

TEACHING CHEMISTRY DURING THE COVID-19 PANDEMIC FROM PRIMARY SCHOOL TO PhD STUDENTS IN POLAND

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Abstract

In order to limit the spread of the virus, schools and kindergartens in Poland were closed on March 12, 2020. In the report "The state of education one year after the COVID-19 pandemic," prepared by the Organization for Economic Co-operation and Development (OECD), there is a disturbing correlation, where the authors point out that the lower the level of education in the country, the longer schools stayed there. The record holder in this respect is Costa Rica, where full-time teaching was introduced after almost 180 days - and at all levels of education. On the other hand, students from Denmark returned to school the fastest, after approx. 20 days. The indicator of the level of education in individual countries is the OECD's International Student Skills Assessment Program (PISA), which measures the ability of 15-year-olds to use their knowledge and skills in reading, math and science to meet the challenges of everyday life (OECD 2021).

Key words: teaching chemistry, Covid-19, distance learning

1. DISTANCE LEARNING IN POLAND DURING THE COVID-19 PANDEMIC

In Poland, the state of school closure was to last until March 25, but due to the persistent difficult situation, teaching was carried out remotely until the end of the 2019/2020 school year. The exception were care and educational activities for students in grades 1-3, which were organized from May 25. Later than expected, external examinations were carried out. The eighth-grade exam took place on June 16-18 (according to the schedule it was supposed to take place in April), while the secondary school-leaving examination began on June 8 (it was usually held in May). At the same time, the Ministry of National Education announced that direct contact teaching will return in the new school year. These plans were implemented and on 1 September 2020, students returned to schools.

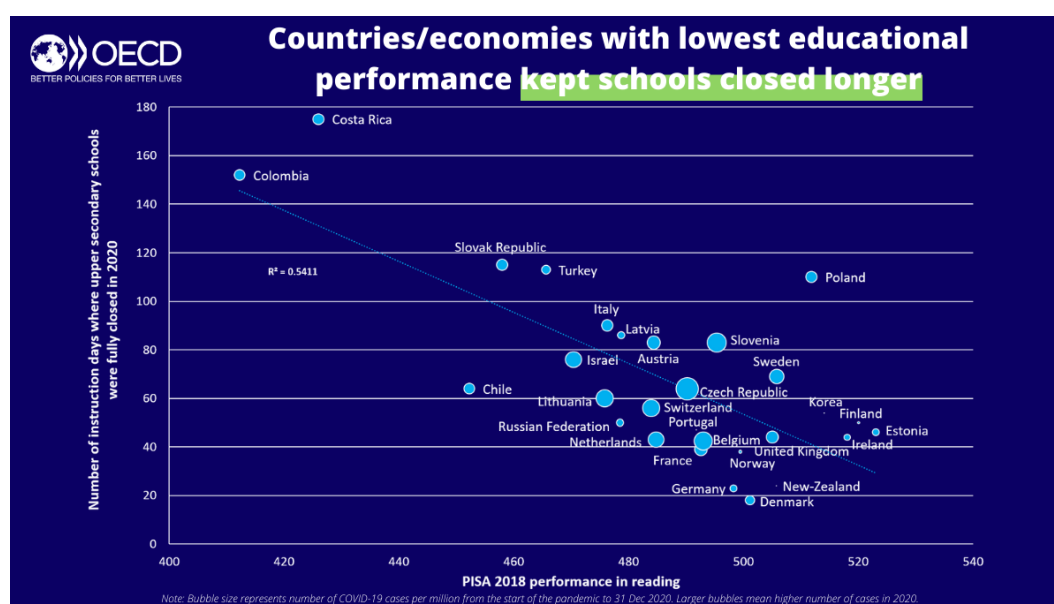


Fig. 1. Countries/economies with lowest educational performance kept schools closed longer

Source: OECD (2021)

2. WHAT WAS DISTANCE LEARNING LIKE?

Many states tried to minimize the effects of the pandemic crisis of education. From among the countries where the survey was conducted, the 6 most popular methods of conducting distance learning were selected: on-line platforms, work packages prepared by the school, television, telephones, radio, other methods of distance learning (OECD 2021).

