionnaire was sent to all academic teachers of The Maria Grzegorzewska University via university mail.

IV. THE SAMPLE

Fifty-eight people took part in the study, which constitutes approximately 19% of employees. The youngest respondent was 30 years old and the oldest was 83 ($M = 46.5$; $Me = 45$; $Mo = 46$). The majority of respondents were women (50 people; 86%), and a minority were men (18 people; 14%). Most respondents had a doctoral degree (43 people; 74%), 7 people (12%) had a master's degree, 7 people (12%) had a habilitation degree, and 1 person (2%) had the title of professor.

V. THE RESULTS

A. The level of IT competences and how to improve them

Lecturers were asked to rate their IT competences on a scale from 1 (very low) to 5 (very high), they declared them on average at the level of 3.88 ($Min=2$, $Max=5$, $Me=4$, $Mo=4$, $Ske=-0.10$, $K=-0.97$).

There are no statistically significant differences between four subsequent measurements of the level of IT competences of lecturers ($F(3, 258) = 1.66$; $p = 0.182$).

TABLE I
DECLARED LEVEL OF IT COMPETENCES OF LECTURERS
DEPENDING ON THE MEASUREMENT

Date of measurement	N	M	SD
June 2020	65	3.68	.83
February 2021	77	3.95	.72
February 2022	62	3.92	.73
January 2024	58	3.88	.86

When asked how academic teachers improve their IT competences, 6 people answered that they do not undertake such activities, one person is satisfied with what he knows, and one person declared the lack of a learning plan in this area.

TABLE II
TYPE OF ACADEMIC TEACHERS' ACTIVITY
TO IMPROVE IN ICT

A type of self-improvement activity	Number of indications
Own activities (self-education)	41
Training	25
Using the support of others	11
Professional activity	8

Among people who improve their IT competences, self-improvement activities are the most common (41 indications). These include: independent learning (13), using online sources of knowledge (searching for news, materials, thematic websites, videos, tutorials, blogs, etc.) (7), testing and implementing new tools (5), learning by trial and mistakes (4), learning according to needs (3), following the news (2), reading (2), getting acquainted with the news (2). Single answers concerned activities such as: regular replacement of equipment with newer ones, use of e-technology and purchasing access to new platforms.

One of the respondents wrote about his path of self-improvement: "I regularly replace my personal equipment with newer ones with new functions"; "I practice, that is, I take advantage of the opportunities offered by technical progress (mObywatel, electronic banking, e-patient, blog, digital knowledge bases, etc.), I participate in training courses offered at the University"

Secondly, various types of training are important (32), including: participation in training, workshops and courses (15), participation in online training (webinars) (7), training offered at APS (2) and free training (1).

Eleven people use the help of other people: they exchange information with other employees (5), consult specialists (3) and use the competences of their family members (3).

For 8 people, development is important, which is associated with constant professional activity, including: 3 people point out the need to work with technology on a daily basis, and single indications concern aspects such as performing professional work in IT, having experience, acquiring skills during implementation specific tasks, improving through practice and systematically solving equipment problems.

B. Tools used in teaching work

Academic teachers indicated what tools they use in their teaching work. E-mail, presentation programs and sharing materials and links are still the most popular. Tools related to the MS Teams platform, enabling the organization of group or individual work, communication with students and sharing files, are popular, although Tasks in MS Teams are not the most frequently used tool. The least frequently used solution is recording lectures and making them available to students, as well as communicating via individual telephone calls.

Five respondents did not answer the question what other ICT tools they use in the teaching process.

TABLE III
OTHER TI TOOLS USED
BY ACADEMIC TEACHERS

Type of ICT tools	Number of indications
Software specific examples	55
Software – general categories	22
No other tools	16
Other	2

Specific examples of programs used by APS teachers included: Kahoot (9), Canva (8), Mentimeter (6), SPSS (3), Chat GPT (2), YouTube (2), Padlet (2), Slido (2). Individuals also provided: Obsidian, Notion, Procreate, Mendeley, Zotero, PDF Expert, Quizlet, Miro, Zoom, Limesurvey, AnswerGarden, Jomboard, Graphics, iMovie, Adobe Scan, iDoceo, Genially, Woolclap, Picer Wheel, IdeaBoards, Quizizz. It is worth emphasizing that some of these tools are paid.

The respondents mentioned the following general software categories: MS Office (5), cloud (file sharing) (2), graphic software (2), digital databases (2). Single indications also referred to: digital textbooks, robots, software for mini-surveys, statistical software, online tools and applications, online quizzes, live exercises, a studio for professional recording of lectures, social media, gamification.

