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SUNRAISE - Stem UNlimited Raise thanks to Arts at School in Europe

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PR1: Analysis of the achievement of STEM skills in EU and the need for a more interactive approach

NATIONAL REPORT POLAND

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1. GENERAL INFORMATION

(about the country according to the latest statistics available (population, education system, number of schools and students)

Population in Poland: 38 million people

1.1. Education system in Poland

Education in Poland is compulsory from 7 to 18 years of age. Education is free and available to all residents. The majority of educational institutions are public.

Polish educational system is in constant change. Assessed as successful lower secondary schools (junior high schools) were abolished by law and in 2017 the compulsory 8-year primary school was reintroduced in Poland. Then, optionally, it was possible to continue education in a 4-year high school or a 5-year technical school or 2 to 3 years of vocational school.

The core curriculum is updated according to the regulations of the Ministry of National Education and includes changes introduced as a result of the 2017 reform.

The following subjects are taught in the four-year general upper secondary school and the five-year technical upper secondary school: Polish language; modern foreign language; philosophy; Latin language and ancient culture; music; history of music; dance history; plastic arts; history of art; history and modern times; Citizenship education; geography; basics of entrepreneurship; biology; chemistry; physics; maths; Informatics; physical education; education for safety; education for family life; ethics; language of a national or ethnic minority; regional language – Kashubian. Religious education is also taught in the school, either by priests or by catechists.

For each subject, there is a teaching framework that the teacher should implement at a given stage of education.

Education system in 2022

• primary schools	14 144
• lower secondary schools – terminated in 2016	(7 465)
• secondary schools	6 678
• post-secondary schools	1 357
• Higher education institutions	347

Students

• at primary schools	376 000
• at secondary schools	1 547 500
• at post-secondary schools	232 700
• Students at Higher education institutions	1 218 200

1.2. Education of persons with special educational needs

• primary schools	151 354	(48 349 of which in special schools)
• special job-training schools	12 832	
• secondary schools	22 720	
• post-secondary schools	240	
Special education and care centres	**357**	
Residents in 2021	**10 439**	
of which		
- blind and sight impaired	349	
- deaf and hearing impaired	613	
- with impaired motor skills and with aphasia	211	
- with intellectual disability	6 062	
- at risk of social maladjustment	114	

Including special educational centres (in 2021 — 31 centres with 1376 places and 1076 residents

Plus:
Youth educational centres (94 Centres with 5156 available places, and 4020 residents)

Youth sociotherapy centres (83 Centres with 5295 available places, and 4266 residents)

Rehabilitation and education centres (188 Centres with 6847 available places, and 6196 residents of which 2693 with a severe intellectual disablility, 3139 with multiple impairments)

Source: Mały Rocznik Statystyczny Polski 2022 (Concise Statistical Yearbook of Poland)[1].

1.3. Polish students performance according to PISA 2018 report

In Poland, the average performance in science of 15-year-olds is 511 points, compared to an average of 489 points in OECD countries. Girls perform better than boys with a non statistically significant difference of 0 points (OECD average: 2 points higher for girls).

The average difference between advantaged and disadvantaged students in reading is 90 points, compared to an average of 89 in OECD countries. However, 11% of disadvantaged students are academically resilient (OECD average: 11%).

Student performance in reading

The mean score in reading performance is one of the highest among PISA-participating countries and economies (512 PISA Score, rank 10/76, 2018).

Boys' performance in reading is one of the highest among PISA-participating countries and economies (495 PISA Score, rank 9/76, 2018).

Girls' performance in reading is one of the highest among PISA-participating countries and economies (528 PISA Score, rank 9/76, 2018).

[1] https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5515/1/24/1/maly_rocznik_statystyczny_polski_2022_12.07.2022.pdf

The percentage of low performers in reading (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies (14.7 %, rank 68/76, 2018).

The percentage of low-performing boys in reading (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies (19.7 %, rank 67/76, 2018).

The percentage of low-performing girls in reading (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies (9.6 %, rank 68/76, 2018).

Student performance in mathematics

The mean score in mathematics performance is one of the highest among PISA-participating countries and economies (516 PISA Score, rank 10/77, 2018).

Girls' performance in mathematics is one of the highest among PISA-participating countries and economies (515 PISA Score, rank 10/77, 2018).

The percentage of low performers in mathematics (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies (14.7 %, rank 69/77 , 2018).

The percentage of top performers in mathematics (proficiency Level 5 or 6) is one of the highest among PISA-participating countries and economies. (15.8 %, rank 10/77 , 2018)

The percentage of low-performing boys in mathematics (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies. (15.4 %, rank 69/77 , 2018)

The percentage of low-performing girls in mathematics (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies. (14.1 %, rank 69/77 , 2018)

The percentage of top-performing girls in mathematics (proficiency Level 5 or 6) is one of the highest among PISA-participating countries and economies. (14.7 %, rank 10/77 , 2018)

Student performance in science

Boys' performance in science is one of the highest among PISA-participating countries and economies. (511 PISA Score, rank 10/77, 2018)

The percentage of low performers in science (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies (13.8 %, rank 69/77, 2018).

The percentage of low-performing boys in science (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies (15 %, rank 69/77, 2018).

The percentage of low-performing girls in science (below proficiency Level 2) is one of the lowest among PISA-participating countries and economies (12.7 %, rank 68/77, 2018).

The change in science performance between 2015 and 2018 shows one of the strongest increases among PISA-participating countries and economies (10 PISA Score, rank 5/25, 2018).

Student performance

The percentage of low performers in all subjects (mathematics, reading and science) is one of the lowest among PISA-participating countries and economies (6.7 %, rank 69/76, 2018).

Participation in education

A small share of advantaged students in Poland have repeated a grade, compared to other countries and economies participating in PISA (0.7 %, rank 68/75, 2018).

Fields of education

The percentage of 15 year-old students expecting to work as ICT professionals at age 30 is one of the largest among countries and economies participating in PISA (10 %, rank 3/78 , 2018).

The percentage of 15 year-old boys expecting to work as ICT professionals at age 30 is one of the largest among countries and economies participating in PISA (18.9 %, rank 1/78 , 2018).

Source: https://gpseducation.oecd.org/CountryProfile?primaryCountry=POL&treshold=10&topic=PI

However, as in other countries, there are differences in the level of education between regions of Poland. Orange Foundation report "Social and digital exclusion in Poland. State of the phenomenon, trends, recommendations" describes inequalities in access to the Internet and how the level of digital skills and motivation to use digital tools lead to the diversification of life chances of Poles. The study shows that currently exclusion is more related to attitudes towards new technologies, skills and knowledge about technological possibilities than to physical access to the network. Territorial differences in the intensity of using the Internet are still significant, even though many people have entered the digital world more courageously during the pandemic.

Source: Wykluczenie społeczno-cyfrowe w Polsce. Stan zjawiska, trendy, rekomendacje. Fundacja Orange, 2021. https://fundacja.orange.pl/strefa-wiedzy/badania-raporty

2. INVESTMENTS IN SCHOOL INNOVATIONS

In the early 21st century a rapid development of ICT services and electronical devices took place, in which the Internet servers multiplied by a factor of 1000 to 395 million and its constantly increasing. On 21 December 2001, the United Nations General Assembly approved Resolution 56/183, endorsing the holding of the World Summit on the Information Society (WSIS) to discuss the opportunities and challenges facing today's information society. According to this resolution, the General Assembly related the Summit to the United Nations Millennium Declaration's goal of implementing ICT to achieve Millennium Development Goals. The United Nations Educational, Scientific and Cultural Organisation (UNESCO), a division of the United Nations, has also made integrating ICT into education as part of its efforts to ensure equity and access to education.