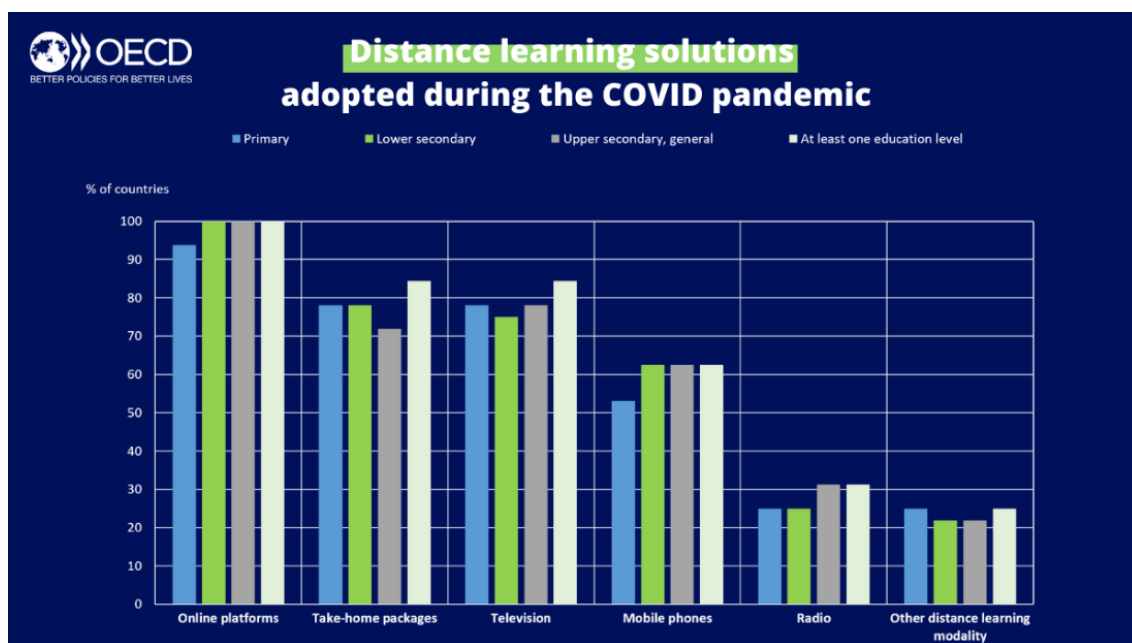


Fig. 2. Distance learning solutions adopted during the COVID pandemic

Source: OECD (2021)

3. CASE STUDY

A survey conducted in the school year 2020/2021 involved 354 people as part of their undergraduate work. Schools from Poznań and Wielkopolska province and individuals were selected at random. Among the real-time connection programs listed in the survey, the majority (77.8%) used Microsoft Teams while studying remotely, while the rest were from Zoom and Google Classroom (Wawrzyniak 2021).

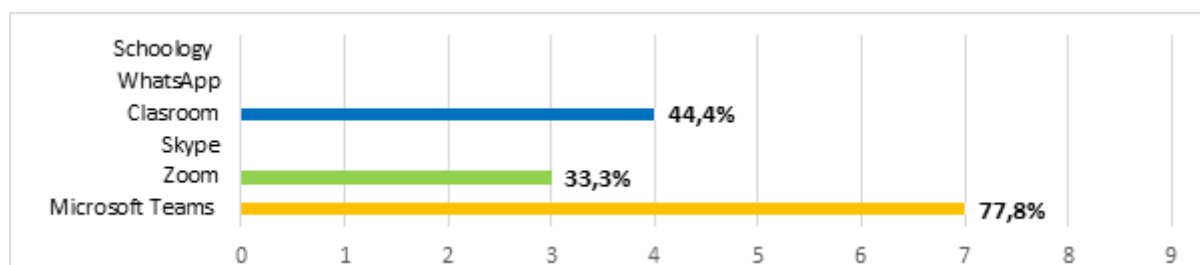


Fig. 3. Video conferencing programs (Wawrzyniak 2021)

However, in the survey conducted on May 8-30, 2020 on an anonymous group of 80 chemistry teachers in primary or secondary schools, as many as 85% of teachers used the "e-class register" platform and e-mail (72.5%) to communicate with their students. Another new place of contact was

Microsoft Teams (41.3%) and Facebook (37.5%). Other applications of choice were Zoom and Google Classroom. The least frequently used programs were Skype and Discord (13.8% and 12.5%, respectively) (Brychcy 2020).

