Co-funded by the
Erasmus+ Programme
of the European Union

NGSS

National Report

POLAND

Project Information

Project acronym	NGSS
Project title	**Next Generation Science Standards through STEAM**
Authoring partner	DANMAR COMPUTERS
Date of preparation	July 2021

Document History

Date	**Version**	**Author**	**Description**
20/07/2021	1		National Report Template

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1. Introduction

1.1 Context of the National Report

This report presents the current situation regarding the STEM and STEAM approach in Poland. In order to identify the presence of specific elements of this approach in Poland education we combined empirical research with desk research. The activity was carried out in the context of the NGSS Erasmus+ project, for the completion of IO1 (Concept Paper). For this, we resorted to the analysis of the curriculum for primary and preschool education and of the studies carried out in our country regarding the approach of STEM and STEAM in Polish schools. Last but not least, we conducted a focus group research with teachers, Science and Arts specialists and parents, in order to achieve the below objectives.

1.2 Objectives of the study:

O1. Identifying teachers, education stakeholders, parents and STEAM professional opinions related to STEAM implementation (good practices, difficulties, strengths, effects) in their region and the value of STEM+Arts education in increasing the motivation and participation of young girls in science education and careers.
O2. Identifying parent`s perceptions of gender differences in their children's play and/or school activities and
O3. Identifying teachers training needs;
O4. Identifying criteria for good practices from the teacher`s perspectives.
O5. Offer a background in the development of the NGSS teaching resources for preprimary and primary school teachers .

2. Methodology

2.1 Methodes

The reserch methodology combined file research (the Focus Group Interviews) and desk research.

In Poland in May 2021, two focus groups were conducted. The focus groups consisted of: 1) teachers group (teachers from primary and preschool education); 2) STEAM professionals group; and 3) parents group.

Due to COVID-19 pandemic restrictions, the focus groups were conducted online using the ZOOM platform. Each focus group meeting lasted approximately 1.5h. Interviews were

conducted according to a pre-created schedule. At the beginning of each interview, the moderators introduced themselves, presented the aim and objectives of the project and asked the participants if they agreed to use the data of the participants in the context of the project, after which they invited to watch a short presentation. During the presentation, the moderators asked pre-prepared questions that will be presented in the next section. These questions were designed to identify knowledge about STEM and STEAM as well as the differences between them, difficulties that teachers encountered or think they will encounter in implementing this teaching approach, how these difficulties were overcome, what kind of support they received/should receive in implementing STEM/STEAM, identify the impact of STEM teaching on children, and identify the kinds of strategies that could motivate students to engage in STEM / STEAM lessons as well as training needs in this area.

2.2.Study population and samples:

A) **Study population:**

We managed to form the following groups:
i) Professional teachers: Professional teachers were representative of all areas in Poland (urban or rural environments, disadvantaged environments, etc.). There were also representatives from both the Primary and Pre-primary (Preschool) education sector.
ii) Student-teachers in their final year of studies. These student teachers have completed three levels of teaching practice at schools, so they were already building their experience in dealing with curriculum subjects and classroom implementations.
iii) Parents from a variety of backgrounds
iv) STEM professionals and
v) Artists.

B) Samples

The following groups were formed for the interviews:

1) TEACHERS group (primary school and preschool teachers from Zespół Szkół w Głogowie Małopolskim, Jan Twardowski elementary school in Nowa Wieś and School Complex in Wyżne); in total 15 female and 4 male participants, 10 pre-school teachers and 9 primary school teachers. The average age of this sample is 35 years. The average work experience (in the educational field) for this sample is eleven years.

2) Student-teachers in their final year of studies: 13 Student-teachers, in their final year, coming from a variety of backgrounds, 10 female and 3 male participants, 21-41 year old (the sample included a mature student)
3) Parents from a variety of backgrounds: 11 parents from a variety of backgrounds (4 females and 7 males)
4) STEM professionals: 4 professionals (2 Females and 2 Male)
5) Artists: 4 Artists (2 Females and 2 Males); Musician, Graphic designer, Painter and Actor.