The European Commission, issuing the "Information Society for All" (European Commission, 2000, 2004), emphasized the need to bring every company, school, home and citizen to digital age. Also national programs for Information for All have been issued.

Among the number of European Commission acts devoted to ICT and education the one issued in 2017 refers to "Strengthening European Identity through Education and Culture". The Digital Education Action Plan follows up on that political agreement.

Sources: https://digitallibrary.un.org/record/455403 https://digitallibrary.un.org/record/425914?ln=en https://commission.europa.eu/about-european-commission/departments-and-executive-agencies/education-youth-sport-and-culture_en

2. 1. Some programs supporting digital education in Poland

The "Digital School" (Cyfrowa szkoła) program. This program was of a pilot nature and was implemented in the period: April 2012 - August 2013. Financed by central budget (50 mln PLN) and regional budgets (11 mln PLN)

The program gave an opportunity to **500 schools to get acquainted with new solutions in the field of technology** and thus influenced the change of work styles in and outside the classroom. Lessons have become more interesting, more modern and thanks to this they better fit into the modern, young, digital world of the student.

Project e-handbook (E-podręczniki) has made **62 textbooks and 2,500** other digital educational materials available in digital form. Implementation period 2012-2015, Cost approx. PLN 50 million.

Project "Scholaris" for teachers offered among others portal www.scholaris.pl (which doesn't work any longer) and introduced an **electronic grade book to schools.** Implementation period 2009-2013, Cost of this project ca 15 mln PLN.

Project Nationwide Educational Network (Ogólnopolska Sieć Edukacyjna) announced in 2017 to celebrate the 100th anniversary of Poland regaining its independence. The goal was to give all schools access to a network with a capacity of 100 Mega. Project cost 895 mln PLN.

Source: Cyfryzacja szkół. Informacja o wynikach kontroli. Najwyższa Izba Kontroli, 2016, Nr ewid. 62/2017/P/16/025/KNO oraz Ustawa z dnia 27 października 2017 r. o Ogólnopolskiej Sieci Edukacyjnej. Dz.U. 2017 poz. 2184 http://archiwum.mc.gov.pl/aktualnosci/rada-ministrow-przyjela-projekt-ustawy-o-ogolnopolskiej-sieci-edukacyjnej-przedlozony

Currently implemented project "Laboratories of the future" (Laboratoria Przyszłości) – an initiative addressed to primary schools and general art schools in 2022. Cost of 1 billion PLN.

Its main goal is **to build creative and technical competences among students in the STEAM (STREAM**) area. As part of the Program, schools can obtain financial support for the purchase of technical equipment necessary for the development of practical skills of children and youth.

Source: https://www.laboratoriaprzyszlosci.edu.pl/ and https://www.gov.pl/web/laboratoria

2. 2. Support to students and teachers during COVID-19 pandemic time

During the recent changes in education caused by COVID restrictions, education around the world, including Poland, has changed dramatically. Teachers and students had to learn new teaching methods - distance learning. It became obvious that the needs of students and teachers for hardware, software and high-speed connectivity increased dramatically. One computer for the needs of the family was no longer enough. That is why the Ministry of National Education has created a program to support teachers in purchasing computers for distance learning.

In September 2020, the European Commission outlined its renewed vision for the European Education Area and the concrete actions to achieve it by 2025. Schools are a focus area for cooperation to make the European Education Area a reality, to support Europe's recovery from the COVID-19 pandemic.

2.1. Support offered in Poland to teachers forced to distance education:

During the pandemic, when lessons in schools were suspended, many institutions took care of supporting distance education. Here are some initiatives, including those that support STEM learning.

In 2020, the project "Lesson: Enter" (Lekcja Enter) was introduced. It was financed by the EU funds and implemented by entities selected in the competition: the Orange Foundation, the Information Society Development Foundation and the Institute of Public Affairs. **Over 75,000 trained teachers**.

In 2020 was made available NAVOICA, a nationwide educational platform offering **free online courses** of the MOOC type (Massive Open Online Courses) implemented by universities and educational institutions. It is still available at https://navoica.pl/. The platform was commissioned by the Ministry of Science and Higher Education as part of the "Polish MOOC" project. The name of the website comes from a girl named Nawojka - according to legend, the first Polish girl-student. The platform was addressed to everyone who wanted to develop and expand their knowledge. The materials available on the website can be particularly useful for students and teachers for distance learning.

In 2020, Polish Radio for Children offered help in teaching. The schedule also includes special programs for parents and teachers. During the week, **over 100 premiere programs** were offered that could be used in remote education. These were mainly broadcasts for younger students. Among the broadcasts were addressed to "Little Scientists" twice a week. Lovers of discovery and experimentation were instructed to carry out the experiments proposed by the radio and make their own observations to understand physics, chemistry, mathematics and astronomy.

Weather lessons (Lekcje pogodowe) created by the Institute of Meteorology and Water Management. How are clouds formed? What is atmospheric pressure? What are the types of precipitation? These and many other questions about climate were discussed during the weather lesson. There are still available 21 lessons on Youtube, and the platform https://www.imgw.pl/instytut/edukacja .

"School with TVP" - a proposal for students of primary and secondary schools - emission of educational materials. Many of them were repetitions of previously prepared lessons, where the How it Works lessons, which introduced physics and chemistry, were particularly attractive. However, some the new hastily produced programs have been criticized as below standard.

Lessons from the Internet - a website of the Ministry of Education on the www.gov.pl/zdalnelekcje platform. (However, some of these spontaneous lectures were judged insufficient)

The following list of platforms supporting distance learning has been prepared for teachers' use

1. Epodreczniki.pl
2. Portal wiedzy dla nauczycieli
3. Strona Centralnej Komisji Egzaminacyjnej i komisji okręgowych
4. Podręcznik internetowy „Włącz Polskę!"
5. Portal lektury.gov.pl
6. Strona Centrum Nauki Kopernik:
7. Portale edukacyjne IPN: Portal edukacyjny Instytutu Pamięci Narodowej i Serwis IPN Przystanek historia
8. Strona Krajowego Biura Programu eTwinning
9. Serwis Ninateka
10. Serwis Muzykoteka Szkolna
11. Biblioteka Cyfrowa Polona
12. Biblioteka Cyfrowa Ośrodka Rozwoju Edukacji
13. Serwis Telewizji Polskiej
14. Serwis Polskie Radio Dzieciom

Particularly helpful for STEM education was portal 6 from the list above: https://www.kopernik.org.pl/e-kopernik

In 2022, the Ministry of Education decided to compensate teachers for expenses incurred from private funds during the pandemic when they used their own equipment to conduct distance lessons to students. From the budget of PLN 1 billion, each teacher could apply for **PLN 500 as a partial refund for equipment** purchased for teaching during the pandemic.