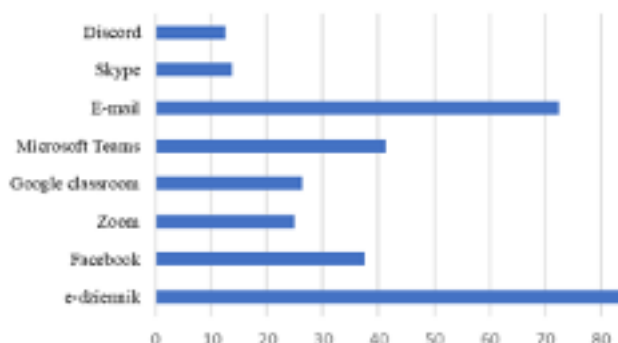


Fig. 4. Platforms for communicating with students used by teachers (Brychcy 2020)

Among these methods, the most popular online platforms are for teaching lessons. They formed the basis of teaching in all countries at the primary, middle and high school levels. As it soon turned out, in the following weeks of the new school year, there was a sharp increase in the number of infections and the decision was made that on October 23, 2020, students in grades 4-8 of primary schools and secondary school students began remote learning (Turska-Kawa, Stępień-Lapma & Grzywna 2020).

In the event of a coronavirus infection at school, at the request of the principal, in consultation with the leading authorities and with the positive opinion of the sanitary inspector, they could switch to a mixed system (combining stationary education and distance education) or entirely to distance learning for a specified period. From October 19, 2020, the functioning of public and non-public, including secondary schools in the poviats located in the red area - these schools have switched to remote work. On the other hand, the activities of secondary schools in the poviats in the yellow zone were partially limited - these schools switched to the hybrid (mixed) work mode. The exception were special secondary schools operating independently, in complexes of special schools, special educational and educational centers (Ministry of Education and Science Republic of Poland 2021).

On the eve of the suspension of the above-mentioned full-time classes, i.e. on October 23, 2020, the information provided by the Education Superintendents showed that distance learning was conducted:

- in secondary schools with the division into yellow and red zones:
 - remotely: 5778 - 46.34% (red zone)
 - hybrid: 5503 - 44.14% (yellow zone)
- in 1187 - 9.52% of secondary schools (including special schools) excluded from the restrictions in primary schools
 - remotely: 410 - 2.7%
 - hybrid: 1,270 - 8.5%

In turn, from November 9, 2020, distance learning was also provided to students of grades 1-3 of primary schools. From that moment on, only compulsory pre-school education was provided in the form of direct contact.

From 30 November 2020 to 3 January 2021, the limitation of the functioning of schools in a stationary manner was extended, with the exception of the possibility of conducting sports activities in sports schools and practical vocational training in schools providing vocational training.

From Monday, 18, January 2021 students of grades 1-3 of primary schools, as well as special schools, returned to full-time education in strict sanitary regime. The possibility of carrying out apprenticeships for selected classes has also returned. Students in grades IV to VIII of primary school, secondary school, continuing education institutions and vocational training centers participate in distance learning. The return of students to schools was preceded by a nationwide campaign to test teachers and school staff for the presence of coronavirus (Ministry of Education and Science Republic of Poland 2021).

4. SUPPORT EXAMPLES

A special tab has been prepared on the website of the Ministry of National Education, which collects information about commonly available materials that students and teachers can use while learning on-line. The tab includes, among others links to the educational resources of the Ministry of Agriculture, the Ministry of Climate and the Environment, the Military Center for Civic Education, the National Heritage Board of Poland, the National Opera, the Central Statistical Office, the Ministry of Foreign Affairs, the Institute of National Remembrance or the Institute of Meteorology and Water Management - National Research Institute.