As one of the people emphasized, the software used “depends on the teaching content, and in my case, these are very practical issues, so the use of technology comes down to supplementing the content of the subject.”

Other answers not related to new technologies included simulations and thematic games.

As a justification for not using other tools, respondents gave answers such as: “The listed methods are sufficient for me.”

C. University support for the use of ICT in teaching

Lecturers' opinions regarding university support in the use of ICT in teaching are divided. Technical support and solving technical problems on an ongoing basis are rated the best. The possibility of renting equipment, the availability of software and room equipment are also rated well. Taking care of the efficiency of computer equipment in classrooms and updating

software is also rated well, although in these categories some respondents have no knowledge about it. The lowest rated items are readiness to purchase hardware, software, and Internet connection at the university.

Among the respondents, 7 people said that they did not expect anything from the university, because everything was sufficient, 3 people did not know how to answer this question, and one indicated that everything was insufficient.

TABLE IV
TYPE OF SUPPORT EXPECTED FROM UNIVERSITIES IN THE
FIELD OF THE USE OF IT TECHNOLOGIES IN EDUCATION

The type of support expected	Number of indications
Access and quality of equipment and Internet connections at the university	41
Software related issues	14
Access to training	12
Technical service support at the university	10
Organizational and technical solutions	9
Providing support to students	4
Other	2

Issues related to the availability and quality of equipment and Internet connections are mentioned as the most important elements of support from universities (41). The key among them are: a stable Internet connection enabling connection from anywhere at the university (11), no need to use personal hardware, software and the Internet (6), access to a computer and projector in every classroom (5), efficient computer equipment (5), equipping employees with a work laptop (4), improving the quality of equipment at the university (3), purchasing VR glasses for use in teaching (2), purchasing interactive whiteboards and software (2), more computers for plants (2), equipping employees with headphones (1).

The respondents also drew attention to issues related to software (14), including: financing of specific programs/licenses (7) (e.g. Qulatricks, Eduflow, Mentimeter, Canva Pro, Genially, a wider version of MS Teams), systematic updating of programs at the university, including MS Office (5) and access to paid platforms for creating educational resources (1) and ensuring that you can effectively log out of your account on university laptops (1).

Another aspect that the respondents paid attention to is training (12). The expectations included: more training (9), provision of ICT tutorials/training materials (2) and financing of training (1). The desired topics include the use of AI in education and new tools to keep up with students.

For 10 people, effective support from the university's technical service is important. The following elements were mentioned: faster response and availability of the technical department in the face of a problem (4), designation of a constantly available technical person who can always be contacted (2), politeness and respect from IT specialists from the technical department (2), a person on duty with MS Teams (1) and regular checking of the equipment condition by technical staff (1).

Among the organizational and technical issues (9), attention was paid to: transfer of duty hours to MS Teams (3) and solving

the problem of double verification, increasing the number of computer rooms, preparing rooms for hybrid classes (microphone, camera), creating a science and language laboratory, purchasing tablets for a group of 25 people.

For 4 respondents, it is also important that education provides support to students, i.e. equips them with laptops or tablets, creates individual accounts for them in computer rooms, covers them with a software license (not only MS Office), allows them to rent a laptop with specialized software.

Other declarations (4) concerned the possibility of printing materials for students in color and laminating documents for classes.

D. ICT as an obstacle to learning

When asked to what extent information technologies constitute an obstacle to teaching, 6 people did not answer, one said that it was difficult for her to determine it, and one said that she had not noticed such a problem.

For 30 people surveyed, ICT is not an obstacle or, on the contrary, it is helpful.

TABLE V
INFORMATION TECHNOLOGIES AS AN OBSTACLE IN TEACHING

Type of obstacle	Number of indications
Technical issues (including technical support at the university)	20
Competencies	5
Students' dishonesty	4
Social aspects	4
Reduction of teaching goals	4

Those who believed that information technologies interfere with teaching drew attention to technical issues (20): lack, low quality or faulty equipment (e.g. freezing computers, flashing projector, low-quality screen, poor Internet, etc.) (8), lack of computers or computer workstations in classrooms (4), lack of access for lecturers to peripheral tools (color printer, projector, technology) (4), low quality or lack of support from technical staff (2), cost of access (1) and hardware synchronization (1).