3. Results

3.1 Focus group inteviews results

3.1.1. The sinthesis of the participants answers:

- What kind of experience the teachers and STEAM professionals had with STEAM approach; what do they know about STEM / STEAM

Most of the teachers and STEAM specialists are aware of what STEAM is but only some have experience in implementing STEAM in education. All participants admitted that in Poland they hear more and more about STEAM but few have experience in this field. In general, most of the focus group participants admitted that they do not have much experience when it comes to teaching STEM subjects through arts. Some admitted that they are not experienced in teaching STEM in general. Teachers are aware that arts can be very helpful not only in developing creativity but also in contributing to a better understanding of the world and society. In conclusion, STEAM specialists have a lot of knowledge about STEAM, but teachers, although they have heard about the concept, are not really aware of how it works and how they can use it in education.

- If the STEAM professionals are aware of the possibility of teaching / approaching science and/or art in an integrated way (trans- and interdisciplinary) (see the answers to questions C1 and C2)

STEM professionals know exactly what STEM is and how to teach STEM subjects through the arts. Most of the participants admitted that they know that this approach can be used in education but they don't know quite how to implement it.

- What difficulties **they faced/they could face in implementing this approach** (difficulties related with their **infrastructure/logistics**, related with the framework provided by their national curriculum, **with the lesson plans design** etc.)

Teachers and students reported the following difficulties:

- Difficulty in arousing interest in children
- Difficulty in adapting to the level of all children
- Lack of adequate training and experience
- Lack of adequate resources to assist in implementing the STEAM approach.

- How did they overcame these difficulties; which were their strengths; what/who helped them; did they have any support from the policy makers/stakeholders etc.

Teachers admitted that there is no form of support from advisors and stakeholders, and all the knowledge they have about the STEAM approach comes only from their interest in the topic and deepening their knowledge on the topic through Open Educational Resources found on the Internet.

- Their own perceptions on **their readiness for the implementation of STEAM approach, their training needs (**especially regarding the use of methods and tools necessary for teaching STEAM).

Most of the participants admitted that they were not ready to teach STEAM in their classroom due to knowledge gaps. They admitted that they need more training and information about this approach to feel more confident in the field. Teachers acknowledge that they have significant training needs when it comes to this approach, including access to open source digital platforms and materials, mentoring, demonstration lessons, etc. They also agreed that there is a need to provide them with ready-to-use school projects that are related to STEAM topics. They also agreed that there is a need to provide them with ready-to-use school projects that are related to STEAM topics and that it would be helpful to have trainings and workshops where they can acquire the necessary knowledge to help them implement this approach at school.

- What are the **expectations related to the implementation of STEAM in their teaching**; what they consider to be the characteristics / attributes of a ”good practice” in STEAM education .

Teachers expect that the STEAM approach will enrich the curriculum and will be helpful in keeping teachers and children well connected. Through this approach, children will be able to become familiar with the digital world from an early age and also to enrich and develop their creativity. The STEAM approach will have a positive impact on children's knowledge and

social-emotional development. Through this approach children will be able to develop communication, teamwork, and increase self-esteem.

- Did they take the pupils` **social and emotional learning process** into account, while teaching STEAM or science lesson.

The process of social and emotional learning was considered by all teachers. According to the teachers, students who can express themselves have better self-esteem and are more confident. In addition, art develops creativity, empathy and cooperation between children.

- What is their perception on the **value of STEM+Arts education in increasing the motivation and participation of young girls** in STEM fields of study and careers.

Teachers and professionals believe that the STEAM approach makes a difference and is an opportunity for children to develop better, deepen their knowledge and be better prepared for their future profession.

- How did the STEAM professional manage to make STEM/STEAM more attractive to girls and disadvantaged students, and to get them become familiar with tools and other devices.

According to the participants, pupils should be introduced to this approach gradually, starting with simple exercises and gradually doing more difficult ones so that children feel safe and not demotivated.

- If parents have biased perceptions of gender differences in the use of toys, programs and activities specific to their children's age.

Regarding attitudes towards and interest in STEAM subjects, teachers admit that they see a difference in the preferences of boys and girls. According to the teachers, this is due to stereotypes as well as to the upbringing of children and the roles assigned to them by their environment.

- What are the parents perceptions on the value of Science and Art; If and how did they helped children understand it too.

Parents do not have much knowledge and experience when it comes to the STEAM approach. They admitted that through this focus group their curiosity about this approach was increased and they will deepen their knowledge so that their children will have more opportunities. According to them, the approach and the project that they had the opportunity to learn about is

very necessary and thanks to the STEAM approach children will be able to create new and innovative concepts and better express their ideas.