- The PGNiG Foundation of Ignatia Łukasiewicz has prepared a series of free online training courses for teachers. They took place from 25 August to 3 September and from 12 to 24 November. It took the form of open and free webinars.
- Educational and information campaign for the dissemination of the benefits of the use of digital technologies implemented by the Ministry of Digitization in cooperation with the Nask State Research Institute.
- On 30 September 2020, together with the Office for Personal Data Protection, an on-line training was organised for data protection officers in the education sector. It provided an opportunity to answer questions about the organisation of remote learning and data security in this form of education.
- Nationwide training for teachers in the field of education of children and young people in the field of road safety prepared by the National Road Safety Council and the Ministry of Infrastructure. By participating in training, educators gained the knowledge that allowed them to conduct road safety classes at every stage of their studies.
- Remote Lessons – teaching materials for remote, hybrid and traditional learning. The four-month online education experience gathered and the analysis of teachers' and students' needs resulted in changes that allowed for a better adaptation of the resources of the gov.pl
- Science techniques – the project is the result of conceptual cooperation between MEN and TVP, in which the programme's experts, trainers and lecturers provide an accessible guide on how to develop and improve one of the most important competences of the 21st century – the ability to learn. All episodes can be viewed free of charge on the platform vod.tvp.pl.
- Educational programmes of Polish Children's Radio, which included m.in. foreign language lessons, safety-related programs, broadcasts about experiments and covers, a series about saving, a band on linguistic correctness, as well as lullas, musical journeys, stories, fairy tales and legends.
- On-line programming workshops as part of the second edition of the Young Programmer's Club prepared by the Digitization of KPRM in cooperation with the State Research Institute NASK.
- Offer of remote MOOCs provided by universities and educational institutions on the NAVOICA platform. The platform is aimed at all who want to develop and expand their knowledge. The materials available on the website can be especially useful for students and teachers during distance learning.

As part of activities aimed at counteracting the effects of the pandemic, COVID-19 is modified and developed under the EU project called "Development of the functionality of the Integrated Educational Platform epodreczniki.pl increasing the possibilities of distance learning" implemented by the Education IT Center, which is a unit subordinate to the Minister of Education and Science.

In the field of chemistry, as an example, from July 1 to December 31, 2020, issues related to the types of bonds: covalent and covalent polarized chemical bonds had 86,745 views.



Fig. 5. Number of pageviews for website [e-podreczniki.pl](http://epodreczniki.pl) in July (lipiec) and August (sierpień) in 2020
Source: <https://www.gov.pl/web/edukacja-i-nauka> (viewed 1 July 2021)

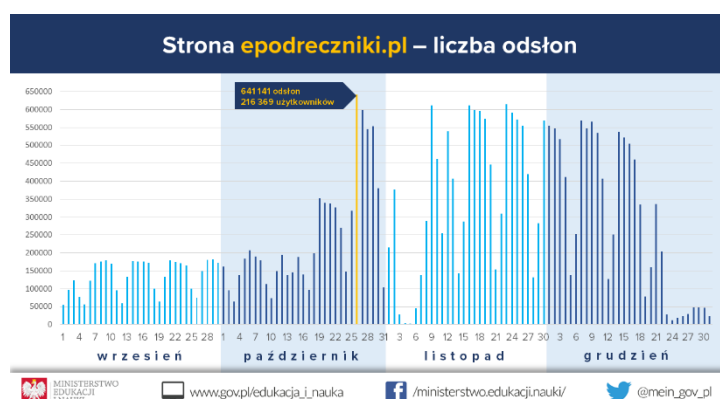


Fig. 6. Number of pageviews for website [e-podreczniki.pl](http://epodreczniki.pl) in September (wrzesień), October (październik), November (listopad) and December (grudzień) in 2021
Source: <https://www.gov.pl/web/edukacja-i-nauka> (viewed 1 July 2021)

In May 2020, a report was published the first large remote education study conducted during the COVID-19 pandemic in Poland. In April, almost 1,000 teachers and teachers from primary schools from all over the country took part in it. The vast majority of respondents had no previous experience with distance learning. The teachers faced, inter alia, with problems such as the time-consuming nature of the new form of work, shortages of students' equipment, and conflicting expectations of parents (Buchner, A & Wierzbicka M 2020).