Low competences in the field of information technologies are also problematic (5), including: lack of skills in this area, lack of thematic training, resistance to learning new things, reluctance to include ICT in their classes, lack of competences to conduct hybrid classes.

Four people emphasized that technology is an educational obstacle when it becomes a goal, instead of a means to an end (tool).

Four people also drew attention to social issues, i.e. the reduction of interpersonal relationships (2), students being distracted by social media ("students stare at their laptops and dummy-scroll social media instead of listening") and harassment of lecturers by students ("students often harass lecturers with e-mails in matters that they should deal with personally on duty and during classes).

Four respondents emphasized the importance of students' dishonesty: the lack of originality of their works, the inability to check whether their students had done their own work, the change of the role of the lecturer into an "investigator" and the fact that new technologies provide students with ready-made solutions.

E. The impact of the use of ICT on the teaching process

All of the above-mentioned aspects were assessed by lecturers as having a tendency to have a positive impact on the teaching process. The most appreciated are organizational issues related to organizing materials (having everything in one place, efficiency of managing teaching materials), communication efficiency and management of student groups. According to lecturers, the use of ICT increases the attractiveness of the message and makes it more convenient to assign and check final papers. The greatest doubts were raised about the independence of students' work on tasks.

F. The use of mobile devices in the teaching process

Lecturers declare frequent use of mobile devices in most categories, which are sharing materials with students, ad hoc looking for information, documenting the effects of teaching, communication with other lecturers or students. Mobile devices are used least often to communicate with technical support.

G. The use of ICT during the process of checking knowledge and skills

To the question regarding the use of new technologies in the process of checking knowledge and skills, one person did not answer, and 4 answered: technology is not suitable for checking knowledge, I prefer traditional methods, online only during the pandemic, I would use it if possible.

Twelve people answered this question by indicating the frequency of using ICT tools to check knowledge and skills, i.e. 6 people said they did not use them, two: to a large extent, to a small extent and one: rarely and almost always.

TABLE VI
THE USE OF TECHNOLOGY IN THE PROCESS OF CHECKING STUDENTS' KNOWLEDGE AND SKILLS

Scope of use	Number of indications
Methods of checking knowledge using ICT	36
Forms of student activity	11
Preparing and sharing materials	9
Communicating with students	4
Archiving achievements/effects	4
Other forms	3

Of the 36 people who described various methods of checking knowledge using ICT, 11 respondents indicated conducting exams and tests using MS Forms; 8 for using online tests, 6 for knowledge quizzes, 6 for tasks made available in MS Teams, 4 for various types of exams, one person indicated the use of an "entrance test". An example is the statement of one of the respondents: "I allow the use of electronic notes (on laptops or tablets) during open-book tests while the tests themselves are conducted on paper to prevent students from communicating online while taking the test."

For 9 lecturers, ICT tools are used to prepare and share materials for students, mainly presentations, assignments, written works, and projects.

Eleven people drew attention to students' activities aimed at checking their knowledge and skills, i.e. preparing written works in electronic form (2), making presentations (2), working on common documents (2) and using the Internet during classes, working in SPSS, in MS Word, sending various works in electronic version, presenting solutions.

For 4 respondents, issues related to communication are important, i.e. providing feedback (2) and communicating in general (2).

Archiving learning outcomes in electronic form is also important for 4 respondents.

Three respondents indicated that they use the ICT tool depending on their needs, use it to check whether the work is original and use it to compare achievements and draw conclusions.

H. ICT competences acquired during the pandemic

When asked about the further use of IT skills and experiences acquired during the crisis period of remote education during the pandemic, 2 people did not answer and two more said that this question did not apply to them. In one case, the interviewee emphasized that the pandemic had not changed anything.

Seven people declared that they still use all the skills and experiences from the pandemic period, two confirmed that they use them, two - that they use most of them.

TABLE VII
SKILLS AND EXPERIENCES FROM THE DISTANCE EDUCATION
CRISIS PERIOD STILL USED IN THE EDUCATIONAL PROCESS

Type of skills/experiences	Number of indications
Specific functionalities of MS Teams	58
MS Teams (general)	34
Other forms of work	12
Other applications	10

The respondents declared that the most important post-pandemic IT tool for them is MS Teams (34) ("MS Teams is great!"), mentioning various functionalities of this application that are still important for them in their teaching work (58). These include: communicating (12), posting documents for students (including audio and video) (11), subject teams (7), archiving learning outcomes (6), conducting online classes (4), conducting individual consultations (3) and seminar (3), sharing documents (2), transmitting documents by students (2), teamwork (2), online meetings (2) and making up classes, exams, duties and assignments.