The positive result of the epidemic is the appreciation of information technology and its use. An example that shows how effectively ICT can be used in education is the Empiriusz tool created by Nowa Era and VULCAN, i.e. the largest edutech in Poland. This is the first virtual chemical laboratory in Poland and in Europe for grades 7 and 8 of primary schools. In the virtual laboratory, you can experiment with all kinds of reagents in a safe way. Empiriusz is ready for lessons as soon as the button is turned on. **https://biznes.newseria.pl/news/technologicznie-polskie,p984003041**

3. STEM, STEAM STREAM in Polish School Curricula

STEM – Science, Technology, Engineering, (Ecology) Math

STEAM – Science, Technology, Engineering, Art, Math

STREAM – Science, Technology, Robotics, Engineering, Art, Math

The STREAM model focuses not only on supporting science. In addition to mathematics and engineering, students broaden their knowledge of biology, computer science, programming, the use of new technologies in everyday life, appreciate the role of art and design as important components of the project. All this affects the acquisition of such skills as: the ability to think logically and creatively, develop computational thinking and the ability to cooperate in a team, which is very desirable by employers.

https://streamedukacja.pl/

Despite the good results of Polish students in STEM (PISA evaluation, awards in competitions), the number of hours devoted to teaching these subjects in the curriculum is minimal.

The only exception is math. The basic program established by the Ministry of Education includes:

- 105 hours (3 hours a week) during the 1st year of education,
- 140 hours (4 hours a week) during the 2nd year of education,
- 105 hours (3 hours a week) during the 3rd year of education,
- 108 hours (3 hours a week) during the 4th year of education,

The extended program established by the Ministry of Education includes:

- 140 hours (4 hours a week) during the 1st year of education,
- 175 hours (5 hours a week) during the 2nd year of education
- 175 hours (5 hours a week) during the 3rd year of education,

- 162 hours (5 hours a week) during the 4th year of education,

In the case of geography, physics, chemistry and biology, the core curriculum assumes that these subjects will be taught 1-2 hours a week. The school principal is responsible for setting the timetable.

Source: ROZPORZĄDZENIE MINISTRA EDUKACJI NARODOWEJ z dnia 30 stycznia 2018 r. w sprawie podstawy programowej kształcenia ogólnego dla liceum ogólnokształcącego, technikum oraz branżowej szkoły II stopnia. Dz.U. 2018 poz. 467

3. 1. Out of school support for STEM education

Kangourou Sans Frontières - Kangur matematyczny
Competition for students organized since 1990 in Australia, and internationally. Popular competition in Poland organized by Society for the Dissemination of Knowledge and Mathematical Sciences (Towarzystwo Upowszechniania Wiedzy i Nauk Matematycznych) with the seat at the Nicholas Copernicus University in Toruń.
Over 4 million students from 37 countries take part in the annual competition, including over 400,000 in Poland.

Nationwide Physics Competition Lion Cub (**Lwiątko**) – competition in physics for students of primary schools (only 7th and 8th grade), junior high and high schools. The Lion Cub competition is modeled on the Mathematical Kangaroo competition. It was initiated in 2001 by the teachers of the Lviv Academic Lyceum. Poland joined the competition in 2003. This event is organized by teachers from High School No. 5 in Krakow.

International Young Physicists' Tournament, IYPT The competition was initiated by a Russian scientist in 1979. Poland joined the campaign in 1989. Each country selects its own team (after national qualifiers) which takes part in the international competition. By 2022, Polish students have won 5 gold, 6 silver and 3 bronze medals, which places them in 4th place.

A square (mPotęga) by mBank

mPotęga is the main grant program of mBank, organized since 2014 to break the spell of mathematics and encourage children and youth to explore this science. 1.1 thousand projects have already been co-financed!

mBank's free book Mathematics is everywhere

#HackEdu as part of HackYeah! powered by GovTech HackYeah! is a hackathon co-organized by the Centrum Govtech at the Chancellery of the Prime Minister for seven years, which was one of the first to encourage state institutions to participate. During the event, within the set time, the participants jointly created innovative technological solutions. In **November 2022, #HackEdu** was a special edition dedicated to last year students from primary schools from all over Poland. The task was for students to create a project of their dream lesson using equipment from the Future Laboratories equipment catalogue. Ideas could be submitted in four areas**: exact sciences (mathematics, physics)** foreign languages (selected foreign languages) humanities (Polish, WOS, history) **natural sciences (biology, geography, chemistry)**

Source: https://www.gov.pl/web/laboratoria/wyzwanie-hackedu-rozstrzygniete

How it's working? – Polish popular science program broadcast on TVP1 from September 10, 2011 to June 10, 2018, hosted by a journalist with education at the Faculty of Electronics and Information Technology Radosław Brzózka. 159 presentations were prepared. In each episode, the principles of operation of popular devices, such as a refrigerator, microwave oven or camera, were presented, as well as general phenomena

such as sound, electricity or thunderstorms. In addition, the episode contained suggestions for experiments that you can do yourself at home and a puzzle for viewers.

4. STUDENTS WITH SPECIAL EDUCATIONAL NEEDS

There are 2 million students with special educational needs in Poland. There are, on average, eight students for every 25-person class. These students require an individualized approach to teaching and emotional development support. The expert points out that the Alpha generation born after 2010, which has already entered primary schools, is a generation of growing neurodiversity. Students need individualization, empathy and a diverse approach to teaching. This is where digital technologies, when properly used, help.

Source: https://biznes.newseria.pl/news/technologicznie-polskie,p984003041

Unfortunately, the support given to students with SEN is far from sufficient. Polish schools do not have enough teachers to teach classes in overcrowded classrooms. Most students take advantage of paid tutoring. Nevertheless, students who need support can benefit from individual home lessons.

With an insufficient number of teachers and psychologists, there is no support for students with more serious health problems. In some cases, special schools may be the solution.
The school for the blind in Laski near Warsaw, founded in 1921 by the blind Countess Róża Czacka (who founded the Society for the Care of the Blind in Warsaw in 1911), enjoys particular recognition. It is a complex offering education tailored to the abilities of individual students, at all stages of education. The comprehensive care provided prepares graduates for independent living and working.
An example of a center that takes care of students with hearing impairment is the oldest and best-known center in Bydgoszcz. The school was founded in 1871. Students were prepared mainly for useful professions. The first exams took place in May 1999. Currently, some of the graduates of this school are studying at universities in Bydgoszcz.
For students with mental disabilities, training is mainly organized to help them find a job. An example is the Kuyavian-Pomeranian Special School and Educational Center in Toruń. The school opened in 1964 as a primary school, but a vocational school was added in 1971. Initially, vocational training was offered there: tailoring and locksmithing. In the following years, further fields of vocational education were developed, such as cook, wallpaperer and green area restorer.
We do not have a well-recognized situation in STEM education for people with SEN. In a technical school for people with disabilities, STEM education is at a low level. Only math is at the high school level. There are no guidelines for teaching in the field of Geography, Biology, Physics, Chemistry. In a technical school for people with disabilities, STEM education is at a low level. Only math is at the high school level. There are no guidelines for teaching subjects in the field of geography, biology, physics and chemistry, apart from the general information that all of them can be taught 3 hours a week in accordance with the decision of the school head in consultation with the interested parties.

However, it is obligatory to allocate at least 8 hours a week of revalidation classes for disabled students in a special school. And in the integration class - 2 hours of revalidation classes per student.