- Before the outbreak of the pandemic, 85.4% of surveyed teachers had no previous experience with distance learning, yet 48% had no difficulties with using digital tools
- 36% of teachers indicated shortages of students' equipment as one of the main problems with distance education

- Teachers point out the necessity to adapt the core curriculum to the realities of remote education

In the second edition of the survey, teachers were asked to summarize the 2019/20 summer semester carried out mainly remotely and to evaluate the preparation of schools for remote education in the 2020/21 school year. The group of respondents was expanded to include secondary school and industry teachers, more than 700 respondents gave their answers. A survey conducted at the turn of September and October 2020 showed that although the digital competences of teachers have increased, the number of problems they face has not decreased. The biggest challenges again turned out to be: the time-consuming process of remote education, lack of equipment, as well as stress and fatigue. Information chaos and lack of support from the Ministry of National Education also turned out to be a big problem (Buchner & Wierzbicka 2020).

- Teachers pointed to information chaos, lack of clear guidelines and support from the Ministry of National Education. Only 5% of them feel that they have received substantive support from the Ministry of National Education during remote education
- YouTube and other video sites were the most frequently used sources for the preparation of remote lessons. 84% of teachers used them
- Teachers drew attention to the phenomenon of students disappearing from the education system, as well as to the new situation - disappearing teachers (Buchner & Wierzbicka 2020)

5. EDUCATION OF DOCTORAL STUDENTS AT THE DOCTORAL SCHOOL OF ADAM MICKIEWICZ UNIVERSITY DURING THE COVID-19 PANDEMIC

Teaching and learning at the Doctoral School of Adam Mickiewicz University, Poznań is conducted on the basis of this framework curriculum and an individual research plan and ends with the submission of a doctoral dissertation. The framework curriculum includes three types of classes/courses: obligatory, elective obligatory and optional (Framework curriculum at the Doctoral School 2020).

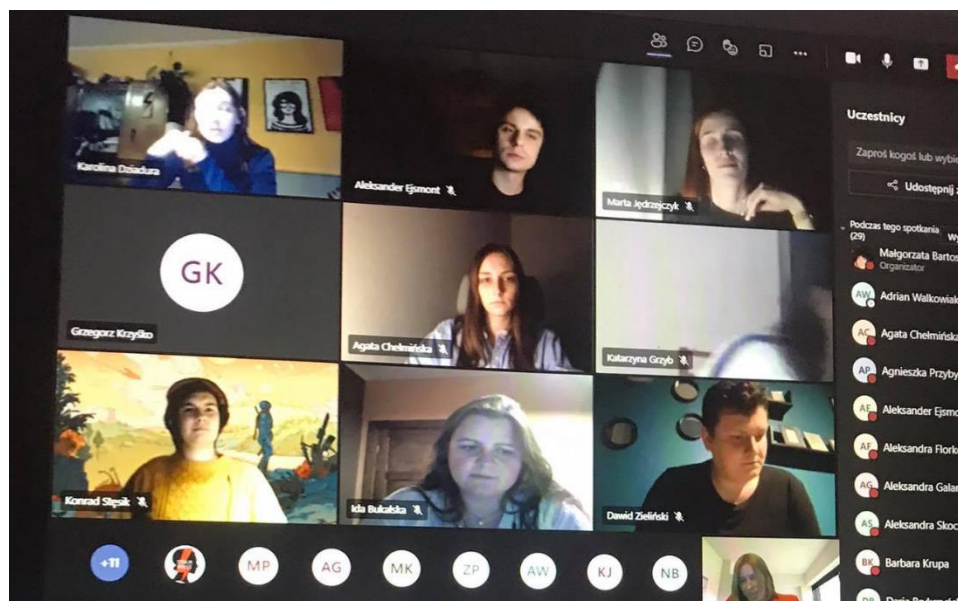


Fig. 7. On-line classes with PhD students

Source: Own source

In the academic year 2021/2022 we conducted courses obligatory and elective obligatory. The obligatory course Chemistry didactics for PhD students included the lectures and workshops available on the Moodle platform and MS Teams and covering in particular the following subjects: scientific publication channels, popularization of scientific research, the fake news, preparation and presentation of visual data, presentation of research results in Polish and in a foreign language .