3.2 The conclusions of the Focus Groups Interviews

The Focus Group meeting and Inteviews was very fruitful. Despite various difficulties related to the COVID-19, the goal was achieved. The participants took an active part in the statements and in sharing their opinions and experiences. The answers collected are at the same time confirmation of some of the conclusions of Desk research, but also guidelines for the development of further results. In Poland there are many shortcomings in STEAM education in primary school. Teachers often do not have the knowledge, support and tools to change this.

4. Desk research results

The framework provided by the national curriculum for science education:

Education system in Poland

In Poland the education system is divided into stages. This study focuses on the preschool education stage (kindergarten), and the primary education (children at the age 7-15). The education system in Poland is based on a document prepared by the Polish Government (Ministry of Education) in 2017. The whole education system and school activities and programmes are based on that document. The paper is included in Journal of Laws of The Republic of Poland.

Preschool education

The aforementioned document includes the specific tasks of pre-primary educational institutions, along with the objectives and expected results of this stage of education. The very beginning of the paper indicates the importance of exploring a child's abilities and gaining experience. The tasks of the institution (kindergarten), also highlight the importance of the cognitive aspect of a child's behaviour. In the document one reads that the kindergarten shall take care of the proper space and conditions which will encourage the experiencing process of the pupil. Furthermore, the kindergarten's responsibility is to support the child's independent process of exploration of the world, including the natural environment. There is one point which is connected to a child's technical skills only, which states that the education institution shall create "conditions enabling safe, independent exploration of technical elements in the

environment, construction, DIY, planning and taking intentional action" (Journal of Laws of The Republic of Poland, February 2017).

The next section of the document is the description of the expected results of the education at the earliest stage and the achievements of the pupils. It is divided into: physical achievements, emotional development, social interactions, and the development of the cognitive skills. The last aspect mentioned (cognitive), focuses on perceiving the world by a child. At the end of pre-primary education stage pupils are expected to:

- Show their understanding of the world using non verbal communication (gestures, dance, artistic, technical and theatrical impression – using models and materials);
- Show their understanding of the world via verbal communication;
- Know letters (which is the effect of play and spontaneous exploring):
- Experiment with rhythm, sound and voice, sing songs and know melodies;
- Experiment with paints and pencils, creating simple signs and adding meaning to it;
- "experiment, estimate, predict, measure the length of objects, e.g. using a hand or a foot" (Journal of Laws of The Republic of Poland, February 2017);
- Know the basic numbers and able to count;
- Know the basic concepts which appear in natural environment (words like „rainbow" and „blooming");
- "undertake independent cognitive activity, e.g. viewing books, development of space with own construction ideas, the use of modern technology" (Journal of Laws of The Republic of Poland, February 2017).

The above mentioned expected results are connected to the cognitive and scientific world as well as the world of arts. The words "explore" and "experiment" occur many times in the document at this stage. This proves the fact that Polish schools should be a place where the child is encouraged to develop using cognitive skills and basic human senses – the ability to explore via everyday interactions is at the core of the programme. Thus, pupils are not expected to be taught but rather to explore the world around them via playful activities. The teacher is more of a guide and observer of the child's development process – he is there to support the cognitive process rather than to teach: "Teachers diagnose, observe children and creatively organize the space for their development, including the potential of children and their interest in the elements of the environment in preschool games and experiences". Thus, the time spent in kindergarten is a moment "filled with fun, which, under the supervision of specialists, creates a field of developmental experiences that build school maturity".

To sum up, the general idea is to let the child explore the world around him or her and make them ready for the next stage of education – which is school stage.

Primary education

Primary education in Poland is a very important stage for every single pupil. This is the time when a child visits school for the very first time. The main responsibility of the educational institution (school) at this point is to familiarize students with the institution, but also with their duties and their self-development path.

It is important that primary education in Poland is also divided into:

- Classes 1-3;
- Classes 4-8.

The governmental document also includes the expected learning objectives of primary education. The file indicates the importance of one's identity and emotions, as well as ethical values . Nevertheless, there's plenty of space given to cognitive skills as well. It is important to encourage students' creativity, critical thinking and drawing conclusions. Moreover, it is crucial to encourage innovation and entrepreneurship skills of the children, along with allowing "comprehensive personal development of the student by expanding his/ her knowledge and awakening the natural cognitive curiosity".