The standard program established by the Ministry of Education for general high school (liceum) includes:

Mathematics:

1st year - 3 hours a week; 2nd year - 4 hours a week; 3rd year - 3 hours a week; 4th year - 4 hours a week

Fizyka

1st year - 1 hour a week; 2nd year - 1 hour a week; 3rd year - 2 hours a week; 4th year – no lessons

Chemistry

1st year - 1 hour a week; 2nd year - 2 hours a week; 3rd year - 1 hour a week; 4th year – no lessons

Biology

1st year - 1 hour a week; 2nd year - 2 hours a week; 3rd year - 1 hour a week; 4th year – no lessons

Geography

1st year - 1 hour a week; 2nd year - 2 hours a week; 3rd year - 1 hour a week; 4th year – no lessons

Lp.	Obowiązkowe zajęcia edukacyjne i zajęcia z wychowawcą	Tygodniowy wymiar godzin w klasie				Razem w czteroletnim okresie nauczania
		I	II	III	IV	
		Zakres podstawowy				
1.	Język polski	4	4	4	4	**16**
2.	Język obcy nowożytny	3	3	3	3	**12**
3.	Drugi język obcy nowożytny	2	2	2	2	**8**
		+ 3[1)]	+ 3[1)]	+ 3[1)]	+ 2[1)]	**+ 11[1)]**
4.	Filozofia lub plastyka, lub muzyka, lub język łaciński i kultura antyczna[2)]	1	–	–	–	**1**
5.	Historia	2	2	2	1[3)]	**7**
6.	Historia i teraźniejszość	2	1	–	–	**3**
7.	Podstawy przedsiębiorczości	–	1	1	–	**2**
8.	Geografia	1	2	1	–	**4**
9.	Biologia	1	2	1	–	**4**
10.	Chemia	1	2	1	–	**4**
11.	Fizyka	1	1	2	–	**4**
12.	Matematyka	3	4	3	4	**14**
13.	Informatyka	1	1	1	–	**3**
14.	Wychowanie fizyczne	3	3	3	3	**12**
15.	Edukacja dla bezpieczeństwa	1	–	–	–	**1**
16.	Zajęcia z wychowawcą	1	1	1	1	**4**
Razem przedmioty w zakresie podstawowym i zajęcia z wychowawcą		**27 + 3[1)]**	**29 + 3[1)]**	**25 + 3[1)]**	**18 + 2[1)]**	**99 + 11[1)]**
Przedmioty w zakresie rozszerzonym		4	5	7	6	**22**
Razem obowiązkowe zajęcia edukacyjne i zajęcia z wychowawcą		**31 + 3[1)]**	**34 + 3[1)]**	**32 + 3[1)]**	**24 + 2[1)]**	**121 + 11[1)]**
Godziny do dyspozycji dyrektora szkoły		3				**3**
Ogółem		**124 + 11[1)]**				
Religia/etyka[4)]						
Wychowanie do życia w rodzinie[5)]						
Język mniejszości narodowej / język mniejszości etnicznej / język regionalny / własna historia i kultura[6)]						
Geografia państwa, z którego obszarem kulturowym utożsamia się mniejszość narodowa[7)]						
Zajęcia sportowe[8)]						
Dodatkowe zajęcia edukacyjne[9)]						
Język migowy[9)]						
Zajęcia z zakresu pomocy psychologiczno-pedagogicznej[10)]						

Source: Ramowy plan nauczania dla liceum ogólnokształcącego, w tym liceum ogólnokształcącego specjalnego dla uczniów w normie intelektualnej: niepełnosprawnych, niedostosowanych społecznie oraz zagrożonych niedostosowaniem społecznym. Dziennik Ustaw - rok 2022 poz. 658, Załącznik 1.

https://www.infor.pl/akt-prawny/DZU.2022.082.0000658,metryka,rozporzadzenie-ministra-edukacji-i-nauki-zmieniajace-rozporzadzenie-w-sprawie-ramowych-planow-nauczania-dla-publicznych-szkol.html

The standard program established by the Ministry of Education for technical secondary school (technikum) for students with disabilities includes:

Lp.	Obowiązkowe zajęcia edukacyjne i zajęcia z wychowawcą	Tygodniowy wymiar godzin w klasie					Razem w pięcioletnim okresie nauczania
		I	II	III	IV	V	
		Zakres podstawowy					
1.	Język polski	3	3	3	3	4[1)]	**16**
2.	Język obcy nowożytny	2	2	2	3	3[1)]	**12**
3.	Drugi język obcy nowożytny	2 + 2[2)]	2 + 2[2)]	2 + 2[2)]	1 + 2[2)]	1[1)] + 2[1), 2)]	**8 + 10[2)]**
4.	Filozofia lub plastyka, lub muzyka, lub język łaciński i kultura antyczna[3)]	1	–	–	–	–	**1**
5.	Historia	2	2	1	1	1[4)]	**7**
6.	Historia i teraźniejszość	1	1	1	–	–	**3**
7.	Podstawy przedsiębiorczości	–	1	1	–	–	**2**
8.	Geografia[5)]					–	**16**
9.	Biologia[5)]					–	
10.	Chemia[5)]					–	
11.	Fizyka[5)]					–	
12.	Matematyka	2	2	3	3	4[1)]	**14**
13.	Informatyka	1	1	1	–	–	**3**
14.	Wychowanie fizyczne	3	3	3	3	3	**15**
15.	Edukacja dla bezpieczeństwa	1	–	–	–	–	**1**
16.	Zajęcia z wychowawcą	1	1	1	1	1	**5**
Razem przedmioty w zakresie podstawowym i zajęcia z wychowawcą		**23 + 2[2)]**	**22 + 2[2)]**	**22 + 2[2)]**	**19 + 2[2)]**	**17 + 2[1), 2)]**	**103 + 10[2)]**
Przedmioty w zakresie rozszerzonym		1	1	2	2	2[1)]	**8**
Kształcenie zawodowe[6)]		11	13	12	13	7[1)]	**56**
Razem obowiązkowe zajęcia edukacyjne i zajęcia z wychowawcą		**35 + 2[2)]**	**36 + 2[2)]**	**36 + 2[2)]**	**34 + 2[2)]**	**26 + 2[1), 2)]**	**167 + 10[2)]**
Godziny do dyspozycji dyrektora szkoły		4					**4**
Ogółem		**171 + 10[2)]**					
Religia/etyka[7)]							
Wychowanie do życia w rodzinie[8)]							
Język mniejszości narodowej / język mniejszości etnicznej / język regionalny / własna historia i kultura[9)]							
Geografia państwa, z którego obszarem kulturowym utożsamia się mniejszość narodowa[10)]							
Zajęcia sportowe[11)]							
Dodatkowe zajęcia edukacyjne[12)]							
Język migowy[12)]							

In a technical school for people with disabilities, STEM education is at a low level. Only math is at the high school level. There are no guidelines for teaching in the field of Geography, Biology, Physics, Chemistry, apart from the general information that all of them can be taught 3 hours a week in accordance with the decision of the school head in consultation with the interested parties.

However, it is obligatory to allocate at least 8 hours a week of revalidation classes for disabled students in a special school. And in the integration class - 2 hours of revalidation classes per student.