Elective obligatory module coordinated by us included soft skill workshops in particular the following issues: Communication and interpersonal skills; Teamwork and management of the research group; cultural differences in science, ethics in science. Classes were conducted using distance learning methods and techniques, including Moodle and MS Teams that enable synchronous and asynchronous interaction between us and PhD students.

CONCLUSIONS

Preparations for the 2020/2021 school year were based on the analysis of experiences from the work of schools and institutions during their limited functioning from mid-March to June 2020. At this particular time, the education of children and adolescents was not interrupted, and the teaching process could be continued.

The tasks carried out by the Ministry of National Education concerned mainly the preparation of solutions in connection with the resumption of the functioning of schools and institutions and the return to full-time education in a state of epidemic. At the same time, it should be emphasized that the solutions concerning the return of students to schools applied in Poland were similar to those adopted in other European countries.

Despite the fact that the difficulties prevailed, teachers also pointed to the positive effects of distance learning. Vigorous community groups were created where teachers exchanged materials and support. Many teachers declared that the tools and methods learned or introduced in the pandemic would also be used in traditional teaching. The crisis situation may therefore turn out to be a catalyst for the desired changes in Polish education.

REFERENCES

- OECD 2021, *The State of School Education. One year into the Covid pandemic*, OECD Publishing, <<https://doi.org/10.1787/201d8e84-en>>
- Ministry of Education and Science Republic of Poland 2021, *Report II of the Minister of Education and Science. Ensuring the functioning of education system units during the COVID-19 epidemic*, viewed 1 July 2021 < <https://www.gov.pl/web/edukacja-i-nauka/raport-mein-covid-19>>
- Turska-Kawa, A, Stępien-Lapma, N, Grzywna, P 2020, 'Parents and teachers' concerns about new forms of education during the SARS-COV-2 pandemic. Study of the Silesian Province' - Pro Silesia Report, "Pro Silesia" Business-University-Region Association, Katowice, viewed 1 July 2021, <https://www.researchgate.net/publication/347930179_Obawy_rodzicow_i_nauczycieli_wobec_nowych_form_edukacji_w_okresie_pandemii_SARS-COV-2_Studium_wojewodztwa_slaskiego_-_Raport_Pro_Silesia>
- Wawrzyniak, B 2021, 'Pandemic influence on teaching chemistry at primary level', BA thesis, Adam Mickiewicz University, Poznan
- Brychcy, J 2020, 'Remote teaching of chemistry at school during the Covid-19 in Poland', BA thesis, Adam Mickiewicz University, Poznan
- Buchner, A & Wierzbicka M 2020, 'Education during a pandemic' Report II edition, Foundation Centrum Cyfrowe, Warszawa, viewed 1 July 2021, <<https://centrumcyfrowe.pl/edukacja-zdalna/>>

Framework curriculum at the Doctoral School 2020/2021, Adam Mickiewicz University, Poznan, 2020, viewed 1 July 2021, <<https://amu.edu.pl/doktoranci/ramowy-plan-ksztalcenia-framework-curriculum-202021>>

<https://www.gov.pl/web/edukacja-i-nauka/nauka-zdalna--materiały>

<https://www.gov.pl/web/edukacja-i-nauka/darmowe-szkolenia-on-line-dla-nauczycieli>

<https://www.gov.pl/web/edukacja-i-nauka/cyberprzemoc--poradnik-dla-rodzicow>

<https://www.gov.pl/web/edukacja-i-nauka/webinarium-uodo-men>

<https://www.gov.pl/web/edukacja-i-nauka/droga-z-klasa>

<https://www.gov.pl/web/zdalnelekcje>

<https://www.gov.pl/web/edukacja-i-nauka/techniki-nauki--nowy-cykl-edukacyjny-tvp-vod>

<https://www.gov.pl/web/edukacja-i-nauka/audycje-edukacyjne-w-polskim-radiu-dzieciom>

<https://www.gov.pl/web/edukacja-i-nauka/klub-mlodego-programisty-dolacz-do-warsztatow-programowania-online>

<https://www.gov.pl/web/edukacja-i-nauka/ogolnopolska-platforma-edukacyjna-navoica--sprawdz-oferte-bezplatnych-kursow-on-line>

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