There are seven major general skills being developed in primary schools:

- Communicating (in national and foreign language);
- Using mathematic tools in everyday life;
- Searching, analysing and using information;
- Solving problems;
- Solving problems in a creative way, using IT tools;
- Teamwork and social activity;
- Taking part in the cultural life of the school, local society and country.

Scientific subjects (biology, technical skills, mathematics, geography), are introduced in the 4th class of primary school. At the same time art and music is being taught, along with foreign languages (foreign language is introduced in the 1st class already). Art and literature are equally important subjects at this stage since they "stimulate the multilateral, harmonious and holistic development of the student". Moreover the importance of literature is highlighted in the programme document as well since "the ability to understand, use and reflectively process texts, including cultural texts, is one of the most important skills acquired by student in the learning process".

Each and every subject is described in detail in the document – there is no division in terms of range into „more" and „less" important subjects. Instead all the subject are considered equally important since they help children develop their talents and shape their identity. Nevertheless, some experts claim that the education system in Poland is too much subject-related.

In Poland the STEM and STEAM approach is getting more popular nowadays – it is known as innovative method of teaching. Since it is quite a new trend in Poland, there aren't any additional official documents prepared by the Polish government which would include this approach as part of the policy for educational system. Nevertheless, apart from the programme document prepared in 2017 by the Ministry of Education, every school in Poland has its own regulations as well. Since the governmental papers allow taking part in programmes and projects, it is the school's policy that matters here. The school can take part in programmes since such actions "help to develop entrepreneurship and creativity of students and enable the use of innovative program, organizational or methodological solutions in the education process". Thus, many schools in Poland choose STEAM and STEM approach to develop students' skills and knowledge. It is worth mentioning that these projects and programmes are not included as obligatory in the official education programme prepared by the Polish Ministry of Education.

New Technology (STEAM tools) in Polish schools

Polish educational institutions – schools, kindergartens and universities – choose innovative technologies nowadays. Every year we observe an "increase of teachers and institutions focusing on modern education" (Mentor). Teachers search for new innovative solutions which can help prepare the lesson and convey the knowledge in an attractive way. According to a headmaster of a Primary School in Lubsko city the role of a teacher is different today than what it used to be in the past since a teacher "ceases to be an omniscient figure, threatening with quizzes and tests, and instead takes the role of a mentor, advisor who motivates to act, encourages to overcome barriers, makes new attempts and sets new challenges in the area of the student's closest development". (Rabenda, 2019). As a consequence teachers need new tools which will enable them to prepare projects that will provide "answers to real problems; refer to everyday life; study phenomena occurring in nature; or improve already existing solutions". Moreover, in her article M. Dabkowska-Wilczek indicates that "in the current era of technological progress, there can be no effective education without the involvement of new technologies" (2017).

Teachers can choose between various options of introducing new technologies to schools: EU programmes, governmental programmes, private companies' support and more. A great and popular example is the "Active Blackboard" programme prepared by Polish Government. It is financial support offered to Polish educational institutions – both: private and public. Thanks to this programme a school is able to get whiteboards, interactive touch monitors, computers, 3D printers, robotics and more teaching aids. The estimated amount of funds for the programme between 2020-2024 was over 361 000 Polish Zlotych (which is around 80 000 EUR).

Specific data gathered by the Ministry of Education also proves that numbers of innovative teaching aids are increasing in Poland. In an article published on „Stawiam na Edukacje" online portal we read about the exact numbers of interactive boards distributed within Polish educational institutions. According to the data published on the portal, the number of sold interactive boards for Polish schools in 2010 was around 6000 while it increased to 10 000 in 2016. The advantages of such interactive boards are wide: an increased interest of pupils, engaging the students, effective learning process, better understanding of the subject thanks to the colourful material. Thus, it is understandable that Polish teachers choose such interactive teaching aids more often.