Source: Ramowy plan nauczania dla technikum, w tym technikum specjalnego dla uczniów w normie intelektualnej: niepełnosprawnych, niedostosowanych społecznie oraz zagrożonych niedostosowaniem społecznym. Dziennik Ustaw - rok 2022 poz. 658, Załącznik 2. https://www.infor.pl/akt-prawny/DZU.2022.082.0000658,metryka,rozporzadzenie-ministra-edukacji-i-nauki-zmieniajace-rozporzadzenie-w-sprawie-ramowych-planow-nauczania-dla-publicznych-szkol.html

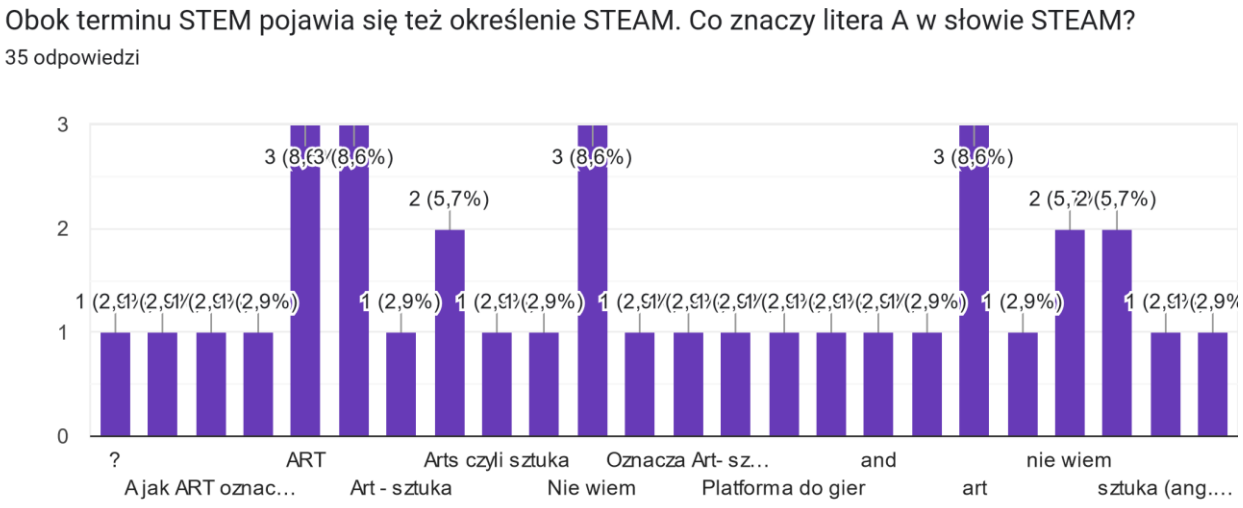
5. RESULTS FROM RESEARCH CARRIED OUT BY THE SUNRAISE PARTNERS – POLAND

We invited teachers from schools cooperating in various projects to participate in the survey. Unfortunately, in Poland it is difficult to persuade people to take part in surveys and not everyone responded. In this situation, using the addresses of schools that were previously invited by us to participate in conferences or other events, we sent an additional 250 requests to participate in an anonymous online survey. After a longer than planned time, 36 questionnaires were completed. Perhaps this is the result of the school environment being tired with the current situation. Because in Poland there are so-called School complexes, associating both secondary schools (previously also junior high schools), primary schools, and sometimes even kindergartens, some questionnaires were also completed by primary school teachers. Most of the respondents were employees of secondary schools (25), primary schools (7), universities (2), and non-governmental organizations (2). Half of them were teachers from the STEM group (physics, mathematics, computer science, chemistry).

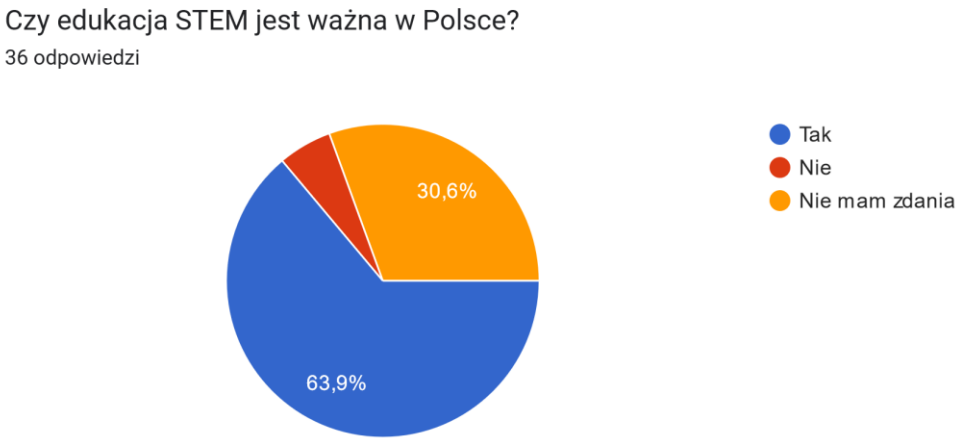
The file with the answers to the survey is attached to this report.

Of the 36 people who completed the online survey, 31 people answered the question of what the STEM acronym means, while 3 people replied that they had not come across the STEM acronym. Most respondents indicated that STEM covered subjects such as science, technology, engineering and mathematics. Other indicated subjects are: Economics (1), Ecology, Robotics.

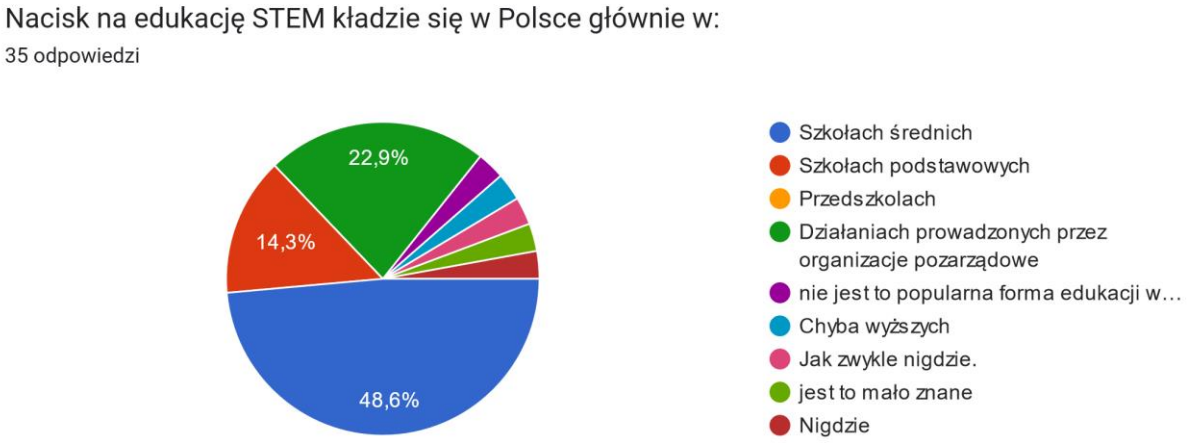
The answer to the question what the letter A stands for in the STEAM acronym, 11 people did not know the answer or gave the wrong answer, such as a gaming platform or and.