Even though MS Teams is used by the respondents, they are not uncritical, as illustrated by the following statement: "I use Teams as a communication tool with students, I post materials there, I post assessments there and I do not make backups on my own computer, so if something goes wrong something will go wrong in Teams and I will lose my data, I have no way to prove my teaching outcomes."

Other applications (10) mentioned by the respondents included: MS Forms, Google tools, MS tools, meeting platforms, platforms for creating educational resources, Padlet, Zoom.

Among other forms of work (12), respondents mentioned: webinars (3), tests (3) and online work, remote conferences, creating research tools, quizzes, project work and meetings.

In turn, when asked about IT skills and experiences acquired during the crisis period of remote education during the pandemic, which were no longer needed by lecturers, 2 people did not answer, while 3 people stated that this question did not apply to them, one said that the pandemic had not changed anything, and one - that limits the use of IT tools, one stated that this form of contact is burdensome and overused.

Thirty-eight people declared that there were no such tools, that they were useful, and that all of them were useful.

Detailing their answers, the people who mentioned skills that they do not use after the pandemic (13) include: conducting online classes (7), online tests/Forms (2), online exams, creating groups, tasks, using various programs.

Justifying their statements, there were descriptions such as "better communication occurs during live meetings, and the online form remains a substitute for emergency situations" and "I use IT tools only when required by the teaching process or the special needs of students. I try to have direct contact with students as often as possible."

VI. THE DISCUSSION

Academic teachers are required to update the knowledge they already have and, in the context of constantly changing technologies, to continuously refresh and develop their skills. This is necessary to use tools that are familiar to students, but also to direct students to tools that are valuable for a given specialization. Current expectations regarding teachers' competences include a wide range of knowledge and skills in the field of new technologies. These include the use of 3-D printers, programming, or other specialized resources dedicated to solving specific problems from various areas of life, as well as the readiness to update one's own thematic knowledge [22]. With regard to resources, platforms and repositories that collect and make available collections, including those of a scientific nature, their number becomes problematic. Therefore, without the teacher's guidance, it may be difficult for learners to find content that is valuable and worth attention. Teachers' competences translate into how they teach, what they encourage, and how flexible they are in searching for and selecting teaching resources.

Analyzing the obtained results, it is visible that the surveyed teachers declare a rather high level of IT competences and it has not changed significantly over the years. The vast majority of teachers have a wide range of learning strategies and expand their knowledge and skills, recognizing that this is necessary not only for professional work, but also for life in a dynamically changing technological situation affecting every field of human activity.

It is noticeable that the recommendations developed as a result of the crisis distance education are used in the strategies of universities and individual teachers. These include the selection of one specific e-learning platform for teachers and students [23] that can support stationary education. As well as the adequate and conscious use of technology in those areas where it brings real benefits, individualization of feedback, which should be provided in an appropriately short time, creating documentation of students' work, developing and encouraging teachers to develop digital competences [23]. Hence, in the respondents' declarations, one can find specific proposals for the tools they use and areas of influence (organizational, checking, communication, etc.), as well as declarations of expectations towards universities to make their teaching activities more effective. In addition, teachers recognize the need to critically analyze the scope of use of IT tools by themselves and students, so that they do not become an end in themselves and do not provoke students to abuse them, including depriving them of independence in thinking and acting.

Due to the high dynamics of changes, teachers often feel insufficiently competent and are rarely provided with systematic training support, which contributes to the fact that they do not trust technology in education [4]. However, as Tomczyk notes, “the low level of digital skills prevents the full implementation of popular and free solutions supporting learning and teaching” [24, pp. 94-95], and what's more, “admitting inability is not a bad thing if it is not a lack of basic competences” [25, p. 231]. In the perspective of the results obtained, it is encouraging that the surveyed academic teachers not only have adequate initial IT competences, which was to some extent contributed to by the experience of the pandemic, but also a constant readiness to seek and learn in this area.

LIMITATIONS

Being aware that research on technology in education is very complex, it should be emphasized that the presented results relating to one specific university providing education in the field of social sciences cannot be generalized to other universities. It would be advisable to conduct comparative research on the use of technology in universities with different educational profiles.