3D printing as STEAM tool in Poland

Another example of using technology during STEAM classes in Polish schools is a 3D printer. Such technology makes the learning process attractive while it becomes "a form of interactive fun" (Fundacja Digital Poland, 2018). Some claim that " 3D printing is critically important for all students to learn, and the younger they begin, the better" (Scott, 2017). A Polish high school IT teacher from Kolobrzeg city – Jacek Kawalek – is a 3D Expert as well. He tries to encourage students to use 3D technology. An example of his activity was a project which he created together with his students "in which they learned about their city by 3D modelling and 3D printing it at various important phases of its history". One of the goals of this high school teacher is to open a 3D printing learning centre for teachers. Furthermore, Kawalek not only uses 3D printing technology during his classes but also "works with local institutions, including museums, to fulfil various needs through 3D printing". His mission is to make 3D printing an official school subject since there is no official 3D printing curriculum in Poland. This solution could really help especially those students who plan to apply to technical schools.

The aforementioned example proves that more and more teachers at Polish educational institutions strive to use innovative teaching aids along with new methodologies and approaches - including STE(A)M. New technology, like 3D printing, is a perfect tool for

STE(A)M methodology. Since the approach is based purely on experiments and the new role of the student (who becomes an explorer rather than a passive listener) the new 3D technology enables him/ her to challenge themselves and learn by doing. Thus, they can discover the world around them thanks to the 3D technology. Since "3D printing requires students to take an idea through a design and production process in order to complete a model" it is students' work and design that matters (Velez). Obviously, the younger students will need the support of a teacher, but it is still the student's project that is paramount. If the design is not appropriate then the printed outcome would not be good enough – the child will then get the opportunity to learn why the design was wrong. It is a "process of trial-and-error in multiple dimensions" that help students understand the problem and encourage them to find the right solution.

As consequence Polish schools choose to order 3D printers more and more often nowadays. Two Polish companies are now working together in order to promote further the use of 3D printers within Polish schools and educational institutions. These companies are: Zortrax (a company producing 3D printers and 3D printing materials), and Skriware (a company developing innovative teaching aids for schools – including STEAM teaching aids). The two enterprises are now cooperating: "Zortrax M200 Plus 3D printers will become a part of Skriware range of solutions aimed at educators around the world. The first joint project of Zortrax and Skriware is going to be placing a bid to deliver fully equipped SkriLab workshops to over 4.5 thousand schools in Poland under the Active Blackboard program." (Anusci, 2021). The impact of Skriware on education in Poland (and global education) is also worth mentioning at this stage. The company has created original programme called "STEAM education in every school" which gives "the possibility to implement a modern educational laboratory based on 3D printing, robotics and programming adapted to the conditions of remote and hybrid learning in schools" (Skriware). The company offers not only 3D printers but more teacher-friendly technologies like educational robots, programming tools and online platforms for teachers.

Another example of using 3D printing technology in Polish school would be EU projects. This does not mean financial support only but more of a research and development support as well. An example would be an Erasmus Plus project in progress – the 3DP Teacher project. The project aims to develop the competences of teachers and promote 3D printing methods in EU schools. There is an international group of experts working on the development of the project's results – amongst them there is a school from Poland (primary school in Czudec city). The school's website provide examples of the work of the students who had a chance of printing their projects using 3D printing. This is a great proof that 3D technology can be used in primary education stage as well as high school.

Robotics in Polish school

An interesting STEAM teaching aid is robotics. The popularity of robots is still increasing – children and adults become more and more interested in innovative solutions offered by robotics and augmented reality or artificial intelligence. Since technology is all around us it is also appreciated in the field of education and school environment. Polish schools are still places of traditional teacher-centred approach but they are evaluating rapidly. Robotics is an interesting and attractive solution for both – students and teachers. It gains popularity and it is used in Polish educational institutions.

Robotics is widely used in STEAM model as well:

"Robotics in the classroom has positive results on students such as encouraging students to pursue more STEM career paths and develop the necessary 21st century skills that will enable them for success in the future. […] It has been proven that the use of robotics can help to encourage confidence and a positive attitude toward education in students, which helps to reinvigorate classrooms with cross-curricula activities. STEM education proponents are looking for more ways to incorporate robotics classes into schools at the earliest of ages" (Grover, 2015).

An example of a company offering support for Polish educational institutions in the field of robotics is TROBOT. The company has been operating since 2008 – its mission is to provide and develop innovative teaching aids for Polish schools, on every stage of education. The company offers e-learning courses for teachers and workshops (for children and young people) and prepare lesson plans which have become the basis for many schools in Poland. While visiting the website of the company's partners one can see many models of robots offered as educational tools for schools. Companies like TROBOT are key support for teachers who acknowledge the value of robotics used during classes and want to start their journey with new technologies at school.