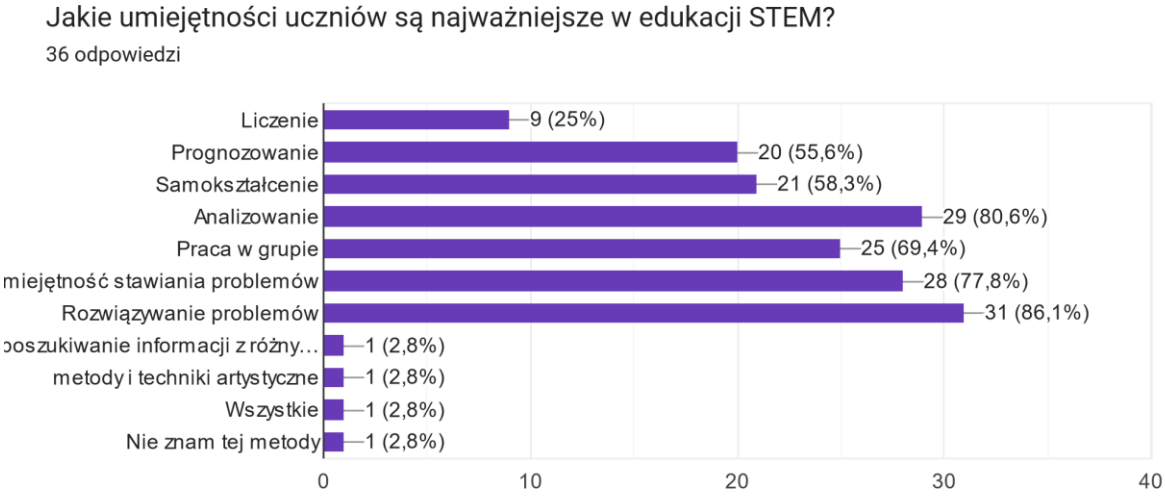
Answer to the question whether STEM education is important in Poland 23 (64%) of respondents believe that it is, 2 people think that it is not, and 11 have no opinion.



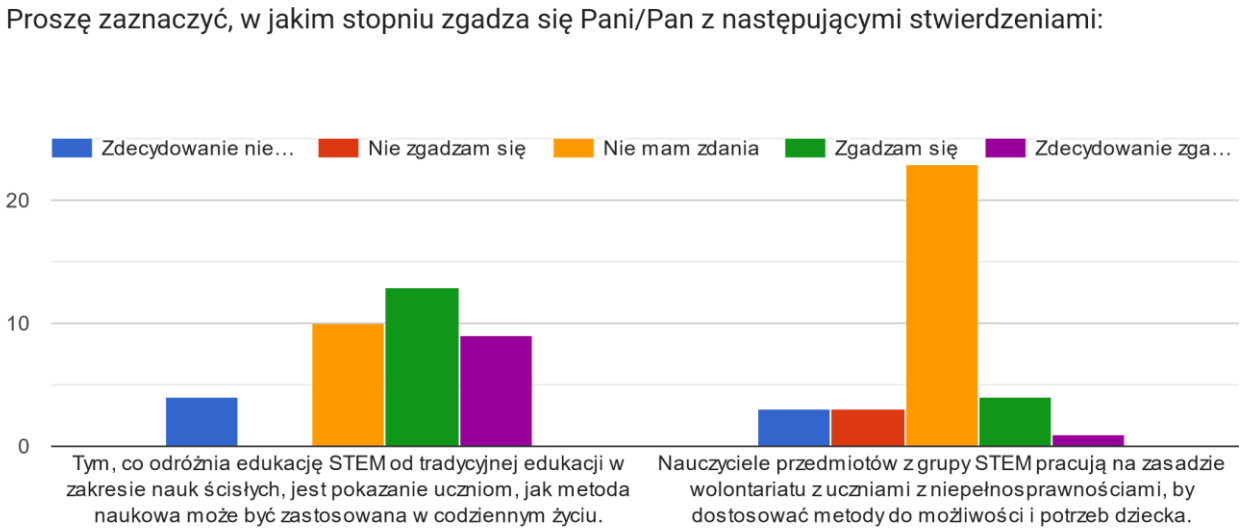
Respondents believe that the emphasis on STEM education in Poland is mainly in: secondary schools (17); activities organized by non-governmental organizations (8); primary schools (5). Others believe that nowhere, because it is little known.



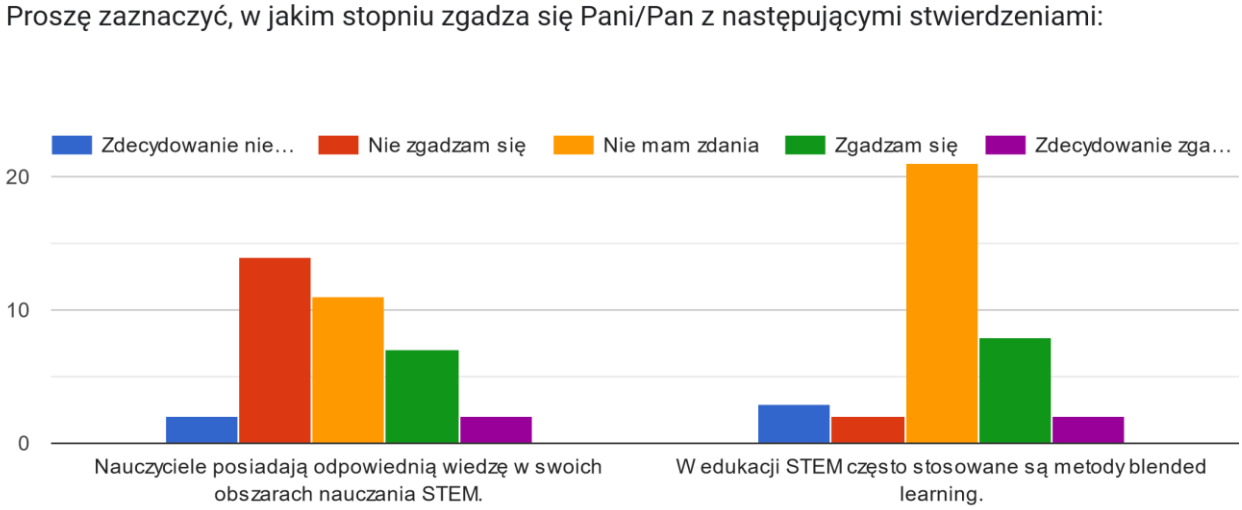
When determining the most important skills of students in STEM education, the respondents put the highest: Problem solving (31), Analyzing (29), Ability to identify problems (28), Teamwork (25). Only a few appreciated: artistic methods and techniques (1), searching for information in various fields of knowledge (1) and 9 people considered counting important. Several answers could be selected for this point.



Respondents don't know too much about teaching students with disabilities (23). 5 people believe that STEM teachers work with students with disabilities on a voluntary basis to adapt methods to their needs. On the other hand, 6 people believe that it is opposite (one person indicates that these are additionally paid activities).



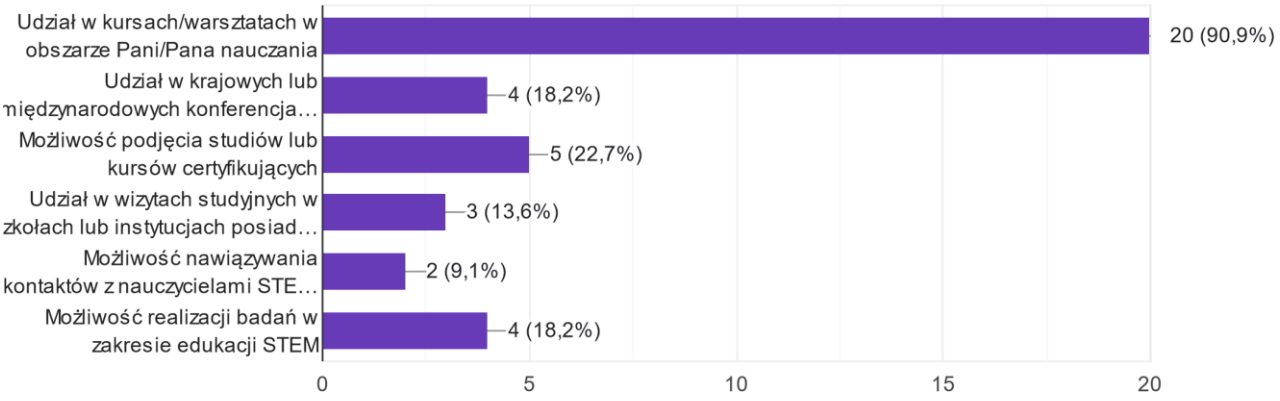
Surprisingly, only 9 people believe that teachers have adequate knowledge of the STEM subjects they teach. The rest either have no opinion (11) or believe that they or their colleagues do not have such knowledge.