REFERENCES

- [1] W. Furmanek, “Nowoczesne technologie w oświacie i edukacji,” *Edukacja - Technika - Informatyka* 5(2), pp. 15-26, 2014.
- [2] M. Burns, “Technology in Education: Background Paper for 2023 Global Education Monitoring Report,” UNESCO, <https://doi.org/10.13140/RG.2.2.16651.98082>, 2021.
- [3] M. Plebańska, “Cyfrowa edukacja – potencjał, procesy, modele,” in *Edukacja w czasach pandemii wirusa COVID-19*, Warszawa, EduAkcja, 2020.
- [4] UNESCO, “Global Education Monitoring Report Summary 2023: Technology in education: A tool on whose terms?,” UNESCO, Paris, 2023.
- [5] J. Pyżalski, “W jaki sposób możliwe były główne edukacyjne relacje w edukacji zdalnej?,” *Studia z Teorii Wychowania* 3(36), pp. 71-82, 2021.
- [6] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Zdalna edukacja kryzysowa w APS w okresie pandemii COVID-19,” Warszawa, 2020. <https://doi.org/10.13140/RG.2.2.18059.52006>
- [7] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Crisis Remote Education at The Maria Grzegorzewska University During Social Isolation in the Opinions of Academic Teachers,” *International Journal of Electronics and Telecommunications*, vol. 66, no. 4, pp. 801-806, 2020. <https://doi.org/10.24425/ijet.2020.135673>
- [8] R. Tadeusiewicz, *E-learning na uczelniach. Koncepcje. Organizacja. Wdrażanie*, Warszawa: Wydawnictwo Naukowe PWN, 2021.
- [9] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Crisis Remote Education at The Maria Grzegorzewska University During Social Isolation in the Opinions of Students,” *International Journal of Electronics and Telecommunications*, vol. 66, no. 4, pp. 807-812, 2020. <https://doi.org/10.24425/ijet.2020.135675>
- [10] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Crisis remote education from the perspective of one-year experience of academic teachers,” *International Journal of Electronics and Telecommunications*, vol. 67, no. 2, pp. 213-219, 2021. <https://doi.org/10.24425/ijet.2021.135967>
- [11] M. Klimowicz, “„Polskie uczelnie w czasie pandemii”: czy zaszła cyfrowa rewolucja?,” SpołTech, Warszawa, 2020.
- [12] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Academic Lecturers Towards the Students' Examining. Similarities and Differences of Stationary and Remote Exams in the Pandemic Era,” *International Journal of Electronics and Telecommunications*, vol. 68, no. 1, pp. 63-68, 2022. <https://doi.org/10.24425/ijet.2022.139849>
- [13] T. Triyason, A. Tassanaviboon and P. Kanthamanon, “Hybrid Classroom: Designing for the New Normal after COVID-19 Pandemic,” *IAIT2020: Proceedings of the 11th International Conference on Advances in Information Technology*, pp. 1-8, <https://doi.org/10.1145/3406601.3406635>, 2020.
- [14] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Hybrid education in higher education on the example of academic teachers' experiences in post-pandemic reality,” *International Journal of Electronics and Telecommunications*, vol. 38, no. 3, pp. 489-496, 2022. <https://doi.org/10.24425/ijet.2022.141265>
- [15] J. Singh, K. Steele and L. Singh, “Combining the Best of Online and Face-to-Face Learning: Hybrid and Blended Learning Approach for COVID-19, Post Vaccine, & Post-Pandemic World,” *Journal of Educational Technology Systems*, Vol. 50 (2). <https://doi.org/10.1177%2F00472395211047865>, 2021.
- [16] J. Pyżalski and W. Poleszak, “Relacje przede wszystkim – nawet jeśli obecnie jedynie zapośredniczone,” in *Edukacja w czasach pandemii wirusa COVID-19*, Warszawa, EduAkcja, 2020.
- [17] J. Yao, J. Rao, T. Jiang and C. Xiong, “What Role Should Teachers Play in Online Teaching during the COVID-19 Pandemic? Evidence from China,” *Science Insights Education Frontiers*, 5 (2), pp. 517-524, 2020.
- [18] T. Böttger, G. Ibrahim and B. Vallis, “How the Internet reacted to Covid-19: A perspective from Facebook's Edge Network,” *IMC '20: Proceedings of the ACM Internet Measurement Conference*, pp. 34-41, <https://doi.org/10.1145/3419394.3423621>, 2020.