Examples of robotics used in Polish educational institutions can be easily found online. An example is a Primary School in Bielsko Biala where children from different classes (starting at the age of 7) are able to test robots during classes. The actual task for the pupil is to create and test the specific programme which controls robots. An example of a robot used would be an "Ozobot" which is a type of a robot used in order to teach children how to programme. It starts with drawing colourful lines on a piece of paper and continues with colourful blocks in a special programme called "Ozoblockly". The use of colours enables the youngest pupils to

use this tool which proves that even the youngest students are welcomed to use innovative technology in the learning process.

STEAM education in Poland – project example and inspirations

It is important to notice that STEM and STEAM approach is much more than new technology used at schools. The idea is that thanks to this new approach students are able to learn new competences that are crucial on labour markets nowadays such as abstract thinking and logical thinking. While it is true that technology is all around us today and students should learn it from the earliest stages of education it is not the technical skills that are crucial but rather "creative thinking, allowing students to understand the processes of controlling devices and learn them" (Librus).

Despite the fact that STEAM method is not included in the official education programme in Poland the schools are interested in the approach. An example would be SteamPolska – it is a project aimed to promote the ideas of STEAM approach in Polish educational institutions. SteamPolska brings together enthusiasts and practitioners of STEAM approach not only in Poland but worldwide. The authors organise conferences and workshops which aim to develop STEAM competences of the teachers. There has been prepared an original model of creative training laboratories - STEAMLab and CREATIVELab. The authors offer support for teachers and institutions interested in introducing the new approach. Nevertheless, it is the student who is still at the core of the programme: "A student who experiences work in STEAMLab will be a problem-solving, creative person, able to use a variety of tools and aware of his/ her talents" (STEAMPolska). Students will gain new competences and skills and will manage to develop much more than digital skills. The work in STEAMLab was planned in detail and divided into S-T-E-A-M spheres. For instance, in S sphere (Science sphere) the students will be able to learn about climate while creating a form of a spectacle taking place in Italy, Verona – they will need to design a model of the theatre, including the costumes of the main characters and the set/ scenography. Thus they need to know about natural environment in Italy – is the climate hot or cold there?; what kind of clothes would their characters wear? etc. On the contrary in the M sphere (Mathematics) the students need to learn how to calculate in order to build characters' houses. They should remember that they need a detailed calculation in order for their theatre model to be properly prepared. Again, this is a kind of learning through experience where the student is the explorer and then the constructor of the model. All the teachers who want to take part in the SteamPolska project are welcomed to contact the authors via email address provided on the project's website.

A different source of knowledge about STEAM methodology – apart from IT companies offering innovative teaching aids and specialistic programmes like SteamPolska project – are

the teachers themselves along with couches and education experts. An example would be Marlena Plebanska who is a Polish e-learning expert. In her online article Plebanska claims that we do not need the standard learning system which is based on learning by heart and completing tests which are then to be assessed by the teacher and result in marks and grades. According to her the education system today is "not sufficiently focused on teaching children to solve real problems; it is not interdisciplinary and confines itself to an artificial framework of standards and principles" (Plebanska, 2021). In her article the author encourages to use an interdisciplinary teaching method and gives STEAM approach as an example. Plebanska presents the advantages of STEAM approach:

- Inspired by real life scenarios;
- Based on observing the social life;
- Experience gained through experiments and role plays;
- Building students' motivation to learn;
- No age limit (children from kindergarten are welcomed to take part in STEAM classes);
- No time limits (STEAM classes can be conducted by the teacher once a week or every single day);
- STEAM classes are intuitive.

Such articles prepared by education experts and teachers become a great source of inspiration and knowledge for teachers and tutors interested in new teaching methodologies, like STEAM approach.

Opportunities for the engaging of girls in science learning in pre-primary and primary education.

In the joint message from directors of UN, on the occasion of the International Day of Women and Girls in Science in February 2021, we read that certain stereotypes which prevent many women from starting a career in science still exist today: "Gender stereotypes and gender-based inequalities continue to prevent many girls and women from taking up and remaining in careers in science across the world". The message did highlight the importance of women in the world of science, giving an example of many researchers and experts working during the Covid-19 pandemics. The message indicates the importance of women scientists in the current world: "Women scientists are a source of inspiration for young girls around the world eager to enter scientific fields". As consequence we need programmes and projects that will encourage girls to learn more about the scientific world.