Only 22 people answered the question about supporting their development by the employing institution. Most often, these were courses and workshops (20), the possibility of taking up studies or certification courses (5), participation in conferences (4), research opportunities (4) or study visits and contacts with other teachers (5).

Jakie są Pani/Pana doświadczenia z edukacją STEM? Proszę wybrać działania, w których pomogła szkoła czy instytucja, w której Pani/Pan jest zatrudniona/zatrudniony:

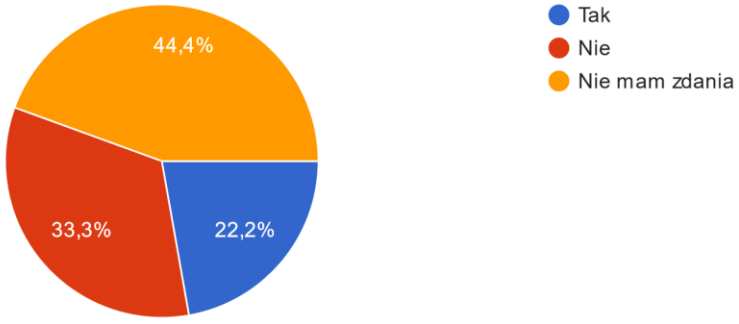
22 odpowiedzi



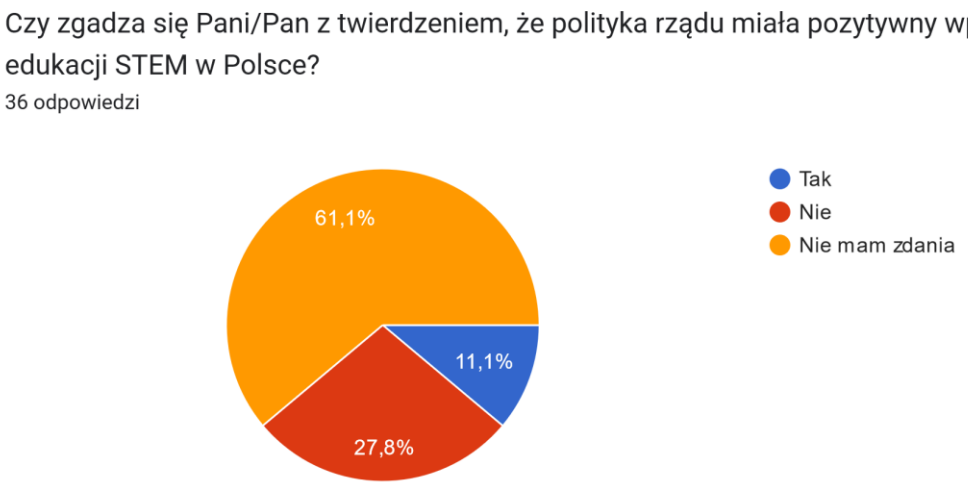
Only 8 people stated that they had the opportunity to introduce innovations in teaching the STEM subject, while 12 did not. The others had no opinion, because they probably taught other subjects, or as they stated at the beginning, they may not have known that their subject belongs to the STEM group.

Czy ma Pani/Pan możliwość tworzenia i stosowania innowacyjnych metod nauczania STEM w instytucji, w której Pani/Pan pracuje?

36 odpowiedzi



In the current situation in Poland, when education is under pressure and treated by the Ministry of Education as an indoctrination environment, only 4 people indicated that the government's actions support STEM education.



6. RESULTS OF THE FOCUS GROUP STUDIES - POLAND

In Poland, we invited two focus groups to participate in the SUNRAISE study. We wanted to obtain data from two perspectives - one from a group of teachers who implement the ideas of STEM education in school practice, and a group of educators and experts who promote STEM ideas to the general public. Both of these perspectives and roles are very important for the development of STEM education in Poland, as they complement each other. Unfortunately, not all of the people invited could attend the focus groups on the agreed dates. Therefore, the third attempt was to collect the addresses of other experts, including Scientix Ambassadors, and involve them individually in the research, first by sending prepared questionnaires, and then completing them in the form of an additional interview. Sending in an additional 20 requests to participate in the research helped only slightly increase the number of experts to twelve. After meetings with members of these two groups, it can be said that there is close cooperation - formal and informal between representatives of these groups, which is important for the forms and methods of STEM education in Poland.

The teachers perspective

The first focus group included teachers working in a secondary school (students aged 14-19) in Poland. The online meeting was organized on November 8, 2022 and was attended by teachers from the Road and Surveying and High School Team. August Witkowski in Jarosław (Zespół Szkół Drogowo-Geodezyjnych i Licealnych im. Augusta Witkowskiego w Jarosławiu). We asked for more teachers to participate, but only 4 people responsible for teaching mathematics and chemistry at school responded.

Since we received answers from primary schools at the survey stage, we also decided to conduct an in-depth interview with several primary school teachers to check what STEM education looks like in the entire Polish education system. They were people who knew each other, worked together and prepared students for the secondary school-leaving examination. They had different experiences, but similar career paths, especially thanks to the decisions of their headmasters. The headmaster ensures that each of them participates in similar courses and projects. Therefore, the important role of school leadership in formally integrating STEM education into the school curriculum and policy should be emphasized. This means that STEM education requires wisdom and sound decisions at both the individual school level and the ministry level.

The teachers presented their STEM teaching methods and tools used in the projects - mainly supported by modern information technologies. They usually used them in extracurricular activities, since STEM classes were optional. They support each other and help each other create STEM classes and activities. In this way, social and symbolic capital is created between teachers teaching STEM. This support is necessary because the preparation of STEM teaching materials is time-consuming and teachers in Poland have a heavy workload, so they require mutual assistance. The teacher also emphasized the support of school management in their innovative work.

Teachers point out the many benefits of STEM education for the student: teamwork competence, critical thinking, problem solving, creativity, critical analysis, initiative, communication and a large scale of digital competence. The student learns to design his tasks using the achievements of various fields of science. STEM education is certainly much more attractive to the student.

Students are satisfied with this STEM approach, they would like to have more STEM classes, but the teacher is obliged to complete the core curriculum of the subject to prepare them for final exams and get into a good university. They must treat the curriculum of the subject very literally, not creating their own original methods.

Educators highlight two major issues in STEM education. In order to teach STEM well, teaching infrastructure is important – this is often the biggest problem for schools. STEM education requires laboratories, computers, IT tools, computer programs to students for free.

A certain problem is the priorities of students' parents, who focus on passing the final exams and enrolling their child at the best university in Poland. Helping children discover new things is in the background. Parents engage in STEM education, but not before important dates in their children's school careers (not just before exams).

Expert perspective

The second focus group includes educators and experts specializing in STEM and STEAM education. The focus group was attended by Dr. Anna Beata Kwiatkowska, who is one of the most important figures in teaching computer science in Poland, Dr. Agata Karska, representing the National Children's Fund, and Prof. Joanna Kaługa-Przymus, member of the Polish Youth Academy.