- [19] H. Baber, “Social interaction and effectiveness of the online learning – A moderating role of maintaining social distance during the pandemic COVID-19,” *Asian Education and Development Studies*, 11 (1), pp. 159-171, <https://doi.org/10.1108/AEDS-09-2020-0209>, 2022.
- [20] M. Sudhir, S. Mascarenhas, J. Isaac, J. Alfroukh and S. A. Rahuman, “Adapting to the need of the hour: Communication skills simulation session using an online platform during COVID-19,” *MedEdPublish*, 9 (85), <https://doi.org/10.15694/mep.2020.000085.1>, 2020.
- [21] J. Łukasiewicz-Wieleba and M. W. Romaniuk, “Academic Interpersonal Relations during the Pandemic Remote Education in the Opinion of Academic Teachers,” *Lubelski Rocznik Pedagogiczny*, vol. 41, no. 3, pp. 67-81, 2022. <https://doi.org/10.17951/lrp.2022.41.3.67-81>
- [22] D. Siemieniecka, “Technologie w edukacji 4.0,” *Przegląd Badań Edukacyjnych* 34, p. 227–250. <http://dx.doi.org/10.12775/PBE.2021.027>, 2021.
- [23] J. Pyżalski and N. Walter, “Edukacja zdalna w czasie pandemii COVID-19 w Polsce – mapa głównych szans i zagrożeń,” Uniwersytet im. Adama Mickiewicza, Poznań, 2021.
- [24] Ł. Tomczyk, “Czego możemy nauczyć się od tych, którzy prowadzą zdalną edukację od dawna?,” in *Edukacja w czasach pandemii wirusa COVID-19*, Warszawa, EduAkcja, 2020.
- [25] P. Augustyniak, “Autorytet nauczyciela akademickiego - jak budować i utrzymywać w nauczaniu zdalnym,” in *E-learning na uczelniach. Koncepcje. Organizacja. Wdrażanie*, Warszawa, Wydawnictwa Naukowe PWN, 2021.
- [26] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Zdalna edukacja kryzysowa w APS w okresie pandemii COVID-19. Edukacja hybrydowa.,” Warszawa, 2022. <https://doi.org/10.13140/RG.2.2.30338.35524>
- [27] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Zdalna edukacja kryzysowa w APS w okresie pandemii COVID-19. Proces egzaminowania w trybie zdalnym i stacjonarnym - porównanie,” Warszawa, 2021. <https://doi.org/10.13140/RG.2.2.18440.55045>
- [28] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Zdalna edukacja kryzysowa w APS w okresie pandemii COVID-19. Z perspektywy rocznych doświadczeń,” Warszawa, 2021. <https://doi.org/10.13140/RG.2.2.10251.62243>
- [29] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Challenges of administering university examinations remotely during the COVID-19 pandemic,” *E-Mentor*, vol. 3, no. 90, pp. 22-31, 2021. <https://doi.org/10.15219/em90.1519>
- [30] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Crisis remote education from the perspective of one-year experience of students,” *International Journal of Electronics and Telecommunications*, vol. 67, no. 2, pp. 221-227, 2021. <https://doi.org/10.24425/ijet.2021.135968>
- [31] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Hybrid education in higher education on the example of students' experiences in post-pandemic reality,” *International Journal of Electronics and Telecommunications*, vol. 38, no. 3, pp. 497-504, 2022. <https://doi.org/10.24425/ijet.2022.141266>
- [32] M. W. Romaniuk and J. Łukasiewicz-Wieleba, “Remote and Stationary Examinations in the Opinion of Students,” *International Journal of Electronics and Telecommunications*, vol. 68, no. 1, pp. 69-75, 2022. <https://doi.org/10.24425/ijet.2022.139850>
- [33] J. Pyżalski, “W jaki sposób możliwe były główne edukacyjne relacje w edukacji zdalnej?,” *Studia z teorii wychowania* 3(36), pp. 71-82, 2021.

- [34] A. Siegelman, "lended, hybrid, and flipped courses: What's the difference?," *Center for the Advancement of Teaching*, pp. URL: <https://teaching.temple.edu/edvice-exchange/2019/11/blended-hybrid-and-flipped-courses-what%E2>, 80, 2019.
- [35] J. Pyżalski, "W jaki sposób możliwe były główne edukacyjne relacje w edukacji zdalnej?," *Studia z Teorii Wychowania*, 12 (3(36)), pp. 71-82, 2021.
- [36] N. Hussain, B. Nawaz, S. Nasir, N. Kiani and M. Hussain, "Positive Teacher-Student Relationship and Teachers Experience - A Teacher's Perspective," *Global Journal of Management and Business Research Interdisciplinary*, 13 (3), 2013.