The official Polish education programme does not differentiate students based on gender. Nevertheless, the stereotype of a woman taking up humanistic career rather than the one connected to science is still present in Polish reality. In her work from 2016 Edyta Bombiak – a PhD from Siedlce University of Natural Sciences and Humanities – studies the career path realia in Poland. Bombiak points out that while it is true that certain social roles are assigned to women in Poland (taking care of the children and housework), they want to receive a proper level of education as they perceive it as a chance for their development:

"Professional career is more and more often perceived by modern women as an opportunity for development and self-fulfillment. Trying to adapt to the growing competition and requirements of modern labour market, they obtain higher education, they are aware of their own values and can articulate the need for economic independence. Increasingly they are also more often involved in social, political and economic affairs of the country." (Bombiak, 2016)

A different article by a Polish author – Justyna Tusinska – indicates that in Polish reality women choose humanistic career indeed and there is nothing wrong about it, with one exception: "the so-called female occupations are perceived as less prestigious and paid lower, while the so-called male occupations are valued and rewarder better" (2020). Furthermore, it is of the highest importance to remember that education stage has an enormous impact on the decision made by children (to develop their scientific interest) and then by young adults who need to choose their career path. This is a significantly important issue for educational institutions – starting from kindergartens and primary schools. Teachers should encourage both – girls and boys – to explore the scientific world around them since the career path should not be gender-related.

As forementioned, the Polish education system does not divide students' tasks based on gender. Instead it focuses on the general development of the knowledge, skills, attitudes and behaviours of the children. Nevertheless, some experts notice that gender-based stereotypes are still present in Polish reality, including kindergartens and schools. Thus, they organise events which aim to develop the scientific interests of young girls. An example of such an event would be a project strongly connected to STEAM methodology. The project was called "STEAM-owe DZIEWCZYNY". It was a series of workshops for girls planned in Walbrzych city, Poland, in 2020 and organized by KidsTech company – an educational company which aim is to introduce new technology and methodology in Poland, including STEAM model. The company promotes the use of robotics, LEGO Education, drones, 3D printing and more. They organize classes even for very small children (at the age of 2,5 and 3) which is part of

their "SMALL EXPLORER ACADEMY". The planned workshops were strongly connected to all the spheres of S-T-E-A-M which included:

- Science – the green energy workshop (participants' task is to build and program wind turbines using LEGO elements and LEGO Education)
- Technology – using 3D printers to produce gel nails and nails' decorations, using recycled materials
- Engineering – inspiring young female engineers while building and programming robotics resembling the world of animals
- Art – a combination of artistic and technological workshops
- Mathematics – the colourful workshops which aim to inspire future math experts.

The workshops were designed for girls aged 6-12. The main objective was to break the stereotypes of STEAM activities interesting for boys only and engaging girls to take up a scientific career in the future. Furthermore, the most important task of the organizators was to make sure that the girls enjoy the event and that they feel confident while working with technology and learning subjects like mathematics and engineering.

Conclusions

The fundamental document and the basis for education system in Poland is an official document prepared by Polish Government (the newest version occurred in 2017). It is a detailed description of each and every stage of education in the country – starting with kindergarten and then proceeding with primary schools and then secondary education. The paper is a description of the education programme in Poland including the tasks of the pupils/students and the expected results of education at every stage. There is no clear division between children or a different curriculum prepared for girls and boys. Nor there is a special curriculum prepared for STEM and STEAM education.

Polish schools are allowed to take part in various projects – this depends on the school's individual policy (which still needs to follow the guidance included in the governmental document from 2017). Polish educational institutions are rather open to innovative projects – like the ones promoting the use of newest technology as teaching aids. Moreover, new teaching approaches are tested often at Polish kindergartens and primary schools – including STE(A)M model.

STEAM approach is gaining more and more popularity nowadays – this is also connected with the use of technology and introducing new teaching tools in schools: interactive boards and 3D printers as examples. Moreover, there are plenty of projects promoting STEAM education at schools. It is worth to mention that very often the teachers and education experts are the inspiration for each others and a source of knowledge for STEAM enthusiasts as well.

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