Anna Beata Kwiatkowska also works as a teacher in one of the best Polish high schools - Akademickie Liceum Ogólnokształcące in Toruń. She is the founder of the IT Olympiad, the organizer of many editions of the "Computer Science in Education" Conference, nationwide computer science exams, co-organizer of the International IT Competition. She spoke about the possibilities of teaching computer science in Poland, pointing to the instability of the ministry's decisions.

Agata Karska describes the activities of the Polish Children's Fund, which is one of the oldest Polish non-governmental organizations that helps talented young people develop their talents. They have been operating since 1983, organizing free workshops, interdisciplinary camps, scientific internships, concerts and exhibitions for the most talented students from all over Poland, interested in developing their passions and interests. All educators in this association are volunteers - they teach students during summer camps. The organization helps students with experimentation, improvisation and critical thinking skills, emphasizing the importance of teamwork and intellectual courage of young people. All teachers are very innovative, not only in STEM subjects.

Actions for the environment of young scientists were presented by prof. Joanna Kaługa-Przymus, member of the Polish Youth Academy. They organize and co-organize scientific conferences, take patronage over

scientific events and popularize science. Their flagship project for high school and university students is Become a Scientist!

All experts pointed to the difficulties encountered in proposing and implementing STEAM activities. Among the main problems they indicated:

- Lack of funds for additional school and teacher activities to improve and implement STEM education;
- Overburdening teachers with curricular work and bureaucracy in schools;
- Lack of interest from parents who studied in traditional schools and do not always understand the value of STEM, treating it not as science, but simply fun;
- Very low participation of women in computer science, technical sciences and experimental sciences;
- Lack of state policy in the field of STEM education.

Among the experts of the second round, we obtained the opinion of Rafał Lew Starowicz Vice-president of the Polish EdTech foundation. In 2016-2021, he was the deputy director of the department implementing textbooks and innovations at the Ministry of Education. Polish delegate to the OECD Educational Policy Committee, expert of the European Commission Agency: Research Executive Agency, Innovation and Networks Executive Agency. Member of the Media Pedagogy Team at the Committee on Education Studies of the Polish Academy of Sciences. According to him all initiatives introducing the project method and supporting cross-curricular education deserve attention. In this respect, STEAM is a coherent concept rooted in scientific research and many years of methodological practice. In his opinion, this method should be recommended at every educational stage. He sees the STEM/STEAM approach as a paradigm shift that prioritizes developing student curiosity, experimenting and achieving results by actively involving students in the learning process. He also sees plenty of evidence that STEAM helps students come up with their own innovative solutions to everyday problems, engage in creative problem solving, and increase students' intrinsic motivation, which is especially desirable.

The second person asked for her opinion about STEM education was a student. She participated in our virtual exhibition project a few years ago. We worked with her when she was a student of an academic gymnasium, repeatedly rated as the best in Poland. As an outstanding person, she continued her studies at an English high school. She is currently finishing her studies at Cambridge University. Apart from that she is Co-Founder at The Neurodiverse - a social initiative aimed at raising awareness about neurodiversity in Poland, which reached over 400 000 people within the first year of its existence. She is a member of Polish Educational Society in Cambridge, took part in Summer Intern at the Polish Ministry of Education, as well as at Legislative Intership at the U.S. House of Representatives. She has learnt sign language. Since this is an opinion seen from the other side of the teaching process, we quote her statement in the original.

> *"Given the centrality of STEM subjects in today's technology-given economy, access to good-quality STEM education has the potential to determine future economic and career status. For example, ability grouping was a common practice at my school: students who were labelled as being good at a STEM subject, such as maths, would be put in a different class than their peers labelled as being less skilled. While in theory being a good way of supporting students' interests, this practice is problematic for a couple of reasons. Mainly, it does not account for the fact that students arrive in secondary education already with a baggage of experience (both from home and previous educational institutions). Consider a child who was very passionate about science at age 5, but didn't have access to resources allowing him/her to develop those passions due to socioeconomic reasons (e.g. lack of exposure to scientific resources such as books, museums, etc.). By age 15, he/she will likely lag behind peers who had the chance to develop those skills and - due to ability grouping - her/his further STEM development at a secondary level is unlikely to take place.*

This phenomenon is further exacerbated by the so-called profilowanie (tracking), another common practice in Polish secondary education: the process of organising education around a predetermined profil (e.g. a maths-physics track, a bio-chemistry track, a humanistic track). Here again, the idea is not inherently flawed: profilowanie can in theory support students' individual interests. In my experience, however, the practice lacked flexibility and therefore did not grant equitable access to STEM education. For instance, at 16 I was interested in both History and Maths/Science, but the profilowanie practice did not allow me to pursue both. I ended up in a humanistic track with very few hours of science and maths and therefore had to end my STEM "career" at that stage. Note that there are educational systems (e.g. British A-Level or International Baccalaureate) where students can explore both STEM and non-STEM subjects at the same time.

I see two main solutions to the issues discussed:

- *Holistic approach starting in early education, as to avoid gaps in students' "abilities" (determined largely by exposure to resources) by the time they reach secondary education. Example: invest in programs popularising STEM education in pre-school/elementary schools in areas that are likely to lack access to it (rural, post-industrial).*
- *Find a balance between allowing students to follow their interests through tracking/ability grouping and a flexible system where students with a diverse range of abilities and interests can learn together and from one another. Example: allow for movements between profile; limit ability grouping to minimum and replace it with a universal design for learning approach."*

Zuzanna Campalastri de domo Kotrych.

7. SUMMARY

The conducted research confirmed the fact that Poles are reluctant to complete questionnaires. This is probably due to fatigue with the situation when, right after the crisis of interpersonal contacts caused by the COVID-19 pandemic, we feel the effects of the war in Ukraine. In addition, the economic crisis and inflation also reduce well-being.

Polish schools, despite some investments in infrastructure, are subject to constant changes. The current government team has made many changes over the last seven years, which the community evaluates negatively. Gymnasiums, thanks to which students from smaller towns had a chance for a higher level of education, were abolished. The education system from the times of the People's Republic of Poland was restored in this place. In the core curriculum, established by the Ministry of Education, more emphasis is placed on history and less on STEM subjects, where only Mathematics, which is a compulsory subject in the final exam, is taught for more hours. Not all teachers who completed the anonymous surveys had knowledge of STEM education.

Surprisingly, the research shows that Polish students do quite well in STEM subjects, as evidenced by the results in international competitions, and above all PISA ratings.

A special issue is the education of students with disabilities. This fact has not been fully recognized. We generally know that the situation of people with disabilities in Poland is very difficult and will probably be even more difficult. Latest information from the debate "Inclusive education: a new quality in the development of the Polish education system. Implementation - barriers - effect" show that about 70 percent of children and students with a statement of special educational needs due to a disability attend kindergartens and schools. To a large extent, this is the result of recent events (pandemic and war in Ukraine) that are beyond the emotional capabilities of children. They have depression and anxiety disorders. There

are not enough psychologists, educators or psychiatrists to support these students. Many of them will require home education. Especially in the case of autistic children or those with Asperger's syndrome.

So maybe the modules supporting the teaching of STEAM subjects prepared in the SUNRAISE project will be of some help to students with special needs and their teachers.

8. APPENDICES

- Full responses to the survey.